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EFFECT OF INTERACTION BETWEEN NUMBER OF DAY LIGHT HOURS AND DIETERY PROTEIN LEVELS ON PRODUCTIVE, PHYSIOLOGICAL AND IMMUNOLOGICAL PERFORMANCE OF TWO DEVELOPED STRAIN CHICKENS.

Hassan. M. S.H , A. M. Bealash , H. A.H. Abdel- Haleem , S. M. H. Mebarez , andHanan, S.M.M.

Animal Prod.Res. Inst. ,Agric.Res. Center, Ministry of Agric., Dokki, Giza, Egypt.

Corresponding Author: Magdy .S .H. Hassan; Email :magdyhassan2@yahoo.com

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ABSTRACT: This experiment was carried out on the Matrouh and Silver Montazah strains which used 120 females + 12 males for each strain to study the effect of interaction between number of day light hours and dietary protein levels on productive, physiological and immunological performance. The groups were as follows: The first group was taken 17 hours lighting /day + 16% dietary protein (control group); the second group was taken 17 hours lighting /day + 18% dietary protein; the third group was taken 15 hours lighting /day + 16% dietary protein; The fourth group was taken 15 hours lighting /day + 18% dietary protein. Theobtained results indicated that the group fed 18% dietary protein gave the lower feed intake and improved feed conversion compared with groups which take 16% dietary protein. The group reared under 17 h lighting /day + 16% dietary protein gave the best egg weight and egg mass compared with groups rearing under 15 h lighting /day and groups had18% dietary protein gave the high egg weight, egg mass and egg production % compared with those take 16% dietary protein. the higher values of egg shell thickness was for group fed 18% dietary protein compared with 16% dietary protein and the groups of Matrouh strain under 17 h lighting /day and 18% and 16% dietary protein and Silver Montazah under 17 h lighting /day and 18% dietary protein gave the higher fertility (%).Matrouh strain reared under 17 h lighting /day and using 18% dietary protein gave the higher values of PCV%, WBC's, lymphocytes, heterophils and H/L ratio. The groups take 17 h dietary /day gave the higher blood total protein level and total cholesterol compared with the groups take 15 h dietary /day. It could be concluded that the best of treated groups was under 17 hour light/day plus preferred that diets containing 18% crude protein for improving productive, physiological and immunological performance for these developed strains in Egypt.

Key Words: Day light - Dietary protein - Productive performance -Developed strain.

INTRODUCTION

Light is important for poultry for many reasons. Vision is the predominant sense in birds, where a large proportion of the total brain size is devoted to eyes and visual cortex, light as an environmental factor consists of three different aspects: intensity, duration, and wave length, light intensity, color, and the photoperiodic regime can affect the physical activity of laying hens, relatively little is known of the effects of the duration of light on stress status in birds (Güntürkün, 2000).

Poultry welfare demands a day and night light schedule for birds kept in captivity, because continuous or near continuous light might reduce birds' abilities to cope with stressful conditions (Khalil *et al.* 2008). There are a number of reports involving the evaluation of exposure laying birds to different photoperiod (Khalil *et al*.2008; Coban*et al.* 2009; El-Slamoney *et al.*2010; and Hanan, 2012).

Similarly, Coban *et al.* (2009) recorded lower H/L ratio in self photoperiod group than exposed to continuous lighting in quail's hens. Wu *et al*. (2007) reported that increasing dietary protein level significantly affected egg production, egg weight, egg mass, feed consumption, feed conversion ratio, egg specific gravity and body weight of the hens. Lighting influences several physiological processes including stimulation of internal organs, initiation of hormone release, and various metabolic steps that facilitate feeding, digestion, egg production rate, egg mass and feed efficiency in laying hens (Molino *et al.,* 2015 and Farghly *et al*. 2019). Light is one of the most powerful exogenous microclimate factors in poultry production that influences body physiological functions, bird activity, behavior, immune response, and growth rate among others (Olanrewaju*et al.,* 2019).

Sohail *et al. (*2003) reported that eggs from hens fed a higher protein level (19.8 % CP) were heavier than those from the hens fed a lower-protein diet (17.4 % CP). Egg weight was decreased from 55.21 to 52.20 g as dietary protein level decreased from 19 to 13 % CP (Zootechnica International, 2008). O'Byrne (2002) reported that small eggs may be due to low protein. Novak *et al*. (2006) reported that hens consuming 13.8 g of protein per day had significantly reduced egg weight compared with hens consuming 14.6 or 16.3 g of protein per day. Hussein (2000) indicated that 19 % CP in layer diets significantly increased egg weight of White Leghorn pullets compared to 16 % CP in the diet, and crude protein in layer diets from 16 to 19 % significantly increased egg production and 19 % CP significantly improved egg weight. Egg mass of hens fed on 16 and 18 % CP diets were significantly higher than the 14 % CP group due to heavier egg weight (Buchasak *et al.,* 2005). Wu *et al*. (2007) reported that there was no significant effect of protein on yolk and shell contents, as protein level increased from 160.7 to 173.9 g/kg, percent albumen linearly increased and yolk to albumen ratio linearly decreased. The developing embryo is completely dependent for its growth and development on nutrients deposited in the egg, consequently the physiological status of the chick at hatching is greatly influenced by the protein nutrition of the breeder hen which will influence chick size, vigor and the immune status of the chick and hens fed diets low in protein produced chicks with higher mortality and poor growth compared to those from hens fed on diets high in protein (Kemp and Kenny, 2007*).* However, Kingori *et al.* (2010) concluded that the dietary crude protein requirement

for laying in digamous hens is about 120 g CP/kg and maternal dietary protein level has no effect on post-hatch off spring feed intake, feed efficiency and growth rate.

