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IMPROVING PRODUCTIVE AND PHYSIOLOGICAL PARAMETERS OF BROILERS USING SOME LIGHT REGIMES AND FEED ADDITIVES

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SUMMARY

A total number of 360 one-day-old unsexed broiler chicks (Arbor Acres) was used in a 42-day experiment to investigate the effect of lighting regimes and Bio-Tonic level in diet on chick performance. Chicks were randomly divided into three equal groups according to light regimes: (L1) continuous (23L:1D), (L2) constant (15L:9D) and (L3) intermittent(8L:4D:8L:4D). Each light program was divided into four groups according to level of Bio-Tonic in diet as follow, (B1) 0.0, (B2) 0.5, (B3) 1.0 and (B4) 1.5 kg/ton diet. Chicks exposed to intermittent lighting had significantly higher (P<0.05 or P<0.01) live body weight at 7 weeks of age and body gain during 4-7 and 1-7 week periods than those exposed to continuous or constant lighting program. Chicks fed on B4 had significantly (P<0.01) higher body weight at 7 wks than those fed on other diets at all ages studied. The differences among Bio-Tonic levels in body weight at 7 weeks and body gain during 1-7 week period were highly significant (P<0.01). Feed consumption and feed conversion ratio of continuous lighting were significantly (P<0.05 or P<0.01) greater than those of either constant or intermittent lighting treatments at all ages studied. The birds fed on B1 had significantly higher (P<0.05) feed consumption and feed conversion ratio than those fed on other Bio-Tonic levels in diet during all periods studied. Chicks fed on B4 gave non-significantly greater percentages of dressing, liver, heart, gizzard and giblets than that fed on the other Bio-Tonic treatments. An opposite trend was true for abdominal fat % with B1 treatment. Birds exposed to constant lighting had ether extract % significantly (P<0.05) greater than those exposed to continuous and intermittent lighting programs. Chicks reared under intermittent gave significantly greater (P<0.05 or P<0.01) liver protein % and glycogen (mg/g) than that reared under both continuous and constant lighting programs. Chicks fed on B4 level had non-significantly lower liver lipids % than other levels, and had greater liver protein % and liver glycogen (mg/g) than the other Bio-Tonic levels. Plasma total lipids were insignificantly higher of constant than those continuous or intermittent lighting programs. The chicks fed on B4 level had plasma total lipids and cholesterol lower, and plasma total protein, albumin, alkaline phosphatase activity, GOT, T3, T4 and GH higher than that fed on the other levels of Bio-Tonic. There were significant differences (P<0.05 or P<0.01) due to interaction effect between light regimes and Bio-Tonic level in the diet on body weight at 4 and 7 wk; body gain during 4-7 and 1-7 wk periods; feed consumption during all periods studied; feed conversion ratio during 1-4 and 4-7 wk periods; E.E.%; liver protein %; percentages of dressing and abdominal fat and plasma total protein, albumin, cholesterol, T3 and GH.

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Keywords: Broilers, feed additives, light regimes, body weight, physiological

INTRODUCTION

Understanding the role of photoperiod regimens in production performance becomes increasingly important especially concerning the cost reduction of the management of broiler chicks. There have been attempts to investigate the advantages of using different light regimens rather that which is commonly used (23 hours of light and 1 hour of darkness daily). Classen and Riddell (1989) and Classen *et al.* (1991) concluded that the use of continuous or near continuous light should not be recommended for broiler chickens. Intermittent light had significantly greater body weights and better feed efficiency than that of continuous illumination (Weaver *et al.,* 1982) and may be less stressful to the birds than continuous light (Buckland *et al.,* 1971).

The manipulation of photoperiods in raising broiler chicks has been largely done to maximize body weight and improve feed efficiency (Classen and Riddell, 1989). Long photoperiods or constant lighting are believed to increase feed consumption due to continuous access to feed. Consumption of feed is almost entirely restricted to the period of light, with a peak in feed consumption at the beginning or at the end of the photoperiod (Savory, 1980). Buyse *et al.* (1993) showed that the amount of feed consumed during the dark period is less than 1 % of that during the light period. Therefore, feed consumption varies according to lighting schedule.

Recent experiments have shown that intermittent lighting regimens can reduce feed intake and improve feed efficiency (Buyse *et al.*, 1996).

The inclusion of minor quantities of specific components of natural or synthetic origin into compound feed is a common practice in the animal and poultry feed industry. These components, which are called feed additives, can be classified into two categories: First, those additives which are essential for the biological function of the animal such as vitamins and trace elements. The second category includes additives which are not essential for biological function, but have demonstrated a positive effect upon the animal, including growth promoters, metabolic modifiers and probiotics (Namur *et al.*, 1988).

Therefore, this experiment aimed to study the effect of different lighting regimes with using certain levels of herbal extraction (Bio-Tonic) on the growth, blood and carcass traits of broiler chicks.

MATERIALS AND METHODS

A total number of 360 one-day-old commercial Arbor Acres broiler chicks was used in these experiments. Chicks were brooded in floor pens. They were fed during the first four weeks of age on a basal starter ration containing 23% crude protein and 3021 Kcal ME/kg and from 5 to 7 weeks of age on a finisher diet containing 21% crude protein and 2995 Kcal ME/kg (Table 1).

