Egypt. Poult. Sci. Vol (31) (I): (77-95)

RESPONSE OF DOMYATI DUCK TO DIETS CONTAINING DIFFERENT LEVELS OF METABOLIZABLE ENERGY AND CRUDE PROTEIN

2- DURING LAYING PERIOD.

By

A.L. Awad ; Kout Elkloub,M.El.Moustafa and A.I.A. Ghonim

Anim. Prod. Res. Institute ,Agric. Res. Center ,Ministry of Agric.Dokki, Giza.

.Received: **26/12/2010** Accepted: **20/02/2011**

Abstract: *A total number of 378 Domyati ducks (297 female and 81 male) at 20-wks-old were divided into nine treatment groups of 3 replicates each, to investigate the effect of different dietary levels of metabolizable energy (ME) and crude protein (CP) in a (3x3) factorial design on laying performance, egg quality parameters(EQP) , egg chemical analysis and nutrients digestibility as well as some blood constituents during the laying period (20-44 weeks of age). The dietary treatments had 2750, 2850 and 2950 kcal ME/kg, each contained 15, 17 or 19 % CP.*

Results indicated that the interaction between dietary ME and CP levels in the diets17 and 19%CP had no significant effect on LBW of Domyati laying ducks at the end of experimental period, whereas it was significantly lower by feeding 15% CP diet. Egg number , egg mass per duck and feed conversion (g feed /g egg) were significantly improved by feeding diet containing 2750 Kcal ME/kg. and.19 %CP during the overall period (20-44 wks). Feed consumption (g/duck/ 28 day) was not significantly affected due to different levels of both ME and CP in the diet during the overall period (20-44wks).

Yolk percentage and yolk index were significantly ($P<0.05$) increased , whereas , albumin percentage was significantly decreased, and shell parameters and shape index were not significantly affected by increasing ME level in the diet. Both of shell weight percentage and thickness values were significantly increased by feeding 15 %CP diet as compared only with that of 17 %CP die,. On the other hand, all EQP were not significantly affected due to the interaction between ME and CP levels in the diet. Different levels of ME and CP in the diets and their interaction had no significant effects on total solids of whole egg, yolk and albumin percent. Feeding 2950 Kcal ME/kg and 19 %CP diet significantly increased protein content of total egg solids, whereas, ash content was significantly decreased.

All nutrients digestibility were not significantly affected by feeding different ME levels in the diets except crude fiber which was significantly improved by 2950 Kcal ME/kg, whereas, CP and EE digestibility as well as TDN were significantly ($P<0.01$) improved by increasing CP level in the diet . Plasma total protein ,albumin, globulin, total lipids and ALT values of Domyati ducks were significantly ($P \leq 0.01$) decreased by feeding 2750 Kcal ME/kg diet, whereas , plasma total cholesterol and AST values were not significantly affected. On the other hand , all studied plasma constituents were not affected due to varying CP levels in the diet except albumin and total lipids which were significantly increased by feeding 19% CP in the diet .

These results indicated that a diet contained 2750 Kcal ME/kg and 19 % CP could be used to improve the laying performance, egg quality and nutrients digestibility of Domyati ducks .

INTRODUCTION

Protein and energy are the major nutrients of laying hens diets. As much as 85% of total costs of the diet come from protein and energy ingredients. Energy is the fuel that keeps many different body functions operate. Dietary protein is a source of amino acids which are the building blocks for body tissue, hence growth and production.

There are many reports about the manipulation of metabolizable energy (***Harms et al.,2000 ; Leeson et al.,2001 Bohnsack et al., 2002; Wu et al., 2005*** and ***Jalal et al., 2006)*** and protein ***(Keshavarz, 2003; Liu et al. , 2004*** and ***2005,*** and ***Wu et al.,2005***) in commercial laying hen diets during different stages of the production cycle .At present, there are wide ranges of dietary energy (2685 to 3100 kcal of ME/kg) and protein levels (14.5 to 19%) being used by the egg production industry(***Grobas et al., 1999***).