The protein level in laying hens diets is considered to be the most important nutrient required from the stand point of quality and total cost of diets. The protein requirements for high producing laying hens varies from 16 to 18 % CP of the diet, to meet the needs of egg production, maintenance and growth of body tissues, feathers growth. However, this depends on the energy content of the feed (Bunchasak *et al*. 2005).The developing embryo is completely dependent for its growth and development on nutrients deposited in the egg, consequently the physiological status of the chick at hatching is greatly influenced by the protein nutrition of the breeder hen which will influence chick size, vigor and the immune status of the chick. Also, hens fed diets low in protein produced chicks with higher mortality and poor growth compared to hens fed on high protein diets (Kemp and Kenny, 2007). Several studies focused on evaluating the effect of protein levels on productive performance of laying hens (Bunchasak *et al.* 2005; Zou and Wu, 2005; Gunawardana *et al.* 2009 and Kingori *et al.* 2010).

The aim of this study was to evaluate the effect of the interaction between dietary protein levels and daily lighting hours on physiological, immunological and productive performance of Matrouh and Silver Montazah laying hens.

MATERIALS AND METHODS

The present study was carried out at the Poultry breeding station in Inshas station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Giza, Egypt, during the period from 24 until 40 week of age for two developed laying hens. The main objective of the experiment was to study the effect of interaction between number of day light hours and dietary protein levels on productive, physiological and immunological performance of Matrouh and Silver Montazah laying hens. A total number of 240 females + 24 males at 24 weeks of age from Matrouh and Silver Montazah strains (120 females + 12 males each) were housed in floor pens. At 24 weeks of age, each strain was randomly distributed into four treatments (30 females + 3 males / treatment) in 3 replicates, 10 females + 1 male each. Birds were kept under normal brooding conditions in floor brooder houses and wheat straw was used as a litter in the houses. Both strains were reared under similar managerial and hygienic conditions. Composition and calculated analysis of the basal and tested diets are listed in Table (1).

Feed and water were offered *ad-libitum* during the whole experimental period. The four experimental treatments for each strain were:

1-The first group take 17 hr. light/day + 16% dietary protein (control group).

2-The second group take 17 hr. light/day + 18% dietary protein.

3-The third group take15hr. light/day + 16% dietary protein.

4-The fourth group take15hr. light/day + 18% dietary protein.

Studied traits:

1-Productive performance:

-Body weight (BW) and body weight change (the end of the experimental body weight-the beginning of the experimental body weight), feed intake (FI) and calculation feed conversion (FC) were recorded for 4 weeks intervals.

Body weight change=final body weight – initial body weight.

-Egg number (EN) and egg weight(EW) were recorded daily throughout the trial and egg mass (EM) was calculated. Egg production rate(EPR) was calculated during 4 weeks (monthly) during the experimental period.

Were egg production rate=egg number/hen/month (number of days at the same period x number of hens) x 100.

-Egg quality traits: At 36 week of age 30 consequently laid eggs were collected from each treatment group to measure interior and exterior egg quality traits. Since, a total of 240 eggs were used in the study (30 eggs x 4 treatment x 2 strains).

-Exterior egg quality (shell weight %, shell thickness and egg shape index).

-Interior egg quality (albumen weight %, yolk weight %, yolk index and Hough unit).

Hough unit (H.U) = 100 log (H + 7.57 – 1.7* $w^{0.37}$)

Were, H = height of thick albumen (mm), w= egg weight (g).

Hatchability parameters:

At 36 week of age 60 eggs/treatment were take for hatchability and embryonic mortality for take fertility %), hatchability of total egg sets (%), hatchability of fertile eggs (%), early embryonic mortality (%), intermediate embryonic mortality (%) and late embryonic mortality (%) for total eggs 60 eggs x 4 treatments x 2 strains = 480 eggs.

2-Physiological performance:

At 40 week of age six blood samples from each treatment were withdrawn from brochial vein in heparinized tubes and centrifuged at 4000 rpm for 10 minutes to obtain the plasma then stored at -20^{o}until the analysis. The plasma samples were used to measure total protein according to Gornal *et al.* (1949), albumin according to Doumas *et al* (1971), triglycerides, total cholesterol, HDL and LDL according to Richmond (1973) and Allain (1974).

3-Immunological performance:

At 40 week of age sixe blood samples from each treatment were withdrawn from brachial vein in tubes for take hematological parameters and count these: RBC's, hemoglobin, packed cell volume (PCV %), WBC's, lymphocytes %, heterophils % and calculated H/L ratio.