Chicks were wing-banded and weighed individually, then randomly divided into three equal groups according to light regimes, the first exposed to continuous light had 23 hours of light and one hour darkness (23 L: 1 D), the second exposed to constant light had 15 hours of light and 9 hours of darkness (15 L: 9 D) and the third exposed to intermittent light had 8 hours light then 4 hours darkbess then 8 hours light then 4 hours darkness (8 L: 4 D: 8 L: 4 D). Each light program included four groups according to Bio-Tonic (a mixture of fermented and dried extracts of several herbs and edible plants in addition to dried condensed corn distillers, Abdel-Malak *et al*., 1995) in diet as follow, (B1) 0.0, (B2) 0.5 , (B3) 1.0 and (B4) 1.5 kg/ton diet.

Table 1. Composition and calculated analysis of the basal experimental diet

Ingredients	Starter diet	Finisher diet %
Yellow corn	57	65
Soybean meal (44%)	23	12
Corn gluten (60%)	10	11
Wheat bran	7	9
Fat or oil	-	-
Limestone	1	1
Salt	0.30	0.30
L – Lysine	0.20	0.20
Di-Calcium Phosphate	1	1
DL – Methionine	0.20	0.20
Premix*	0.30	0.30
Calculated analyses		
Crude protein %	22.24	19
ME, Kcal / Kg	2974.2	3085.42
C / P ratio	133.7	162
Ca %	0.88	0.92
P %	0.43	0.46
Lysine %	1.11	0.86
Methionine %	0.61	0.58
Cystine %	0.39	0.35

* **Premix**: Vitamin and Mineral mixture supplied each kg diet:-
Vit A 1200 IU. Vit D3 2000 IU, Vit E 10mg, Vit K3 2mg, Vit B1 1mg, Vit B2 5mg, Vit B6 1.5mg, Vit B12 10mcg, Niacin 20 mg, Pantothenic acid 10mg, Folic acid 1mg, Choline chloride 250mg, Biotin 50mcg, Manganese 60mg, Zinc 50mg, Copper 5mg, Iodine 0.3mg, Iron 30mg, Cobalt 0.1mg and Selenium 0.1mg.
** According to NRC (1994).

Live body weight and feed consumption were biweekly recorded and body weight gain and feed conversion were then calculated. At the 7th week of age, five birds from each treatment were randomly chosen and slaughtered. Eviscerated weight, giblets (liver, gizzard and heart), total edible parts (carcass and giblets) and abdominal fat were determined. Relative weights of the carcass traits to live body weight (LBW) were then calculated. Dressing percentage was computed as body weight (BW) of clean carcass plus edible viscera/LBW and as clean carcass/carcass weight. Liver samples were secured to determine liver lipids, protein and glycogen. Liver total lipids and total protein were determined using AOAC (1990), glycogen by Der Vies (1954) method.

At slaughtering, blood samples (5ml) were collected and centrifuged at 3000 rpm for 20 minutes. Plasma produced was frozen at -20°C till the time of chemical determination of plasma total protein, albumin, total lipids, cholesterol, activity of alkaline phophatase, Glutamic Oxaloacetic Transaminase (GOT), Glutamic Pyruvic Transaminase (GPT), Triiodothyronine (T_3), Thyroxine (T_4) and growth hormone (GH) using commercial kits.

Recorded data were subjected to statistical analysis using SPSS (1984). Data as percentages were transformed before analysis. The following model was used:

$$Y_{ijk} = \mu + L_i + B_j + (LxB)_{ij} + e_{ijk} .$$

where :

Y_{ijk} = Observation. μ = General mean.
L_i = Light regime effect. B_j = Bio-Tonic effect.
$(LxB)_{ij}$ = The interaction effect between light regime and Bio-Tonic treatment.
e_{ijk} = Random error.

RESULTS AND DISCTION

Live body weight and weight gain

Data presented in Table (2) show means of live body weight and weight gain of broiler chicks exposed to continuous, constant and intermittent lighting regimes from 1 up to 7 weeks of age. Chicks exposed to intermittent or continuous lighting had significantly ($P<0.01$) higher live body weights at 7 weeks of age than that exposed to constant lighting program. However, live body weights at 1 and 4 week of age were nearly similar. Body weight gain in chicks exposed to intermittent lighting was greater than that exposed to either continuous or constant lighting program, the differences in this respect, were significant ($P<0.01$) during 4-7 and significant ($P<0.05$) during 1-7 between intermittent and constant lighting programs (Table 2). This finding agree with the results of Al–Homidan (1994), Renden *et al.* (1996), Laster *et al*., (1999) and Othani and Lesson (2000). El- Neney (2003) showed that under intermittent light birds had significantly heavier body weight than those of continuous light and constant light. Intermittent light birds had the highest daily gain. The lowest one was the constant light regime.

On the other hand, Al-Homidan (1994), Buys *et al.* (1998) and Al–Homidan and Petchey (2001) observed non significant difference between light regimes on body weight at 7 wk of age. Also, Kalamah (2002) found that broiler chicks reared under continuous lighting had significantly ($P<0.01$) higher body weights than those grown under either constant or intermittent lighting regime; also the weekly body weight gain was greater for birds under continuous lighting than those under constant or intermittent lighting regime. However, Smith (1994) found that, photo schedule (23L: 1D and 16L : 8D) had no effect on body weight gain.

Chicks fed on B4 (1.5 kg /ton) Bio-Tonic plus diet had higher body weight than that fed on other diets at all ages studied. The differences among Bio-Tonic levels in body weight were highly significant ($P<0.01$) at 7 and not significant at 1 and 4 weeks of age (Table 2).

Body weight gain in chicks fed on B4 was greater than the other Bio-Tonic treatments, the differences in this respect, were highly significant ($P<0.01$) during 1-7 (Table 2). This finding agrees with the results of Abdel-Malak *et al.* (1995) who found that adding Bio-Tonic to broiler finisher diets as a growth promoter supplement improved live body weight and weight gain. Moreover, supplementing Bio-Tonic in broiler diets increased significantly live body weight and daily weight gain (P<0.01 or 0.001) at marketing age (Bardley *et al*., 1994; El-Gendi *et al*, 1994, Osman, 1996 and Tawfeek and Marai, 1997).