Unlike most domestic birds, waterfowls such as ducks and geese have a relatively short reproductive period and low egg production. Recently, the Domyati ducks increased attention during the last two decades in Egypt for hatching eggs production, especially in Dakahlia and Dumyat (provinces in North Egypt). Information of nutrient requirements of the Domyati ducks are limited, particularly energy and protein.

The objective of the present work is to determine the effect of varying levels of dietary energy and/or protein on laying performance, egg quality and their chemical analysis as well as nutrient digestibility in Domyati ducks during laying period.

MATERIALS AND METHODS

Birds and managements :

The present work was conducted at El- Serw Research Station, Water Fowl branch, Water Fowl Research Department, Animal Production Research Institute, Agricultural Research Center, Ministry of Agricultural, Egypt. Three hundred and seventy eight 20-wks old Domyati ducks were used, weighed and distributed into nine experimental groups of 42 ducks (33 female and 9 males). Each group was subdivided into three equal replicates (11female and 3 males) . The experiment was arranged in a factorial design (3x3) using three energy levels (2750, 2850 and 2950 kcal ME/kg of diet) and three protein levels (15, 17, and 19 % CP) as shown in Table (1). Ducks of each replicate were housed at 2.3 ducks /m^2 in a house with windows and received additional artificial light to provide 16 h light and 8 h dark daily.

Data collection :

Feed consumption of each replicate for all treatments was recorded every 28 days in g/duck throughout the experimental period (20-44 wks of age). Daily egg number per each replicate was counted and recorded for the 6 periods (28 days each) all over the experimental period. Egg number (EN) and mass per duck were calculated and recorded (Average egg mass per duck = total egg mass produced / number of ducks at housing). Feed

conversion for egg production was also calculated during the same periods as g feed consumed/ g egg mass.

Egg quality and chemical analysis traits:

At 35 weeks of age, a total number of 90 eggs (10 from each treatment) were taken to determine egg components and quality. The yolk, albumen and shell were oven dried, ground and stored to proximate chemical analysis (*AOAC,1995*).

Nutrients digestibility :

Twenty seven adult Domyati drakes with average body weight of about 2.0 kilograms, were used to evaluate the nutrients digestibility of the experimental diets. The procedure described by ***Jakobsen et al.(1960)*** was used for separating fecal nitrogen from excreta samples . Urinary organic matter (UOM) was determined according to ***Abou-Raya and Galal(1971).***

Blood constituents:

At 44 wks of age , three ducks per treatment group (one female from each replicate) were randomly taken, blood samples from each duck were collected in heparinized test tubes and centrifuged at 3500 rpm for 15 minutes to obtain blood plasma. Total protein, total cholesterol, total lipids and transaminase activities (ALT and AST) were determined in plasma using commercial kits.

Statistical analysis:

Data obtained were statistically analyzed using the General linear model of ***SAS (2004)***. A factorial design 3x3 was used, considering the energy level and crude protein level as the main effects, as follows:

$$Yijk = \mu + Ti + Rj + (TR)ij + eijk$$

where:

Yijk = An observation;
μ = Overall mean;
T = Effect of energy level; i= (1, 2 and 3);
R = Effect of crude protein level; j = (1, 2 and 3);

TR=Effect of interaction between energy and crud protein level; and eijk = Random error.

Differences among treatments were estimated by Duncan's multiple range test (***Duncan, 1955***).