Statistical analysis:

Data from all the response variable were subjected to factorial (2×2×2) analysis of variance **(** SAS, 2003).Variables having a significant F-test (P<=0.05) were compared using Duncan ,s Multiple Range Test (Duncan,1955).

Model:

Xijl = μ + Ti +Fj+Sl (TFS) ijl+ Eijl

whereX_{ijl} = Any observation

μ = The overall mean.

T_i = Light levels (i= 1and2).

F_j = protein levels (j= 1 and 2)

Sl= type of strain (l= 1 and 2)

(TFS)ijl= Interaction between light levels, protein levels and type of strain,

Eijl = Eperimintal error.

RESULTS AND DISCUSSION

1-Productive performance:

Results in Table (2) show that body weight change was higher in Silver Montazah strain compared with Matrouh strain, and no significant different between 17 h and 15 h/day and no significant different between of protein levels using 18% and 16% in diets, also no significant different between all effect of interaction between two strain Matrouh and Silver Montazah at 17 h or 15 h/day by using two levels of protein 18 % and 16 % in diets. Also, feed intake and feed conversion were not significant differences between two strain Matrouh and Silver Montazah and between all light effect 17 h or 15 h/day, while the group take 18% dietary protein

gave the lower feed intake and feed conversion (best feed conversion) compared with groups take 16% dietary protein, also Matrouh strain under 17 hour of light/day and take 16% dietary protein gave the lowest feed intake and feed conversion compared with all groups. Egg weight, egg mass and egg production % were higher in Silver Montazah compared with Matrouh strain, also the groups rearing under 17 h lighting /day + 16% protein gave the best egg weight and egg mass compared with groups rearing under 15 h lighting /day and the groups take 18% dietary protein gave the highest egg weight, egg mass and egg production % compared the groups take 16% dietary protein.

Also, the Silver Montazah strain reared fewer than 17 h lighting /day and gave 16% dietary protein gave higher egg weight, egg mass and egg production % compared with other groups. These results agree with Sohail *et al.* (2003) , Zou and We (2005) and Gunawardana *et al.* (2009) who found that the strains reared fewer than 17 h lighting /day and gave 16% dietary protein gave higher egg weight, egg mass and egg production % compared with other groups gave lower 16% dietary protein. Also, Novak *et al*. (2006) reported that a high level of dietary protein also maximizes the amount of carcass protein available for egg formation as well as egg size.

On the other hand, in the laying industry, chickens are usually kept on a continuous or nearly continuous lighting schedule in order to maximize growth rate, in the laying industry, selection for short interval between eggs under continuous light could be used to increase the rate of response per generation for high egg production, (Yoo*et al*., 1986) , El-Slamoney *et al.* (2010) reported that light treatments (T1) control; (T2), day light + 2 hours artificial light and (T3) day light + 4 hours artificial light had significant effect on body weight gain.

Hanan (2012) showed that the long photoperiod (18 hours light/day) reduced insignificantly live body weight. Also, Wu *et al.* (2007) reported that increasing protein level significantly affected body weight of the hens. Boon *et al.*, (2000) reported that long photoperiods increased significantly weight gain values.

There were no references on interaction between effects of light + dietary protein levels on body weight of the hens. These results agree with Wu *et al.* (2007) who reported that increasing protein level significantly affected feed consumption and feed conversion ratio of the hens.

Also, These results agree with El-Slamoney *et al*. (2010) who reported that light treatments control, day light + 2 hours artificial light and day light + 4 hours artificial light had higher significant effect on egg number, egg production and egg mass at 32-36 weeks of age. Keshavarz (1998) showed that, egg mass was significantly lower for hens on the step-down lighting regimen and the rate of egg production remained consistently lower for hens fed on the step-down lighting regimen, Khalil *et al.* (2008) found that egg mass and egg production were significantly increased for birds exposed to step-up lighting regimen compared to other exposed to other lighting regimen for Mandarah and Bandarah hens. Also, Hanan (2012) showed that the long photoperiod (18 hours light/day) gave a significant elevation in egg production compared with 16 hours lighting period for Silver Montazah and Matrouh strains at all ages 24 to 42 weeks of age. And no references on interaction between effect of light +

dietary protein on egg weight, egg number, egg mass and egg production rate. Results in Table (3) showed that the effect of lighting program and protein level on external and internal egg quality of two developed strain at 40 week of age shell weight (%), egg shape index, albumen weight, yolk weight, yolk index and Hough unit found that no different between Matrouh and Silver Montazah strains, and between all lighting hours 17 or 15 h/day, between two protein levels 18% or 16% in diets, also between interaction two strains Matrouh and Silver Montazah under 17 h or 15 h/day when gave 18% or 16% protein levels in diets in all groups, but found significant differences in shell thickness. The higher group those take 18% protein compared with 16% protein and the higher group Matrouh strain + 17 h light /day + 18% protein compared with other groups, but the group take 17 h light /day gave the higher Hough unit compared with 15 h light /day in all groups. On the other hand, Wu *et al.* (2007) reported that there was no significant effect of protein on yolk and shell contents, as protein level increased from 160.7 to 173.9 g/kg, percent albumen linearly increased and yolk to albumen ratio linearly decreased. And no references on interaction between effect of light + dietary protein on all parameters of egg quality.