The effect of interaction between light regimes and Bio-Tonic level in diet on live body weight at 7 weeks of age and body weight gain during 1-7 weeks period was significant (P<0.01), significant (P<0.05) for live body weight at 4 weeks and body weight gain during 4-7 weeks period (Table 2). Moreover the highest value of both body weight (at 4 and 7 weeks) and body weight gain (during 4-7weeks and 1-7 weeks) was in treatment L3 x B4.

Table 2. Effect of light regimes and bio-tonic (B) level on body weight and body weight gain

Classification	Body weight (g)			Body weight gain (g)		
	1WK	4WK	7WK	1-4WK	4-7WK	1-7WK
Effect of light regimes						
(L1) Continuous	104	724	1880a	620	1156a	1776a
(L2) Constant	101	717	1739b	616	1022b	1638b
(L3) Intermittent	106	779	1943a	673	1164a	1837a
SEM	2.1	14.2	35.5	17.5	25.0	37.5
Probability	N.S	N.S	0.01	N.S	0.01	0.05
Effect of Bio-Tonic levels						
B1 (control)	101	706	1777b	605	1071	1676b
(0.5 Kg/ton) B2	101	718	1781b	617	1063	1680b
B3 (1.0 Kg/ton)	104	748	1887a	644	1139	1783a
B4 (1.5 Kg/ton)	108	787	1970a	679	1183	1862a
SEM	3.1	15.1	37.1	17.2	23.5	38.5
Probability	N.S	N.S	0.01	N.S	N.S	0.01
Interaction effect between light regimes and Bio-Tonic levels						
LI x B1	100	700a	1830bc	600	1130c	1730c
L1 x B2	102	695a	1835c	593	1140c	1733c
L1 x B3	104	720ab	1906d	616	1186c	1802c
L1 x B4	108	780c	1950d	672	1170c	1842cd
L2 x B1	99	665a	1690a	566	1025a	1591a
L2 x B2	100	700a	1709a	600	1009a	1609a
L2 x B3	101	732ab	1765b	631	1033ab	1664ab
L2 x B4	103	770bc	1790b	667	1020a	1687b
L3 x B1	103	752b	1810b	649	1058b	1707bc
L3 x B2	102	760b	1800b	658	1040b	1698b
L3 x B3	106	793c	1990de	687	1197cd	1884d
L3 x B4	113	810d	2170e	697	1360e	2057e
SEM	3.5	17.5	40.1	18.5	27.5	40.0
Probability	N.S	0.05	0.01	N.S	0.05	0.01

N.S. Not significant

a,b,c,d and e means within the same column not having similar superscripts are significantly different (P<0.05)

Feed consumption and feed conversion ratio

Table (3) shows that feed consumption of continuous lighting was significantly (P<0.01) greater than that of either constant or intermittent lighting treatments at all ages studied. The feed conversion ratio was significantly (P<0.05) higher for continuous than intermittent lighting program and non significant higher than constant lighting program at all periods studied as shown in Table (3). Similar results were reported by Buys *et al.* (1998) and Al–Homidan and Patchey (2001). However, El-Neney (2003) showed that daily feed consumption of continuous and intermittent chickens had significantly higher means than that of constant chickens (P ≤ 0.05) at different periods studied. Each bird under intermittent light consumed less feed than that reared under continuous light regime. These results suggest that birds reared under intermittent light regime were more efficient than those reared under continuous light.

Table 3. Effect of light regimes and bio-tonic (B) level on feed consumption (g) and feed conversion ratio (feed/gain, FCR)

Classification	feed consumption (g)			feed conversion ratio (feed /gain, FCR)		
	1-4WK	4-7WK	1-7WK	1-4WK	4-7WK	1-7WK
Effect of light regimes						
(L1) Continuous	1733^{a}	2927^{a}	4660^{a}	2.80^{a}	2.23^{a}	2.62^{a}
(L2) Constant	1412^{b}	2204^{b}	3616^{b}	2.29^{a}	2.16^{a}	2.21^{a}
(L3) Intermittent	1314^{b}	2287^{b}	3601^{b}	1.95^{b}	1.96^{b}	1.96^{b}
SEM	10.3	12.5	9.8	0.21	0.12	0.13
Probability	0.01	0.01	0.01	0.05	0.05	0.05
Effect of Bio-Tonic levels						
B1 (control)	1569^{a}	2528^{a}	4097^{a}	2.59	2.36	2.44
(0.5 Kg/ton) B2	1472^{a}	2421^{b}	3893^{b}	2.39	2.28	2.32
B3 (1.0 Kg/ton)	1487^{a}	2517^{a}	4004^{a}	2.31	2.21	2.24
B4 (1.5 Kg/ton)	1416^{b}	2424^{b}	3840^{b}	2.08	2.05	2.06
SEM	9.5	13.0	12.1	0.30	0.17	0.12
Probability	0.05	0.05	0.05	N.S	N.S	N.S
Interaction effect between light regimes and Bio-Tonic levels						
LI x B1	1800^{e}	2972^{f}	4772^{e}	3.0^{cd}	2.63^{d}	2.76
L1 x B2	1720^{de}	2964^{f}	4684^{e}	2.9^{c}	2.60^{d}	2.70
L1 x B3	1663^{d}	3036^{f}	4699^{e}	2.7^{c}	2.56^{d}	2.61
L1 x B4	1747^{e}	2738^{e}	4485^{d}	2.6^{c}	2.34^{cd}	2.43
L2 x B1	1415^{c}	2286^{c}	3701^{c}	2.5^{c}	2.23^{c}	2.33
L2 x B2	1380^{bc}	2220^{b}	3600^{b}	2.3^{b}	2.20^{c}	2.24
L2 x B3	1451^{c}	2169^{b}	3621^{b}	2.3^{b}	2.10^{bc}	2.17
L2 x B4	1401^{c}	2142^{ab}	3543^{b}	2.1^{b}	2.10^{bc}	2.10
L3 x B1	1493^{c}	2328^{c}	3820^{c}	2.3^{b}	2.20^{c}	2.24
L3 x B2	1316^{b}	2080^{a}	3396^{a}	2.0^{b}	2.00^{b}	2.00
L3 x B3	1347^{b}	2346^{c}	3693^{bc}	1.96^{b}	1.96^{b}	1.96
L3 x B4	1101^{a}	2394^{cd}	3495^{b}	1.58^{a}	1.76^{a}	1.70
SEM	20.0	19.0	15.0	0.18	0.15	0.20
Probability	0.01	0.05	0.01	0.01	0.05	N.S

