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# EFFECT OF DIFFERENT INTERMITTENT LIGHT PROGRAMS ON PERFORMANCE AND LEG PROBLEMS IN BROILERS

C. BITAR[1]
***Under the supervision of Dr. B. JAMMAL***[2]
[1] *Holy spirit University of Kaslik, Faculty of Agricultural Sciences, P.O. Box 446 Jounieh, Lebanon*
[2] *Lebanese University, Faculty of Agricultural Sciences, Beirut, Lebanon*

**Abstract**

An experiment was conducted between July and August 2004 on the USEK Experimental farm, Maounet, Jbeil to evaluate the effect of some lighting patterns on mortality, live body weight, growth, food intake, food conversion ratio and leg abnormalities. Three hundred and six one day old feather-sexed Cobb broilers were housed in three rooms. Each room contained two pens with either 51 male and 51 female randomly distributed chicks having similar average body weight per pen. Birds in each room were subjected to a light program that differs from that light patterns given in the other rooms. Broilers were watered and fed ad libitum isocaloric pelleted rations based on corn-soybean mixture ensuring the required level of crude protein and metabolizable energy in each feeding stage. Data obtained on live body weight (LBW) at 10, 15, 30 and 37 days of age showed differences among treatments. Group 1 receiving intermittent light presented the highest average for males, 2237.5±127.87 g ($p<0.05$) and females, 1989.8±101.6 g ($p>0.05$)) at the end of the experiment. In the same manner, this group established the highest percentage of increased body weight gain per period (+ 10.6 % and 8.9 % for males and females, respectively) in comparison with control group 3. Group 1 also presented also the best cumulative food conversion ratio (cFCR) for the period of 1-37 days (1.71 kg of feed per 1 kg of broilers LBW for males and 1.77 kg for females Vs 1.81 and 1.87 kg for control group 3 respectively). The lowest percentage of leg abnormalities (LA), crooked toes (CT) and tibial dyschondroplasia (TD) was observed in group 1. These results suggest that the scheme used in group 1 receiving 23hL (hours-light):

1hD (hour-dark) from day 1 to day 7 then followed by 18L : 6D from day 8 to day 14 and 13L : 11D from day 15 to day 21 and an intermittent light pattern 5L: 3D from day 22 to slaughter was the best.

**Key words:** broilers, mortality, weight, light.

**Résumé**

Une expérience a été menée durant les mois de Juillet –Août 2004 à la ferme expérimentale de l'USEK – Maounet, Jbeil afin d'évaluer l'effet de la lumière sur le poids des poulets de chair, la mortalité, la consommation de nourriture et le taux de conversion ainsi que son effet sur la déformation des pieds. Trois cents six poussins (mâles, femelles) âgés d'un jour ont été répartis au hasard en 3 groupes dans 3 chambres recevant chacun un système d'éclairage différent. L'alimentation des poulets a été divisée en 3 phases principales. Ils ont été nourris avec des rations basées sur un mélange de mais et graine de soja fournissant dans chaque étape le même niveau de protéines pour tous les groupes. Les résultats obtenus sur le poids au $10^{ème}$, $15^{ème}$ ,$20^{ème}$, $30^{ème}$, et $37^{ème}$ jours d'âge ont montré une différence significative ($p<0.05$) entre les traitements. A l'abattage, le groupe 1 a présenté le plus grand poids pour les mâles, 2237.5± 127.87g ($p<0.05$) et pour les femelles 1989.8 ± 101.6g ($p>0.05$). Ce groupe a aussi présenté le gain de poids le plus élevé par période : +10.6% pour les mâles et 8.9% pour les femelles apparenté au groupe 3 témoin. Par ailleurs, le groupe 1 a présenté le meilleur taux de conversion (cFCR) durant toute l'expérience (1,71kg d'alimentation pour 1 kg de poids pour les mâles et 1,77 kg pour les femelles) en comparaison avec le groupe 3 (contrôle 1,81 kg mâle et 1,87 kg femelle). Le pourcentage le plus bas en mauvaise déformation des pieds a été présenté dans le groupe 1. D'après ces résultats, le système d'éclairage utilisé dans le groupe 1 recevant 23hL (heure de lumière) du jour 1 au jour 7 suivi par 18 hL du jour 8 au jour 14 et 13 hL du jour 15 au jour 21 avec une lumière intermittente du jour 22 jusqu'au abattage a été le meilleur.