The present results are similar to that reported by Farghly *et al.* (2017) who stated that birds exposed to continuous common light program significantly increased most traits of egg quality. While, shell percentage and thickness (mm) for hens subjected to flash light had lower values than those in common light type.

Table (4) showed the effect of lighting program and protein levels on hatchability and embryonic mortality of two developed strains at 36 week of age, hatchability of total egg sets (%) and hatchability of fertile eggs (%). Fertility (%) was no significant differences between two developed strains Matrouh and Silver Montazah, but the groups take 17 h light /day gave the higher fertility (%) compared groups take 15 h/day and no significant differences between all groups gave 18% and 16% protein levels in the diets. While, the groups of Matrouh strain under 17 h light /day and gave 18% and 16% protein in the diets and Silver Montazah under 17 h light /day and gave 18% protein in the diet gave the higher fertility (%) compared with the other groups.

The embryonic mortality (%) was not significantly affected by two strains, all lighting hours, all protein levels and interaction between all groups, but found that high significant differences in groups take 15 h light /d compared with groups take 17 h light /d and higher in groups gave 16% protein compared with groups gave 18%, also the Matrouh strain + 17 h light /day + 16% protein gave the higher late embryonic mortality (%) compared with other groups.

The results agreed with Whitehead *et al*. (1985) who reported that hatchability reduced when broiler breeders were fed on a limited quantity of a diet containing 160 g/kg compared to those containing 165 g CP/kg or 179 g CP/kg. The current results indicated that the exposure to 17h light/day improved hatchability and embryonic mortality because of the light has an important effect on the reproductive performance and the growth in birds (Li *et al*., 2020). Besides, the light plays an important role in the development and functioning of laying birds reproductive systems, significantly influencing the age when they start laying and how many eggs

they could lay in a given period (Min *et al*., 2012).

2- Physiological performance:

Data in Table (5) showed that there were no significant differences between two strains Matrouh and Silver Montazah on blood biochemical for total protein, albumin, globulin, triglycerides, total cholesterol, HDL and LDL. Also, the groups take 17 h light /day gave higher total protein level and total cholesterol compared with the groups take 15 h light /day, and there was no significant difference in albumin, globulin, triglycerides, HDL and LDL values. The groups take 16% protein level gave the lower triglycerides and total cholesterol compared with groups take 18% protein level and no significant difference in other blood parameters.

The effect of interaction between two strain + lighting hours + level of protein showed that there were no significant differences for the average values of total protein, albumin, globulin, triglycerides, HDL and LDL between all interaction effects, but the Matrouh strain reared under 15 h light /day and gave 16% dietary protein, Silver Montazah strain reared under 17 and 15 h light /day and gave 16% protein were lower total cholesterol levels compared with other groups.

Liu *et al.* (2004) reported that increasing protein level in a diet from 15 to 16% CP increased the immune state for laying hens, Farghly and Makled (2015) stated that there were non-significant differences in blood parameters of hens exposed to light flashes and those of the control group.

On the other hand, El-Slamoney *et al.* (2010) reported that light treatments control, day light + 2 hours artificial light and day light + 4 hours artificial light had significantly increased plasma globulin than control. And no references on interaction between effect of light + dietary protein on total protein, albumin, globulin, triglycerides, total cholesterols, HDL and LDL for laying hens, El-Fiky*et al.* (2008) stated that total protein and cholesterol concentrations were not different among the different lighting regimes for laying hens. In addition, all recorded values of plasma total protein, albumin, globulin, triglycerides, HDL and LDL were within the normal physiological ranges according to (Gyenis *et al.* 2006). In chickens, the liver is the principle site of lipid metabolism (Hermier 1997).Therefore, it is vital to include assessments of hepatic and metabolic health. Thus the excess of plasma cholesterol back to the liver for secretion and excretion. Hence, the hen controlling its blood cholesterol level.

3-Immunological performance:

Results in Table (6) showed that there were no significant differences between Matrouh and Silver Montazah strain in all hematological parameters, but the groups received 17 h light /day gave higher RBC's, hemoglobin, PCV, WBC's, lymphocytes, heterophils % and H/L ratio compared with the groups take 15 h/day, and the groups take 18% protein level in diets gave the higher PCV %, WBC's, lymphocytes, heterophils and H/L ratio compared with the groups take 16% dietary protein level. Matrouh strain reared under 17 h light /day and using 18% protein level in the diet gave same the other trained and gave higher PCV %, WBC's, lymphocytes, heterophils and H/L ratio compared with the other groups.