N.S. Not significant

a,b,c,d,e, f: means within the same column not having similar superscripts are significantly different (P < 0.05)

The birds fed on B1 diet had feed consumption higher than those fed on other Bio-Tonic levels in diet during all periods studied, the differences in this respect, were significant (P<0.05, Table 3).

Chicks fed on B1 level gave insignificantly higher feed conversion ratio than those other Bio-Tonic levels in diet (Table 3). These results suggest that birds fed on B4 were more efficient than those reared under other Bio-Tonic levels in diet. On the other hand, Abdel-Malak *et al.* (1995), El-Hindawy *et al.* (1996), El-Gendi *et al.* (2000) and Abdel-Malak *et al.* (1995) showed that feed consumption increased as the percentage of supplemented Bio-Tonic increased. It was evident that, adding Bio-Tonic to broiler rations may improve the ration palatability and increase the amount of feed consumed.

There were significant differences (P<0.01) due to interaction effect between light regimes and Bio-Tonic level in diet on feed consumption during 1-4 and 1-7 weeks and feed conversion ratio during 1-4 weeks period, significant (P<0.05) for feed consumption and feed conversion ratio during 4-7 weeks period and not significant for feed conversion ratio during 1-7 weeks period (Table 3).The treatment of L3 x B4 was the best in feed conversion at all periods studied.

Carcass parameters

Data tabulated in Table (4) illustrated that the broiler chicks reared under intermittent light regime gave percentage of dressing, liver, gizzard, heart and giblets non-significantly higher than either continuous or constant lighting program. While, abdominal fat was insignificantly higher for continuous than that constant and intermittent lighting program (Table 4). Similar results were reported by Al-Homidan (1994) and Al-Homidan and Petchey (2001), Stanley *et al.* (1997) and El-Neney (2003) who showed that the differences among light regimes (continuous, constant and intermittent light) on carcass weight, abdominal fat, heart weight, liver weight and dressing percentage were not significant. On the other hand, Kalamah (2002) reported that the absolute weight of heart was significantly lower in the chicks reared under constant compared with those exposed to either continuous or intermittent light, the weight of liver and spleen for birds grown under constant was significantly greater compared to the other light treatments, the photoperiods significantly affected the relative weight of liver and spleen, it did not significantly affect the relative weight of heart.

Table (4) show that chicks fed on B4 in diet gave insignificantly percentages of dressing, liver, gizzard, heart and giblets greater than that fed on the other Bio-Tonic treatments. An opposite trend was true for abdominal fat % with B1 treatment (Table 4). In this respect**,** Ali (1999), Tawfeek and Marai (1997) and El-Hindawy *et al.* (1996) showed that the chicks fed diet supplemented with Yea-Sacc plus Bio-Tonic for long period (first 6 weeks of age) insignificantly improved most traits of carcass when compared to control diet.

On the other hand, El-Gendi *et al.* (2000) found that broiler chicks fed on dietary supplementation of Bio-Tonic and Zinc bacitracin showed significant increase in the total edible meat when compared with other level of different treatments applied. However, Abdel-Malak *et al.*(1995) reported that there were no significant differences among groups fed on different levels of Bio-Tonic on total edible protein of carcass, while giblets weight were significantly (P<0.05) different.