**Mots clés:** poulet de chair, mortalité, poids, lumière.

# INTRODUCTION

It is generally accepted that the main cause of leg problems is that modern broilers have been selectively bred (often referred to as "genetic selection") to grow extremely fast. Today's broilers reach their slaughter weight in around 41 days, which is twice as fast as around 30 years ago. These accelerated growth rates have been achieved primarily by selective breeding, but also through the use of rich diets and, recently, growth-promoting antibiotics.

It is a common practice to rear broiler chickens in (nearly) continuous illumination, because it is assumed that under these lighting conditions, feed consumption is

maximal, hence growth rate. However, several studies have shown that alternative lighting programs such as increasing photoperiod lighting systems improve broiler performance and reduce the occurrence of leg problems and mortality due to sudden death syndrome (Classen and Riddell, 1989).

The poultry industry in Lebanon is currently of higher economic importance than dairy or beef in the livestock or agriculture sector. It has in many respects become the leader in the field and has shown a most remarkable growth and development in the past 25 years. Chicken production went from 20 million chicks in 1980 to 35 million in 2003 (FAO, 2004).

The majority of broiler growers use a continuous light program of 23 hours light and 1 hour dark. Intermittent light programs can be of great value to broiler performance in reducing the effects of heat stress, leg defects, downgrading, abdominal fat levels, power cost (Webster, 1964; Gordon, 1994). The extra activity induced by the regular changes from dark to light helps in dissipating heat build up among birds. It is thought that by giving chickens short feeding periods followed by a longer dark period for digestion may improve efficiency of food utilization.

An experiment was conducted at the Faculty of Agricultural Sciences, University of the Holy Spirit-Kaslik (USEK) experimental farm in Maounet-Jbeil to study the effect of various light patterns on the performance of commercial broiler chickens.

## MATERIALS AND METHODS

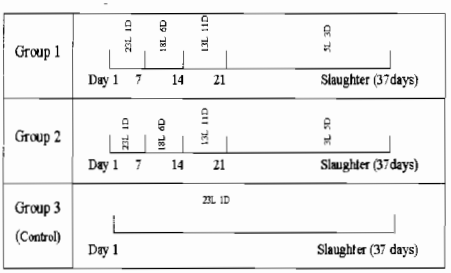
The experiment was 37 days in duration inclusive in rooms with independent control of temperature and light using similar management procedures. The broilers were housed in wood shavings litter (7-10 cm thickness) pens. Supplemental heat was provided by gas-brooders located at approximately 90 cm above the floor level. The temperature schedule consisted of an initial temperature of 32°C and incremental decreases until 21-23°C was reached on day 28 of the trial. Temperature was monitored daily and remained within ± 1°C of the set temperature. Each pen was supplied with an electrical fan for proper ventilation. From day 1 to 14 of age, chicks were placed in circular cardboard guards of 30 cm height to reduce floor rafts preventing the birds from wandering too for from the source of heat, to reduce the risk of crowding, and prevent birds from piling on and smothering. Each group was provided approximately with 16 $m^2$ floor spaces. Each pen was provided with two 75-watt incandescent pulps that were controlled with an automatic timer. Light inten-

sity was between 5 and 10 lux at floor level.

The chicks were fed commercially from prepared broiler starter (crumble) between 1 to 15 days of age, followed by a similarly prepared broiler grower (pelleted) from 16 to 30 days of age and broiler finisher (pelleted) from 31 till slaughter (37 days of age). Feed and water were provided on an *ad libitum* basis.