These results agree with El-Slamoney *et al.* (2010) who reported that light treatments control, day light + 2 hours artificial light and day light + 4 hours

artificial light had significantly increased White blood cells than control at 32-36 weeks of age. Campo and Da-Vila (2002) showed that hens housed under lighting regimen of 23 L:1 D showed longer tonic immobility than hens housed under 14 L:10 D regimen, there was no evidence of an increased stress response as judged by heterophils to lymphocytes ratio in laying hens. Also, Campo and DaVila (2002) showed that hens housed under lighting regimen of 23 L:1 D showed longer tonic immobility than hens housed under 14 L:10 D regimen. Furthermore, there was no evidence of an increased stress response as judged by heterophils to lymphocytes ratio in laying hens.

Moreover, Coban*et al.* (2009) recorder lower H/L ratio in self photoperiod group than exposed to continuous lighting in quail's hen. Also, Liu *et al.* (2004) reported that increasing protein level in a diet from 15-16% CP increased the immune state for laying hens. And no references on interaction between effect of light + dietary protein on RBC's, hemoglobin, PVC, WBC's, lymphocytes, heterophils and H/L ratio of the laying hens.

CONCLUSION

The conclusion that the best of rearing developed strains for example Silver Montazah and Matrouh under 17 hour light/day plus preferred that diets containing 18% crude protein for improving productive, physiological and immunological performance for these developed strains in Egypt.

Table (1): Composition and calculated analysis of the control and tested diets.

Ingredients	**Control diet Percentage (%)**	**Tested diet Percentage (%)**
Yellow corn	62.15	59.35
Soya bean(44%)	17.60	23.75
Wheat bran	5.80	2.45
Corn gluten (60%)	4.22	4.22
Di- Calcium phosphate	1.39	1.39
Lime stone	8.16	8.16
Salt	0.37	0.37
* Mineral and vitamin mix	0.30	0.30
DL Methionine	0.01	0.01
Total	100.00	100.00
Calculated values		
Protein%	16.02	18.00
Metabolizable energy (M.E.) Kcal/kg	2706	2706
Crude fiber (C. F.) %	3.44	3.45
Ether extract%	2.95	2.08
Calcium %	3.40	3.04
Available Phosphorous%	0.397	0.40
Sodium%	0.164	0.16
Lysine%	0.75	0.90
Methionine%	0.332	0.36
Methionine & cysteine%	0.614	0.67

*Mineral and Vitamin mix added to the 1 kg of diet including Vit.A 10000 I U; Vit. D3 2000 I.U; Vit.E 15 mg; Vit.K3 1 mg; Vit B1 1mg; Vit.B2 5 mg; Vit. B12 10 µg; Vit B6 1.5mg; Niacin 30mg; Pantothenic acid 10mg; folic acid 1mg; Biotin 50 µg; choline 300 mg; zinc 50mg; copper 4mg; iodine 0.3 mg; iron 30mg; selenium 0.1mg; manganese 60mg; cobalt 0.1mg and carrier CaCo3 up to 1kg.

* According to CLFF, (2001)

Table (2): Effect of strain, lighting, protein levels and their interaction on performance traits of two developed strains from 24 to 40 weeks of age.

Items			**EP**	**EW**	**EM**	**FI**	**FCR**	**BWC**
Effect of Strain(S)			NS	**	**	NS	NS	*
Matrouh			61.44	45.84^{b}	28.17^{b}	112.40	3.99	252.41^{b}
Silver Montazah			61.92	46.41^{a}	28.73^{a}	113.01	3.93	270.17^{a}
MSE			0.278	0.078	0.139	0.455	0.031	4.498
Effect of Lighting(L)			NS	NS	*	NS	NS	NS
17h			61.99	46.18	28.63^{a}	112.90	3.94	264.12
15h			61.37	46.06	28.27^{b}	112.51	3.98	258.47
MSE			0.266	0.115	0.154	0.464	0.031	5.142
Effect of Protein levels(P)			*	*	**	**	**	NS
18 %			62.09^{a}	46.25^{a}	28.72^{a}	111.49^{b}	3.88^{b}	265.65
16%			61.26^{b}	46.00^{b}	28.18^{b}	113.92^{a}	4.04^{a}	256.93
MSE			0.259	0.111	0.142	0.291	0.021	5.059
Effect of interaction			NS	**	**	NS	NS	**
S	L	P						
Matrouh	17h	18 %	NS	**	**	**	**	NS
		16%	62.36	46.04^{bc}	28.71^{abc}	111.17^{d}	3.87^{c}	260.30
	15h	18 %	61.55	45.71^{c}	28.13^{cd}	114.35^{a}	4.07^{a}	247.90
		16%	61.33	45.92^{bc}	28.16^{bcd}	110.51^{d}	3.92^{bc}	250.88
Silver Montazah	17h	18 %	60.54	45.70^{c}	27.66^{d}	113.56^{abc}	4.11^{a}	250.57
		16%	62.37	46.64^{a}	29.09^{a}	112.03^{cd}	3.85^{c}	283.40
	15h	18 %	61.69	46.35^{ab}	28.59^{abc}	114.03^{ab}	3.99^{abc}	264.86
		16%	62.32	46.39^{ab}	28.90^{ab}	112.25^{bcd}	3.88^{c}	268.03
MSE			0.47	0.14	0.21	0.51	0.04	8.740

* a , b and c Means within a column with different superscripts are significantly differ ($P \leq 0.05$).