Table 4. Effect of light regimes and bio-tonic (B) level on carcass parameters

Classification	Carcass parameters					
	Dressing %	Abdominal Fat %	Liver %	Gizzard %	Heart %	Giblets %
Effect of light regimes						
(L1) Continuous	73.6	2.6	2.20	2.12	0.48	5.77
(L2) Constant	69.7	2.2	2.14	2.16	0.49	5.70
(L3) Intermittent	75.5	2.4	2.23	2.89	0.50	6.76
SEM	2.0	0.30	0.06	0.11	0.03	0.12
Probability	N.S	N.S	N.S	N.S	N.S	N.S
Effect of Bio-Tonic levels						
B1 (control)	71.7	2.3	2.21	2.10	0.47	5.79
(0.5 Kg/ton) B2	71.6	2.3	2.18	2.10	0.48	5.86
B3 (1.0 Kg/ton)	73.4	2.1	2.18	2.18	0.49	6.20
B4 (1.5 Kg/ton)	75.0	2.1	2.21	2.23	0.51	6.44
SEM	1.12	0.25	0.12	0.12	0.02	0.40
Probability	N.S	N.S	N.S	N.S	N.S	N.S
Interaction effect between light regimes and Bio-Tonic levels						
LI x B1	73.5b	2.6c	2.25	2.07	0.46	5.45
L1 x B2	72.7b	2.7c	2.18	2.10	0.47	5.50
L1 x B3	73.6b	2.5bc	2.20	2.13	0.49	6.01
L1 x B4	74.5c	2.6c	2.22	2.17	0.49	6.10
L2 x B1	68.9a	2.4b	2.19	2.10	0.47	5.35
L2 x B2	69.5a	2.3b	2.17	2.13	0.48	5.33
L2 x B3	70.0a	2.1b	2.15	2.20	0.49	5.79
L2 x B4	70.2ab	2.0b	2.07	2.23	0.50	6.30
L3 x B1	72.7b	2.0b	2.20	2.10	0.48	6.56
L3 x B2	72.5b	1.9ab	2.18	2.06	0.48	6.75
L3 x B3	76.7c	1.6a	2.20	2.22	0.49	6.80
L3 x B4	80.2d	1.6a	2.33	2.28	0.53	6.93
SEM	1.5	0.33	0.09	0.13	0.06	0.10
Probability	0.01	0.05	N.S	N.S	N.S	N.S

N.S. Not significant

a,b,c and d means within the same column not having similar superscripts are significantly different ($P< 0.05$)

The interaction between photoperiod and Bio-Tonic level in diet in carcass parameters was highly significant ($P<0.01$) for dressing %, significant ($P<0.05$) for percentages of abdominal fat, and not significant for percentages of liver, gizzard, heart and giblets (Table 4). Moreover, treatment L3 x B4 had the highest value of traits dressing, liver, gizzard, heart and giblets % and the lowest value in trait of abdominal fat %

Chemical composition of meat

The meat moisture % and crude protein (C.P) % were insignificantly higher for birds exposed to intermittent than that exposed to either continuous or constant lighting programs. Moreover, birds exposed to constant light program had ether extract (E.E) % significantly ($P<0.05$) greater than that exposed to intermittent and insignificant for continuous lighting program. Furthermore, crude ash (C.A) % was nearly similar in all lighting programs used (Table 5).

Table 5. Effect of light regimes and bio-tonic (B) level on chemical composition of meat

Classification	chemical composition of meat			
	Moisture %	**C.P %**	**E.E %**	**C.A %**
Effect of light regimes				
(L1) Continuous	74.12	74.71	17.10 ab	5.12
(L2) Constant	73.68	73.48	18.00 a	5.07
(L3) Intermittent	74.63	75.35	16.10 b	5.11
SEM	0.27	0.30	0.27	0.05
Probability	N.S	N.S	0.05	N.S
Effect of Bio-Tonic levels				
B1 (control)	74 00	73.90	17.45	5.10
(0.5 Kg/ton) B2	74.06	74.03	17.24	5.11
B3 (1.0 Kg/ton)	74.28	75.00	16.80	5.09
B4 (1.5 Kg/ton)	74.22	75.12	16.68	5.08
SEM	0.34	0.40	0.36	0.12
Probability	N.S	N.S	N.S	N.S
Interaction effect between light regimes and Bio-Tonic levels				
LI x B1	74.16	74.25	17.11b	5.12
L1 x B2	74.33	74.24	17.03b	5.13
L1 x B3	74.12	75.11	17.10b	5.06
L1 x B4	73.86	75.22	17.01b	5.11
L2 x B1	73.82	73.32	18.52d	5.07
L2 x B2	73.46	73.46	18.13d	5.04
L2 x B3	73.63	73.50	17.67c	5.08
L2 x B4	73.80	73.64	17.52c	5.08
L3 x B1	74.00	74.12	16.72b	5.12
L3 x B2	74.40	74.39	16.55ab	5.14
L3 x B3	75.10	76.26	15.62a	5.12
L3 x B4	75.00	76.64	15.50a	5.04
SEM	0.46	0.48	0.47	0.16
Probability	N.S	N.S	0.05	N.S

N.S. Not significant

a,b,c and d means within the same column not having similar superscripts are significantly different ($P < 0.05$)

C.P % : Crude protein E.E % : Ether extract C.A % : Crude ash

Data presented in Table (5) illustrate that the differences among Bio-Tonic levels in all meat composition were not significant, and the averages were nearly similar (Table 5).

There were no significant differences due to interaction effect between light regimes and Bio-Tonic level in diet in all chemical compositions of meat studied except ether extract (E.E) %, it was significant ($P<0.05$, Table 5). Moreover, the lowest and highest value of ether extract % and crude protein % respectively was in the treatment of L3 x B4.

Liver contents (lipids, protein and glycogen)

Data in Table (6) indicate that broiler chicks reared under intermittent light regime gave significantly (P<0.01and P<0.05) higher liver protein % and glycogen (mg/g) greater than that reared under both continuous and constant lighting programs. Moreover, chicks reared under continuous light regime had insignificantly liver lipids % higher than other photoperiods**.** This finding agrees with the results of El-Neney (2003) who demonstrated that at 7wk of age, birds subjected to continuous or intermittent light systems, exhibited more liver lipids (24.0 and 23.3 %) than those under constant system (21.9 %), the effect of different light systems on protein level was highly significant at 7 wk of age. In case of glycogen content, light systems (continuous, constant and intermittent light) did not affect liver glycogen content. These results were in disagreement with those obtained by Al-Homidan (1994).