A total of three hundred and six one day old feather-sexed broilers of Cobb strain were housed in three rooms. Each room contained two pens by 51 male and 51 female randomly distributed chicks. Broiler-groups (males and females) in each room were treated with a light program that differs from those light patterns given in the other rooms. Chicks of the different experimental groups (table 1) were treated with the following light patterns (L: light period; D: dark period).

**Table 1:** Scheme of the experiment.




## Average live body weight and leg abnormalities examination

Each group was divided into 10 lots (5 males and 5 females) by approximately ten randomly picked broilers in each. Each lot was weighed every ten days and at the beginning of each feeding period. The resulting weight was divided by the number of birds in the lot in order to obtain the average live body weight.

Ten males and ten females per room were randomly selected two times and killed at 15 and 37 days of age. The right leg of each bird was removed by longitudinally sectioning the proximal end of the tibiotarsal bone and drumsticks were examined grossly for TD (tibial dyschondroplasia). All broilers were examined individually for leg abnormalities on days 15, 30 and 37. Leg abnormalities were characterized according to type. Types included outward (valgus) and inward (varus) bending of the metatarsus, rotation of the tibial shaft, enlarged stifle (femoral-tibial) joints, arthritis and crooked toes. Birds with enlarged stifle joints had a stilted gait and poor mobility. Severity of leg abnormalities included culled, trimmed (judged at 15, 30 and 37 days of age to require trimming at slaughtering) and noted (detectable leg abnormality but not requiring trimming) (Classen *et al.*, 1991; Renden *et al.*, 1996).

## Average feed intake (FI)

Feed intake in male and female pens of each broiler group was determined at the end of each feeding period:

$$FI\ (g^{-head\ x\ period}) = IQF\text{-}RQF/number\ of\ birds\ in\ a\ broiler\ pen$$

Where,

IQF = Initial quantity of feeds (concentrates) at the beginning of a feeding period;

RQF = Remaining quantity of feeds (concentrates) at the end of the feeding period;

**Average body weight gain (BWG)**

Body Weight Gain of males and females was calculated at the end of each feeding period:

$$BWG\ (g^{-head\ x\ period}) = BW_1\text{-}BW_2/number\ of\ birds\ in\ a\ broiler\ pen.$$

Where,

$BW_1$ = Body weight of the 5 lots of birds at the beginning of a feeding period.

$BW_2$ = Body weight of the 10 lots of birds at the end of the feeding period.

**Average feed conversion ratio (FCR)**

Feed efficiency or feed conversion ratio (FCR) was calculated:

$$FCR = 1\ kg\ x\ FI\ (g^{-head\ x\ period}) / BWG\ (g^{-head\ x\ period})$$

# RESULTS AND DISCUSSION

## Leg abnormalities

Table 2 shows the percentage of leg abnormalities (LA) (as being valgus, varus, bending of the metatarsus, rotation of the tibial shaft and enlarged stifle joints and arthritis at 15, 30 and 37 days of age as well as (CT) crooked toes and (TD) tibial dyschondroplasia but only of two observations at 30 and 37 days of age.

Data obtained in the three experimental groups show that males are more susceptible to leg abnormalities than female broilers. We can notice that the three groups attained highest levels of LA at 37 days of age for both males and females

**Table 2**: percentage of leg abnormalities (LA).

| | LA[1] | | | | | | CT[2] | | TD[3] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | M | | | F | | | M | F | M | F |
| | At age, days | | | | | | Mean of 2 observations | | | |
| Groups | 15 | 30 | 37 | 15 | 30 | 37 | | | | |
| 1 | 9.4 ±2.8 | 10.0 ±3.3 | 13.2 ±5.7 | 8.4 ±3.9 | 9.6 ±5.2 | 11.2 ±5.7 | 11.3 ±1.8 | 9.3 ±4.6 | 1.3 ±1.8 | 1.2 ±1.7 |
| 2 | 10.4 ±3.7 | 12.0 ±4.9 | 13.2 ±6.2 | 9.2 ±4.1 | 10.2 ±4.5 | 10.6 ±4.3 | 13.7 ±5.3 | 12.5 ±3.5 | 2.5 ±3.5 | 4.5 ±0.7 |
| 3 | 11.4 ±4.4 | 12.2 ±5.2 | 16.0 ±5.8 | 11.4 ±4.8 | 13.4 ±5.8 | 14.6 ±6.2 | 15.7 ±2.5 | 13.5 ±2.1 | 4.5 ±0.7 | 3.5 ±2.1 |