** a , b, c and d Means within a column with different superscripts are significantly differ ($P \leq 0.01$).EP: Egg production ,EW: Egg weight; EM: Egg mass; FI: Feed intake; FCR: Feed conversion and BWC: Body weight change.

Day light - Dietary protein - Productive performance -Developed strain

Table (3): Effect of strain, lighting, Protein levels and their interaction on external and internal egg quality of two developed strains at 40 weeks of age.

Items			External egg quality			Eternal egg quality			
			Shell weight (%)	**Shell thickness mm**	**Egg shape index**	**Albumen weight (%)**	**Yolk weight (%)**	**Yolk index**	**Haugh unit**
Effect of Strain			NS	**	NS	NS	NS	NS	*
Matrouh			11.72	0.378	78.27	55.63	32.65	43.00	78.40
Silver Montazah			11.99	0.390	77.39	55.46	32.56	43.17	78.28
MSE			0.110	0.003	0.966	0.119	0.095	0.414	0.394
Effect of Lighting			NS	NS	NS	NS	NS	NS	*
17h			11.81	0.386	77.70	55.59	32.60	43.43	78.88^{a}
15h			11.90	0.382	77.96	55.49	32.61	42.75	77.79^{b}
Mse			0.113	0.003	0.971	0.120	0.094	0.408	0.374
Effect of Protein levels			NS	**	*	NS	NS	NS	NS
18 %			11.80	0.389^{a}	76.39^{b}	55.63	32.57	43.59	78.51
16 %			11.91	0.379^{b}	79.27^{a}	55.45	32.64	42.58	78.16
MSE			0.111	0.003	0.911	0.119	0.095	0.386	0.392
Interaction			**NS**	****	**NS**	**NS**	**NS**	**NS**	**NS**
Matrouh	17h	18 %	11.68	0.386^{abc}	76.53	55.70	32.61	44.31	79.22
		16 %	11.57	0.380^{bc}	79.74	55.69	32.75	42.90	79.06
	15h	18 %	11.80	0.374^{bc}	76.49	55.69	32.52	42.40	77.82
		16 %	11.85	0.370^{c}	80.32	55.42	32.73	42.40	77.49
Silver Montazah	17h	18 %	11.91	0.396^{a}	75.90	55.57	32.52	43.80	78.99
		16 %	12.06	0.380^{bc}	78.63	55.41	32.54	42.69	78.26
	15h	18 %	11.80	0.398^{a}	76.62	55.58	32.62	43.86	78.01
		16 %	12.17	0.384^{abc}	78.41	55.27	32.56	42.35	77.84
MSE			0.23	0.005	1.86	0.23	0.18	0.75	0.80

* a , b and c Means within a column with different superscripts are significantly differ ($P \leq 0.05$).** a , b, c and d Means within a column with different superscripts are significantly differ ($P \leq 0.01$).

Table (4): Effect of strain, lighting, protein levels and their interaction on hatchability and embryonic mortality of two developed strains at 36 weeks of age.

Items			Hatchability			Embryonic mortality (%)		
			Fertility (%)	Hatchability of total egg sets (%)	Hatchability of fertile eggs (%)	Early embryonic mortality (%)	Intermediate embryonic mortality (%)	Late embryonic mortality (%)
Effect of Strain(S)			NS	NS	NS	NS	NS	NS
Matrouh			88.33	71.67	81.11	5.50	5.33	5.83
Silver Montazah			87.01	71.14	81.71	5.42	4.92	5.64
MSE			0.774	0.948	0.566	0.230	0.227	0.343
Effect of Lighting(L)			*	**	**	NS	NS	**
17h			89.06^{a}	73.55^{a}	82.55^{a}	5.42	4.92	5.22^{b}
15h			86.28^{b}	69.25^{b}	80.27^{b}	5.50	5.33	6.25^{a}
MSE			0.668	0.696	0.444	0.230	0.224	0.301
Effect of Protein levels(P)			NS	**	**	NS	NS	**
18 %			88.40	72.66^{a}	82.17^{a}	5.50	5.25	5.08^{b}
16%			86.94	70.14^{b}	80.65^{b}	5.42	5.00	6.39^{a}
MSE			0.768	0.868	0.505	0.230	0.232	0.278
Effect of interaction			NS	**	**	NS	NS	**
S	L	P						
Matrouh	17h	18 %	90.00^{a}	75.00^{a}	83.32^{ab}	5.00	5.33	4.67^{cd}
		16%	89.44^{a}	72.22^{ab}	80.69^{c}	5.33	5.00	6.89^{a}
	15h	18 %	87.78^{b}	71.11^{ab}	81.02^{c}	6.00	5.33	5.33^{bc}
		16%	86.11^{cd}	68.33^{b}	79.41^{c}	5.67	5.67	6.44^{ab}
Silver Montazah	17h	18 %	89.03^{a}	75.31^{a}	84.61^{a}	5.33	4.67	3.89^{d}
		16%	87.78^{b}	71.67^{ab}	81.59^{bc}	6.00	4.67	5.44^{bc}
	15h	18 %	86.81^{bc}	69.24^{b}	79.74^{c}	5.67	5.67	6.44^{ab}
		16%	84.44^{d}	68.33^{b}	80.91^{c}	4.67	4.67	6.78^{a}
MSE			1.34	1.27	0.62	1.34	1.34	0.34

* a , b and c Means within a column with different superscripts are significantly differ ($P \leq 0.05$).** a , b, c and d Means within a column with different superscripts are significantly differ (P 0.01).