Table 6. Effect of light regimes and bio-tonic (B) level on liver lipids, proteins and glycogen

Classification	**Liver**		
	Lipids%	**Proteins%**	**Glycogen Mg/g**
Effect of light regimes			
(L1) Continuous	22.92	68.85 ab	0.96 b
(L2) Constant	23.42	66.85 b	0.97 b
(L3) Intermittent	21.54	70.11 a	1.32 a
SEM	0.45	0.86	0.18
Probability	N.S	0.01	0.05
Effect of Bio-Tonic levels			
B1 (control)	23.02	67.22	0.98 b
(0.5 Kg/ton) B2	23.12	68.27	0.97 b
B3 (1.0 Kg/ton)	22.20	69.22	1.14 a
B4 (1.5 Kg/ton)	22.14	69.71	1.24 a
SEM	0.52	0.66	0.15
Probability	N.S	N.S	0.05
Interaction effect between light regimes and Bio-Tonic levels			
LI x B1	22.98	68.98b	0.97
L1 x B2	23.00	69.00b	0.96
L1 x B3	22.75	68.66b	0.94
L1 x B4	22.98	68.76b	0.98
L2 x B1	24.00	65.75a	0.99
L2 x B2	23.90	66.77ab	0.098
L2 x B3	23.00	67.00b	0.95
L2 x B4	22.79	67.88b	0.97
L3 x B1	2209	66.93b	0.98
L3 x B2	22.60	69.03b	0.96
L3 x B3	20.82	72.00c	1.53
L3 x B4	20.65	72.50c	1.76
SEM	0.53	0.93	0.22
Probability	N.S	0.01	N.S

N.S. Not significant

a,b and c means within the same column not having similar superscripts are significantly different (P < 0.05)

Table (6) shows that chicks fed on B4 level had insignificantly lower and higher liver lipids and protein % than other levels, respectively. B4 and B3 had significantly (P<0.05) glycogen (mg/g) greater than the other Bio-Tonic levels.

The interaction between light regimes and Bio-Tonic level in diet on liver protein % was highly significant (P<0.01), the highest value was in treatments L3 x B4. There were no significant differences due to interaction between light regimes and Bio-Tonic level in diet on liver lipids% and liver glycogen (mg/g) Table (6). Moreover, the lowest and highest value in liver lipids % and liver glycogen (mg/g) respectively was in treatment L3 x B4.

Blood plasma constituents

Chicks exposed to intermittent lighting program had insignificantly higher plasma total protein, albumin, alkaline phosphatase, and GOT than that exposed to either continuous or constant lighting programs.

Plasma total lipids were insignificantly higher for constant than either continuous or intermittent lighting program, while, cholesterol had the lowest (insignificant) value in intermittent lighting program compared with other light regimes. Plasma GPT was insignificantly higher in chicks exposed to continuous than that exposed to either constant or intermittent lighting programs.

Plasma hormones of T3 and G.H were, in general, greater in chicks exposed to intermittent lighting program than that exposed to either continuous or constant lighting programs, the differences, in this respect, were significant (P<0.05) for T3, and not significant for GH. However, plasma T4 hormone was nearly similar in all photoperiod programs (Table 7). These results are in agreement with those reported by El-Neney (2003) who showed that there was no significant differences due to light regimes on plasma total protein, the broiler chicks reared under intermittent lighting system (4L: 8D : 4L : 8D) had insignificantly total protein and significant (P<0.05) plasma albumin higher than that reared under continuous lighting system (23L: 1D). Birds with constant and intermittent lights had higher GH than that of continuous light. Also, Buyse *et al.*, (1998) reported that birds under intermittent light have higher plasma T3 concentrations than those exposed to constant light. On the other hand**,** Buyse *et al.* (1997), Buys *et al.* (1998) and El-Neney (2003) who found that broiler chicks reared under intermittent lighting system (4L: 8D : 4L : 8D) had plasma cholesterol higher than that reared under continuous lighting system (23L: 1D), the differences in this respect were highly significant (P<0.01).

Light systems, especially intermittent light, showed the most highly concentration of (T_3) among the three light treatments. This may be due to that, the reduction of light may be associated with metabolic changes during darkness. Birds with intermittent lights had higher GH than those of constant and continuous light. These results are in agreement with those reported by (Buyse *et al.*, 1997 and Buys *et al.,* 1998) that Plasma growth hormone levels in birds reared under intermittent light were higher than those of constant light. Intermittent light manifesting compensatory growth have higher mean plasma growth hormone levels than their age-matched counterparts (Kuhn *et al.*, 1996).

The chicks fed on B4 level had plasma total protein and albumin had significantly (P<0.05) higher than those fed on the other levels of Bio-Tonic., for plasma albumin, and not significant for plasma total protein.

Chicks fed B4 had insignificantly higher plasma total lipids, and significantly (P<0.05) lower cholesterol than those fed on different levels of Bio-Tonic in diet.

Plasma alkaline phosphatase activity and GOT were, in general, insignificantly higher in chicks fed on B4 level in diet than the other levels of Bio-Tonic in diet. An opposite trend was true for GPT with B1 (Table 7).