| *Source of Variation* | *Significance for LA* | *Significance for CT* | *Significance for TD* |
|---|---|---|---|
| *Light treatment (LT)* | *P= 0.602* | *NS* | *NS* |
| *Broilers Sex (BS)* | *NS* | *NS* | *NS* |
| *LT x BS* | *NS* | *NS* | *NS* |

*All mean values within a row are not significantly different (P>0.05)*

*[1]Leg abnormalities were characterized as being outward (valgus) and inward (varus) bending of the metatarsus, rotation of the tibial shaft, enlarged stifle (femoral-tibial) joints, arthritis.*

*[2]crooked toes at 30 and 37 days of age*

*[3]TD (tibial dyschondroplasia) at 30 and 37 days of age*

*Group 1 is subjected to light treatment 1. 23h light (L) 1h dark (D) – days 1 to 7, 18hL 6hD – days 8 to 14, 13hL 11hD –days 15 to 21, 5hL 3hD – day 22 to 37*

*Group 2 is subjected to light treatment 2. 23hL 1hD – days 1 to 7 18hL 6hD – days 8 to 14 13hL 11hD – days 15 to 21*

*Group 3 is subjected to light treatment 3. 23hL 1hD – days 1 to 37days (Near continuous light program)*

*NS= Non significance*

Note that leg abnormalities was influenced by the application of intermittent light programs (P=0.002) where as the obtained results were better in both light programs.

Moreover, group 1 in all cases (LA, CT and TD) at 15, 30 and 37 days of age had the best results (P>0.05) and the worst one for control was group 3.

The obtained results related to the general health status and physical activity of the broilers were similar to those of many researchers in the domain (Wilson *et al.*, 1984; Classen and Riddell, 1989; Classen *et al.*, 1991; Dale *et al.*, 1996; Renden *et al.*, 1996) We found that birds receiving near continuous light were docile during the growth period in comparison with those having intermittent light that were more active when the light was on. This extra activity resulted in very few cases of leg abnormalities.

Our findings also agree with the results of Buckland (1975), Buckland *et al.* (1976), Freeman *et al.* (1981), Robbins *et al.* (1984), Wilson *et al.* (1984), Bowes *et al.* (1988) and Classen and Riddell (1989), who found that broilers provided intermittent light schedules had fewer leg problems including TD and CT than broilers provided continuous to increased activity level of birds on the intermittent schedule and were also achieved by restricting feed or energy intakes of broilers.

## CONCLUSION

A tendency to a better performance was sometimes significant when applying intermittent light program has been proven. The results obtained with the first group receiving intermittent light schedule from 1 to 37 days of age (23h light (L): 1h dark (D), day 1 to 7; 18hL: 6hD, days 8 to 14; 13hL: 11hD, day 15 to 21; 5hL: 3hD, day 22 to 37), presented at slaughter improved live body weight and weight gain and feed conversion ratio and lower leg abnormalities with a possible reduction in electric power bill that was not investigated here.

Even though favorable results were established in this experiment, many other light patterns still need to be thoroughly checked and directly applied in production to find a suitable and most economical light program for broiler health and performance.

Lebanese poultry industry is facing serious problems in achieving the planned profit for through keeping the rate of feed intake high and the rate of feed efficiency low under traditional near-continuous light program that increases daily electricity cost. In this case, the use of intermittent light program is to be recommended since that problem may be solved.

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