RESULTS AND DISCUSSION

Domyati laying ducks performance:

Results in Table (2) show significant differences among the experimental groups in egg number (EN) per duck during interval periods and overall period due to varying of ME or CP levels in the diet, except period of 40-44 wks. Egg number per ducks fed 2750 Kcal ME/kg diets was significantly improved by 7.53 and 14.97 % during the overall period (20-44 wks) as compared to groups fed 2850 and 2950 Kcal ME/kg, respectively. Accordingly, level 2750 Kcal ME/kg could be considered suitable for Domyati laying ducks. These results agree with those reported by ***Soliman (2002)*** , ***Yakout et al. (2003) and Zanaty (2006)*** who found that birds fed 2800 Kcal ME/Kg diet had the highest EN. In this connection, ***Nahashon et al. (2007)*** found that egg number was significantly higher in birds that received diets containing 2800 kcal of ME/kg of diet than those fed diets containing 2900 kcal of ME/kg of diet from 26 to 50 weeks of Pearl Gray laying hens.

Varying levels of CP in the diet had significant effect on egg number per duck during all experimental periods except the period 37-40 wks of age ,which was not affected (Table 2) .The group fed 19 % CP had significantly higher egg number per duck during those periods. The improvement of egg number per duck during the overall

period (20-44 wks) ranged from 9.56 to 17.30 % for the group fed 19 %CP as compared to those fed 15 or 17 %CP ,respectively. These results are similar to those reported by ***El-Sayed et al. (2001); Yakout et al., (2004) ; Zanaty (2006)and Gunawardana et al. (2008 and 2009)*** who reported that egg number per hen significantly increased with increasing CP level in the diet. On the other hand, result of ***Nahashon et al.(2007)*** explained that, hens received 14% CP diets exhibited higher ($p<0.05$) egg number per hen than those fed diets containing 16 or 18% CP diets.

Egg number per duck was significantly affected due to the interaction between ME and CP levels in the diet during most of the experimental periods, however, periods 20-24 wks and 33-36 wks of age showed insignificant effect. Groups fed diet contained 2750 Kcal ME/kg and 19 %CP recorded the best egg number per duck (110.9), followed by those fed 2850 Kcal ME/kg and 19 %CP (103.65) during the overall period. Accordingly, both 2750 and 2850 kcal of ME/kg and 19 % CP of the diet provided the best energy and protein ratio to Domyati laying ducks.

Significant differences (Table3) were observed among the experimental groups in egg mass (EM) per duck during experimental periods, due to varying ME levels in the diet, except for the period 41-44 wk of age. Egg mass per duck was significantly improved for the group fed 2750 Kcal ME/kg diet during the overall period (20-44 wks) as compared to groups fed other levels of ME. The improvement of egg mass per duck for group fed 2750 Kcal ME/kg diet was significantly increased by 8.85 and 15.42 % as compared to those fed 2850 and 2950 Kcal ME/kg diet, respectively. Such improvement may be due to the higher egg number and egg weight associated with these diets. These results agree with those of ***Soliman (2002) , Yakout et al., (2003) and Zanaty (2006) who*** found that birds fed 2800 Kcal ME/Kg diet had the highest egg mass per hen . In this connection, ***Nahashon et al. (2007)*** found that egg mass were significantly higher in birds received diets containing 2800 kcal of ME/kg of diet, than those fed diets containing 2900 kcal of ME/kg of diet from 26 to 50 wks, for Pearl Gray laying hens.

On the other hand, varying levels of CP in the diet had significant effect on egg mass per duck during the experimental period except at 33-36 wks of age , which was not affected (Table 3).The group fed 19 % CP diet had significantly higher egg mass per duck by 10.31 and 17.31 % as compared to those fed 15 and 17 %CP diets, respectively. Results are in harmony with those investigators who reported that EW and EM increased as dietary protein level increased (***Yakout et al., 2004 ; Zanaty , 2006 and Gunawardana et al. ,2008 and 2009***).

Egg mass per duck was significantly affected due to the interaction between ME and CP level in the diet during all experimental periods, except the period 33-36 wks which showed insignificant effect. The best records of egg mass per duck (7763 g) occurred by the groups fed diet contained 2750 Kcal ME/kg and 15% or 19 % CP followed by those fed diets containing 2850 Kcal ME/kg with either 19 %CP during the overall period, being 7260 and 7188g, respectively.