Table 7. Effect of light regimes and bio-tonic (B) level on blood plasma constituents

Classification	Plasma				
	Total protein g /100ml	Albumin g / 100ml	Total Lipids g/L	Cholesterol Mg/100ml	Alkalin phosphatase U/L
Effect of light regimes					
(L1) Continuous	4.62	1.76	16.63	111	222
(L2) Constant	4.00	1.81	17.00	110	225
(L3) Intermittent	4.77	1.94	15.00	107	230
SEM	0.38	0.19	0.48	0.61	0.44
Probability	N.S	N.S	N.S	N.S	N.S
Effect of Bio-Tonic levels					
B1 (control)	4.22	1.65 b	16.83	113 a	204
(0.5 Kg/ton) B2	4.38	1.75 b	16.36	109 a	217
B3 (1.0 Kg/ton)	4.58	1.92 a	16.00	107 b	235
B4 (1.5 Kg/ton)	4.64	2.03 a	15.56	106 b	247
SEM	0.40	0.20	0.50	1.20	0.56
Probability	N.S	0.05	N.S	0.05	N.S
Interaction effect between light regimes and Bio-Tonic levels					
LI x B1	4.45bc	1.56a	16.85	117c	205
L1 x B2	4.63c	1.62a	16.75	110b	213
L1 x B3	4.66c	1.86b	16.56	109b	232
L1 x B4	4.72c	2.00c	16.36	107a	238
L2 x B1	3.99a	1.65a	17.22	113b	200
L2 x B2	3.97a	1.70ab	17.19	111b	219
L2 x B3	3.98a	1.89b	17.20	108ab	235
L2 x B4	4.00a	1.99bc	16.30	109b	247
L3 x B1	4.23b	1.75b	16.42	110b	207
L3 x B2	4.54c	1.92b	15.13	108ab	220
L3 x B3	5.11d	2.00c	14.20	105a	237
L3 x B4	5.21d	2.10c	14.02	103a	255
SEM	0.52	0.23	0.56	0.75	0.80
Probability	0.05	0.05	N.S	0.01	N.S

N.S. Not significant

a,b,c and d means within the same column not having similar superscripts are significantly different (P< 0.05)

Table 7. Cont.

Classification	**Plasma**				
	GOT U/I	**GPT U/I**	**T 3 ng/dl**	**T 4 ng/dl**	**G.H Iu/ml**
Effect of light regimes					
(L1) Continuous	30	6.2	135 ab	1.79	0.299
(L2) Constant	29	4.7	132 b	1.75	0.324
(L3) Intermittent	31	5.6	137 a	1.76	0.333
SEM	0.05	0.04	0.21	0.30	0.05
Probability	N.S	N.S	0.05	N.S	N.S
Effect of Bio-Tonic levels					
B1 (control)	26	6.1	136 b	1.79	0.230 c
(0.5 Kg/ton) B2	30	5.9	134 c	1.79	0.356 b
B3 (1.0 Kg/ton)	31	5.7	137 b	1.80	0.370 b
B4 (1.5 Kg/ton)	33	5.8	140 a	1.82	0.385 a
SEM	0.07	0.03	0.18	0.61	0.10
Probability	N.S	N.S	0.01	N.S	0.05
Interaction effect between light regimes and Bio-Tonic levels					
LI x B1	27	7.0	134a	1.80	0.320b
L1 x B2	29	5.9	134a	1.79	0.327bc
L1 x B3	30	5.8	137ab	1.83	0.347c
L1 x B4	33	5.6	138b	1.85	0.367d
L2 x B1	25	7.1	132a	1.79	0.298a
L2 x B2	28	6.2	133a	1.77	0.323b
L2 x B3	30	4.9	135a	1.80	0.339c
L2 x B4	31	5.8	138b	1.83	0.354cd
L3 x B1	26	6.9	137ab	1.81	0.345c
L3 x B2	32	5.7	141b	1.78	0.360d
L3 x B3	33	5.3	147c	1.83	0.386ed
L3 x B4	35	5.4	150c	1.87	0.395e
SEM	0.08	0.04	0.23	0.75	0.15
Probability	N.S	N.S	0.05	N.S	0.05

N.S. Not significant

a,b,c and d means within the same column not having similar superscripts are significantly different ($P < 0.05$)

Plasma albumin and hormones of T3, T4 and GH were, in general, greater in chicks fed on B4 level in diet than the other levels of Bio-Tonic in diet (Table 7), the differences, in this respect, were highly significant ($P<0.01$) for plasma T3, significant ($P<0.05$) for Plasma GH and albumin and insignificant for plasma T4 (Table 7). In this respect, El-Gendi *et al.* (2000) and Abdel-Malak *et al.* (1995) who reported that the means values of total protein, albumin, globulin, alkaline phosphatase in blood serum increased, while, GOT and GPT in blood serum decreased for broiler chicks fed on Bio-Tonic. They added that serum blood of total lipids and cholesterol were not significantly affected by this feed additive (Bio-Tonic). Moreover, Abdel-Azeem (2002) reported that biological feed additive for broiler chicks diet did not have a significant effect on liver function (GOT and GPT).

While, chicks fed on diets supplemented with biological feed additives showed higher values of blood total protein, albumin (A) and globulin (G). But, lower values of A/G ratio, cholesterol and total lipids were observed when compared with the control group.

On the other hand, Poo and Millan (1990) and Tawfeek *et al.* (1993) observed that serum total protein, albumin (A), globulin (G), A/G ratio, total lipids and thyroid hormones were not significantly affected by biological feed additive for broiler chick's diet.

The effect of interaction between photoperiod and Bio-Tonic level on plasma cholesterol was highly significant ($P<0.01$) and the lowest value of plasma cholesterol was in treatment L3 x B4, significant ($P<0.05$) for plasma total protein, albumin and plasma hormones of T3 and G.H, and the highest value of the previous traits was in treatment L3 x B4 and not significant for plasma total lipids, alkaline phosphatase activity, GOT , GPT and T4 hormones with the lowest value in treatment L3 x B4 of plasma total lipids, GPT and T4, moreover, the highest value in treatment L3 x B4 of traits alkaline phosphatase activity and GOT.

We recommend using the treatment L3 x B4 in broiler diet because it enhance body weight, body weight gain, meat composition and carcass traits, also decrease cholesterol, total lipids and increase total protein in the liver and plasma. All the previous characteristics increase the economic profit in broiler farmers.