Table (5): Effect of strain, lighting, protein levels and their interaction on blood biochemical of two developed strains at 40 weeks of age.

Items			T P (g/dl)	A (g/dl)	G (g/dl)	TG (mg/dl)	TC (mg/l)	HDL (mg/l)	LDL (mg/l)
Effect of Strain			NS	NS	NS	NS	NS	NS	NS
Matrouh			4.443	2.513	1.931	360.72	162.21	104.90	80.08
Silver Montazah			4.573	2.565	2.008	361.14	160.74	104.37	79.35
MSE			0.098	0.053	0.112	3.131	2.044	1.965	1.471
Effect of Lighting			**	NS	NS	NS	**	NS	NS
17h			4.703^{a}	2.570	2.132	363.96	164.65^{a}	104.07	80.91
15h			4.314^{b}	2.507	1.807	357.90	158.30^{b}	105.20	78.52
MSE			0.081	0.053	0.101	3.013	1.810	1.944	1.407
Effect of Protein levels			NS	NS	NS	*	**	NS	NS
18 %			4.573	2.597	1.976	365.43^{s}	165.72^{a}	105.36	80.86
16 %			4.443	2.481	1.963	356.42^{b}	157.23^{b}	103.91	78.57
MSE			0.099	0.051	0.113	2.844	1.607	1.951	1.415
Effect of interaction			NS	NS	NS	NS	**	NS	NS
Matrouh	17h	18 %	4.653	2.627	2.025	368.76	171.09^{a}	106.55	82.53
		16 %	4.488	2.418	2.069	357.67	160.55^{bc}	102.45	79.89
	15h	18 %	4.382	2.555	1.827	361.00	162.11^{bc}	106.44	80.67
		16 %	4.252	2.450	1.802	355.45	155.08^{c}	104.18	77.24
Silver Montazah	17h	18 %	4.888	2.657	2.231	369.87	169.14^{ab}	104.28	81.11
		16 %	4.782	2.579	2.203	359.52	157.81^{c}	102.99	80.12
	15h	18 %	4.370	2.550	1.820	362.11	160.55^{bc}	104.18	79.14
		16 %	4.252	2.475	1.778	353.05	155.47^{c}	106.01	77.02
MSE			0.159	0.110	0.218	6.14	2.68	4.28	3.02

* a , b and c Means within a column with different superscripts are significantly differ ($P \leq 0.05$).

** a , b, c and d Means within a column with different superscripts are significantly differ ($P \leq 0.01$).TP: Total protein , A: Albumin , G: Globuine, TG: Ttiglecrides , TC: Total cholesterol , HDL: Hi-density Lipoprotein and LDL : Low-density Lipoprotein .

Table (6): Effect of strain , lighting , Protein levels and their interaction on hematological parameters of two developed strains at 40 weeks of age.

Items			RBC,s (10^6/mm)	Hb (g/dl)	PCV (%)	WBCs (10^3/mm^3)	L (%)	H (%)	H/L ratio
Effect of Strain			NS	NS	NS	NS	NS	NS	NS
Matrouh			5.06	12.00	28.73	12.85	58.63	34.28	0.584
Silver Montazah			4.97	11.85	28.89	12.93	58.54	33.86	0.578
MSE			0.171	0.221	0.460	0.278	0.334	0.405	0.005
Effect of Lighting			*	**	**	**	**	**	**
17h			5.28^{a}	12.37^{a}	29.80^{a}	13.53^{a}	59.39^{a}	35.14^{a}	0.592^{a}
15h			4.75^{b}	11.48^{b}	27.81^{b}	12.25^{b}	57.78^{b}	32.99^{b}	0.571^{b}
MSE			0.152	0.176	0.342	0.202	0.228	0.253	0.003
Effect of Protein levels			NS	NS	*	*	**	**	**
18 %			5.14	12.12	29.44^{a}	13.24^{a}	59.04^{a}	34.69^{a}	0.587^{a}
16 %			4.89	11.74	28.17^{b}	12.54b	58.13^{b}	33.44^{b}	0.575^{b}
MSE			0.166	0.212	0.420	0.257	0.304	0.366	0.004
Effect of interaction			NS	NS	*	**	**	**	**
Matrouh	17h	18 %	5.43	12.85	30.57^{a}	13.87^{a}	60.17^{a}	36.13^{a}	0.601^{a}
		16 %	5.14	12.05	29.22^{ab}	13.14^{ab}	58.80^{bc}	34.87^{bc}	0.593^{ab}
	15h	18 %	4.99	11.71	28.03^{b}	12.81^{ab}	58.20^{cd}	33.77^{cd}	0.580^{abc}
		16 %	4.67	11.41	27.08^{b}	11.78^{b}	57.33^{d}	32.33^{e}	0.564^{c}
Silver Montazah	17h	18 %	5.37	12.59	30.42^{a}	13.66^{a}	59.73^{ab}	35.40^{ab}	0.593^{ab}
		16 %	5.17	12.00	28.99^{ab}	13.45^{a}	58.87^{abc}	34.17^{cd}	0.580^{abc}
	15h	18 %	4.78	11.32	28.74^{ab}	12.63^{ab}	58.07^{cd}	33.47^{d}	0.576^{bc}
		16 %	4.56	11.49	27.40^{b}	11.77^{b}	57.50^{cd}	32.40^{e}	0.563^{c}
MSE			0.33	0.35	0.59	0.362	0.400	0.324	0.006