Feed consumption values (g/duck/ 28 days) were not significantly affected during all studied periods, due varying levels of ME in the diet except for the period 25-28 wk which was significantly affected (Table 4).The group fed 2750 Kcal ME/kg diets at the period 25-28 wks of age consumed lower feed than those fed 2850 and 2950 Kcal ME/kg diets. Generally , feed consumption of the group fed diet contained 2950 Kcal ME/kg was insignificantly increased by about 6.87 and 1.96 % as compared to those fed 2750 and 2850 Kcal ME/kg, respectively during

overall period (20-44 wks). The increase in feed consumption may be due to the improved diet palatability of as a result of increasing ME level in the diet. In the present study, the lack of significant difference in feed consumption between ducks fed 2750 , 2850 and those fed 2950 kcal of ME/kg of diet may be due to the narrow range of the three energy levels. These results agreed with those obtained by ***Soliman (2002)*** who reported that feed intake was increased with increasing ME level in the diet . Also, ***Nahashon et al. (2006)*** reported that when Pearl Gray replacement pullets were fed diets containing 2900 or 3000 kcal of ME/kg of diet, differences in feed consumption were not significant. On the other hand, a negative response of increasing ME level on feed intake was reported by ***Yakout et al. (2003) and Zanaty and Ibrahim (2005)***.

Feed consumption values were not significantly affected during all studied periods due to feeding on varying CP levels in the diets except the periods 20-24, 33-36 and 20-44 wks of age, which were significantly affected (Table 4). Generally , feed consumption of the group fed diet contained 15 %CP was significantly decreased by about 10.13 % as compared with those fed 19 %CP level, during overall period (20-44 wks). In general, feed consumption increased gradually by increasing dietary CP level. These results agreed with those obtained by ***Nahashon et al. (2006)*** who reported that Pearl Gray pullets fed diets containing 18% CP consumed 3% more feed ($P < 0.05$) than those fed 14 and 16% CP diets from 62 to 86 wks of age. Also, ***Wu et al.(2005) and Gunawardana et al. (2009)*** reported that feed consumption significantly increased with increased CP levels in the diet. On the contrary, ***Zanaty (2006) and Zanaty and Ibrahim (2005)*** found that feed intake increased CP level decreased in the diets.

Feed conversion (g feed / g egg) was significantly affected by feeding different levels of ME in the diet during the all periods, except the first period (20-24 wk) which was not significantly affected (Table5). Feed conversion was significantly improved for the group fed 2750 Kcal ME/kg diet during periods 25-28 , 41-44 and the overall period as compared to groups fed 2850 or 2950 Kcal ME/kg diet , whereas , it was significantly improved during the periods 29-32 , 33-36 and 37-40 wks of age as compared only to the group fed 2950 Kcal ME/kg diet. The improvement of feed conversion of the group fed 2750 Kcal ME/kg diet was significantly increased by 13.31 and 18.82 % as compared to those fed 2850 and 2950 Kcal ME/kg diet during overall period (20-44 wks), respectively. These results may be attributed to the different amounts of feed consumed and egg production. These results are reverse with those obtained by ***El-Husseiny et al. (2005)*** who indicated that the diets containing 3000 kcal ME/kg improved FCR by 19.72% as compared to the diet containing 2600 Kcal ME/ kg. However, ***Zanaty (2006)*** reported that feed conversion was significantly ($P<0.05$) improved with increasing dietary energy level from 2400 to 2800 Kcal ME/Kg diet .