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تحسين الصفات الإنتاجية والفسيولوجية لبدارى التسمين بإستخدام بعض نظم الاضاءة والإضافات الغذائية

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١- قسم بحوث تربية الدواجن- معهد بحوث الإنتاج الحيوانى- مركز البحوث الزراعية، ٢- قسم أنتاج الدواجن - كلية الزراعة - جامعة المنوفية

أجريت هذه الدراسة فى محطة أبحاث الدواجن- قسم أنتاج الدواجن - كلية الزراعة- جامعة المنوفية. وكان الهدف من البحث هو دراسة تأثير كل من نظم الاضاءة واضافة مستخلص الأعشاب الطبيعية (البيوتونيك) كمنشط نموطبيعى الى العليقة ، وكذلك التداخل بينهما على كل من الأداء الأنتاجى والصفات الفسيولوجية لبدارى التسمين ، حيث قسمت الطيور عند عمر يوم الى ٣ مجموعات متساوية العدد طبقا الى ثلاث نظم مختلفة لفترات الاضاءة، وهى اضاءة مستمرة (٢٣ ساعة اضاءة : ١ ساعة اظلام)، واضاءة ثابتة (١٥ ساعة اضاءة : ٩ ساعة اظلام)، واضاءة متقطعة (٨ ساعة اضاءة : ٤ ساعة اظلام : ٨ ساعة اضاءة : ٤ ساعة اظلام)، وكل نظام من نظم الاضاءة الثلاثة تم تقسيمه الى أربع مجاميع تبعا لمستوى اضافة البيوتونيك للعليقة وهى، كنترول، ٥٠٠، ١٠٠٠، ١٥٠٠ جرام / طن . وتم أخذ المقاييس أسبوعيا حتى عمر ٧ أسابيع وتلخصت النتائج فى الآتى : كانت الطيور المرباة تحت نظام اضاءة متقطعة أثقل معنويا فى وزن الجسم عند عمر ٧ أسابيع ، وكذلك الزيادة الأسبوعية فى وزن الجسم خلال الفترات ٤-٧، ١-٧ أسابيع من العمر عن المعاملتين الآخرتين. أوضحت النتائج أن الطيور المغذاه على عليقة مضاف اليها البيوتونيك بمعدل ١٥٠٠ جم / طن زادت زيادة معنوية فى كل من وزن الجسم عند ٧ أسابيع وكذلك الزيادة الأسبوعية فى وزن الجسم خلال الفترة ١-٧ أسابيع من العمر. كان استهلاك الغذاء ومعدل التحويل الغذائى للطيور المعرضة للضوء المستمر أعلى معنويا فى جميع الأعمار وخلال جميع فترات العمر المدروسة. وجد أن الطيور التى تغذت على عليقة كنترول أستهلكت من العليقة كمية أكبر معنويا عن تلك المغذاه على عليقة مضاف اليها البيوتونيك فى جميع الفترات المدروسة. أوضحت النتائج أن الطيور المغذاه على عليقة مضاف اليها البيوتونيك بمعدل ١٥٠٠ جم / طن أعطت نسب تصافى، كبد، قونصة، قلب، أحشاء مأكولة أعلى عن المعاملات الأخرى، بينما وجد أن دهن البطن كان أقل عموما فى الطيور المغذاه على عليقة مضاف اليها البيوتونيك عن تلك التى غذيت على عليقة كنترول. كانت الطيور المرباة تحت نظام اضاءة متقطعة أعلى معنويا فى محتوى الكبد من بروتين وجليكوجين عن المعاملات الأخرى. وجد أن دهن الكبد كان أقل، بينما محتوى الكبد من بروتين وجليكوجين كان أعلى وذلك فى الطيور المغذاه على عليقة مضاف اليها البيوتونيك بمعدل ١٥٠٠ جم / طن عن المعاملات الأخرى. الليبيدات الكلية كان ارتفاعها غير معنويا فى دم الطيور المرباه تحت نظام اضاءة ثابتة بالمقارنه بالاضاءة المتقطعة او المستمرة. أنخفض محتوى بلازما الدم من الليبيدات الكلية والكوليستيرول بينما أرتفع محتوى بلازما الدم من البروتينات الكلية والألبيومين والألكالين فوسفاتيز والجلوتاميك

أوكسال أسيتك أسد الناقل لمجموعة الأمين (GOT) وهرمونات (T3 , T4, GH) فى دم الطيور المغذاة على البيوتونيك بمعدل ١٥٠٠ جم / طن عن المعدلات الأخرى. وجد أن هناك فروقا معنوية راجعة للتداخل بين نظم الاضاءة و مستوى اضافة البيوتونيك للعليقة على أوزان الجسم عند ٤، ٧ أسابيع والوزن المكتسب خلال ٤–٧، ١–٧ أسابيع وكمية الغذاء المستهلك خلال جميع الفترات ومعدل التحويل الغذائى خلال ١–٤، ٤–٧ أسابيع ومحتوى الكبد من البروتين ونسب التصافى ودهن البطن ومحتوى بلازما الدم من البروتينات الكلية والألبيومين والكوليستيرول وهرمونى (T3 , GH).

بصفة عامة ، يمكن أن نوصى باستخدام نظام الاضاءة المتقطعة مع اضافة مستخلص الأعشاب الطبيعية كمنشط نمو طبيعى وذلك بمعدل ١٥٠٠ جم / طن لتحسين صفات النمو والذبيحة وتقليل نسبة الكوليستيرول فى الدم والكبد مما يزيد من العائد الأقتصادى فى كتاكيت اللحم