* a , b and c Means within a column with different superscripts are significantly differ ($P \leq 0.05$).

** a , b, c and d Means within a column with different superscripts are significantly differ ($P \leq 0.01$)

Hb: Hemoglobin ; PCV: Packed cell volume; L: Lymphocytes and H: Heterophils**%.**

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الملخص العربى

تأثير التداخل بين عدد ساعات الاضاءة اليومية ومستويات بروتين العليقة على الاداء الانتاجى والفسيولوجى والمناعى لدجاج سلالتين مستنبطة.

مجدى سيد حسن حسن ، أحمد محمد بعيلش ، حسن عبدالكريم حسن عبدالحليم ، *سامية مصطفى حسين مبارز حنان صابر محمد محمود

قسم بحوث تربية الدواجن - معهد بحوث الانتاج الحيوانى – مركز البحوث الزراعيه – الدقى – الجيزه

*قسم بحوث تغذية الدواجن - معهد بحوث الانتاج الحيوانى – مركز البحوث الزراعيه – الدقى – الجيزه

أجريت هذه الدراسه على عدد 120 دجاجه + 12 ديك من سلالة المنتزة الفضى وعدد 120 دجاجه + 12 ديك من سلالة المطروح من عمر 24 أسبوع حتى عمر 40 أسبوع لدراسه تأثير التداخل بين عدد ساعات الاضاءة اليومية ومستويات بروتين العليقة على الاداء الانتاجى والفسيولوجى والمناعى لدجاج سلالتين مستنبطة .وتم تقسيم المعاملات على سلالة المنتزة الفضى كالآتي: المجموعه الاولي أخذت الطيور 17 ساعة اضاءة يومية وتم تغذية الطيورعلى عليقة تحتوى على 18 % بروتين (معامله كنترول).المجموعه الثانية أخذت الطيور 17 ساعة اضاءة وتم تغذية الطيور على عليقة تحتوى على 16 % بروتين ز المجموعه الثالثه أخذت الطيور 15 ساعة اضاءة يومية وتم تغذية الطيورعلى عليقة تحتوى على 18 % بروتين .والمجموعه الرابعة أخذت الطيور 15 ساعة اضاءة يومية وتم تغذية الطيور على عليقة تحتوى على 16 % بروتين.وتم تكرار نفس الاربع معاملات على سلالة مطروح.

.و كانت النتائج المتحصل عليها كما يلى:

المجاميع التى أخذت 18% بروتين و 17 ساعة إضاءة أعطت أفضل وزن وكتلة بيض بالمقارنة بباقى المجاميع التى أخذت 16% بروتين و 15 ساعة إضاءة وسلالة المنتزه الفضى التى أخذت 17 ساعة إضاءة + 16% بروتين أعطت أعلى وزن بيض وكتلة بيض ونسبة إنتاج البيض بالمقارنة بباقى المجاميع.و المجاميع التى أخذت 17 ساعة إضاءة +18% بروتين بالعليقة كانت أعلى فى سمك القشرة ووحدات هاو بالمقارنة بالمجاميع التى أخذت 15 ساعة اضاءه و 16% بروتين وخاصة فى مجاميع سلالة المطروح ولم يتأثر باقى صفات جودة البيض بعدد ساعات الإضاءة اليومية أو بنسبة بروتين العليقة.أدى إعطاء المجاميع 17 ساعة إضاءة مع تقديم علائق تحتوى على 18% بروتين الى تحسين صفات الفقس والتفريخ والخصوبة للسلالتين. مجاميع سلالة مطروح التى أخذت 17 ساعة إضاءة/يوم مع أخذها علائق تحتوى على 18% بروتين أدى لزيادة الأداء المناعى للطيور حيث زاد كلا من PCV%, WBC's, lymphocytes, heterophils, H/L ratio بالمقارنة بباقى المجاميع.

الخلاصة: نستخلص من النتائج السابقة أنه يفضل تربية السلالات المستنبطة مثل المنتزه الفضى والمطروح تحت 17 ساعة إضاءة/يوميا وتقديم عليقة تحتوى على 18% بروتين خلال فترة الانتاج لتحسين الأداء الإنتاجى والفسيولوجى والمناعى لهذه السلالات المستنبطة فى مصر.