Different levels of CP in the diet had significant effects on feed conversion during some periods (Table 5).The group fed 17%CP diet had the poorest feed conversion ($P<0.05$ or $P<0.01$) as compared to those fed 15 and 19 %CP diets, during the periods 25-28 , 29-32 , 41-44 and 20-44 wks of age . Similar results were obtained by ***Zanaty (2006)*** who reported that feed conversion was significantly ($P<0.05$) improved by increasing dietary protein level from 14 to 16 or 18% in the diet. Also, ***Nahashon et al.(2007)*** reported that Pearl Gray guinea fowl hens consuming diets containing 14% CP exhibited FCR that were 34% lower than those of birds fed diet containing 18% CP diets at 26 to 50 wks of age. Feed conversion was significantly affected due to the interaction between ME and CP level in the

diet during all experimental periods except of the periods 20-24, 29-32 and 20-44 wks of age. The best values of feed conversion occurred by the groups fed the diet containing 2750 Kcal ME/kg with either 15 or 19 %CP during the overall period.

Egg quality parameters : (EQP)

The results of feeding different dietary energy and protein levels and their interactions on EQP at 35 wks of age are shown in Table (6). It is observed that yolk percentage and index were significantly ($P<0.05$) increased by increasing energy level in the diet, whereas, albumin percentage was significantly decreased. On the other hand, shell parameters and shape index were not significantly affected due to varying levels of ME in the diet. Increase of yolk percent as ME level increase, the ability of ducks may be due to use available exogenous fat, as lipids, for egg yolk formation. These results are in a relative harmony with those obtained by ***Zanaty (2006)***, who found that dietary energy levels had no effect on most external and internal egg quality , and that yolk weight percentage and index,were increased with the increase of ME level. Similarly, ***Ciftci et al. (2003)*** found that shell thickness was not significantly affected by dietary energy level (2650 and 2750 kcal ME/kg). On the other hand, ***El-Husseiny et al.(2005)*** and ***Nahashon et al.(2007)*** found that shell thickness was significantly increased by decreasing ME level in the diet. Improvement of egg shell thickness by feeding diets containing low-ME (2750 kcal ME/kg) may be due to the calcium losses on the low ME diet which were lower than on the high ME diet. The greater loss of calcium from pullets fed a high ME diet was attributed to calcium combining with the excess of dietary fat to form indigestible soaps (***Atteh and Leeson ,1985***) . Also, ***Gunawardana et al. (2009)*** reported that albumin percent linearly decreased with the ME increase from 2776 to 2908 Kcal/kg .

Different levels of CP in the diet had no significant effects on yolk percentage and index and albumin percentage, whereas, shell parameters and shape index were significantly affected (Table 6). Both of shell weight percentage and thickness were significantly increased at 15 %CP as compared to those at 17 %CP level in the diet. On the other hand , all EQP were not significantly affected due to the interaction between ME and CP levels in the diet. Results are in agreement with those obtained by ***Yakout et al. (2004)*** who found that yolk percentage increased as CP level did. On the other hand, ***Zanaty (2006)*** noted that shell weight and thickness were significantly ($P<0.05$) increased and yolk percentage decreased as CP increased .

Chemical components of egg:

Chemical components of egg solids percentages are presented in Table (7). Total lipid values were not significantly affected due to both of ME and CP levels in the diet , while , the interactions between them showed significant effects. Both ME and CP levels and their interactions had significant effects on protein and ash content of egg solids. Feeding 2950 Kcal ME/kg and 17 % CP diet significantly increased protein content of total egg solids as compared to other interactions of ME and CP. The improvement of protein content of egg solids reached 10.93 % of the group fed 2950 Kcal ME/kg diet , also , it was improved by 5.10 % of the group fed 17 % CP as compared with those fed 2750 Kcal ME/kg and 15 % CP , respectively. The best values of protein content of egg solids occurred with the combination of 2950 Kcal ME/kg and 19 % CP followed by 2950 Kcal ME/kg and 19%CP.

Ash content of egg solids was adversely affected with increasing both of ME and CP in the diet (Table 7). It was significantly decreased by 6.41 and 4.32 % of the groups fed 2950 Kcal ME/kg and

19%CP compared to those fed 2750 Kcal ME/kg or 15 % CP , respectively. Also, feeding diet containing the combination of low level of both ME and CP resulted in the best value of ash content of egg solids as compared to those contained high level of both ME and CP level. However, ***Wu et al.(2005 and 2007)*** reported that increasing ME and CP levels had no significant effects on the percentage of whole egg solids, albumen solids, and yolk solids.

Nutrients digestibility:

The effects of dietary ME and CP and their interaction on nutrients digestibility of the experimental diets are presented in Table (8). It is worthy to note that the digestion coefficient values of dry matter (DM) , crude protein (CP) , ether extract (EE) and nitrogen free extract (NFE) were almost similar and no significant effects were observed due to varying ME level in the diet, whereas, crude fiber (CF) digestibility values were significantly affected . Moreover, values of DM , CP and NFE digestibility were significantly ($P<0.01$) increased by the 17 % CP diet compared to the 15 %CP diet. Crude protein and EE digestibility values were significantly increased with the 19 %CP diet compared to the 15 % diet .On the other hand, data showed that the best values of DM, CP, EE and NFE digestibility occurred by the interaction between 2850 Kcal ME/kg and 19 %CP in the diet. The lowest values of DM,CP and NFE digestibility occurred by the interaction between the 2750 Kcal ME/kg and 15 % CP diet.

These results may be due to varying ME and CP levels, which could contribute to the higher digestive enzymes activity in intestinal fluid of ducks ***(Fan, 2003). Maiorka et al. (2004)*** reported that overfeeding and dietary ME and CP content had effects on the activity of amylase, lipase, trypsin, chymotrypsin, and disaccharidase in pancreas or intestinal digesta of chicks, which mean that dietary nutrients were mediating these endogenous digestive enzyme levels. ***Zhao et al. (2007)*** reported that amylase, trypsin, and chymotrypsin activity in jejunal fluid of ducks are adapted to the dietary CP content but not to dietary ME content.

Results show that both of TDN (%) and ME (kcal/kg) were not significantly affected due to ME level ,whereas , it were significantly improved by increasing CP levels in the diets Table (8) . The ducks fed 2850 or 2950 Kcal ME/kg and 17 or 19 %CP in their diet had almost the best values of TDN and ME as compared to those fed 2750 Kcal ME/kg and 15 %CP in their diets. Such result may be due to the improvement of nutrients digestibility of all diet nutrients by dietary 17 %CP level.

Blood plasma constituents:

Plasma constituents of Domyati laying ducks, measured in the present study, were estimated to show the metabolic status of ducks and their health as affected by feeding varying ME and CP levels in the diet . Results presented in Table (9) show no significant differences between treatments on plasma total cholesterol and AST. Other studied plasma constituents were significantly affected due to different ME levels. The group fed diet contained 2750 Kcal ME /kg had significantly low level of plasma total protein, albumin, globulin and total lipids as well as ALT as compared to the groups fed both 2850 or 2950 Kcal ME / kg. On the other hand, varying CP levels had no significant effect on all plasma constituents except plasma albumin and total lipids which were significantly increased by feeding 19 % CP in the diet . The interactions between varying levels of ME and CP show that no significant effect exist on all plasma constituents of Domyati laying ducks except plasma albumin which was affected significantly. These results are

in agreement with those obtained by ***Abdel-Azeem et al.(2007)*** who reported that plasma total lipids and triglycerides of adult pigeons were significantly ($P<0.05$) increased when ME levels increased. Also, ***Kout El-Kloub et al. (2005)*** reported that feeding different protein levels in layers diets had no significant effects on serum total protein and total cholesterol. ***Zhang et al.(2008)*** reported that plasma ALT and AST activities were increased in chicks fed *ad-libitum* the high energy diet as compared to control treatment (low energy).

CONCLUSION

It is concluded that the diet containing 2750 Kcal ME/kg and 19% CP could be used to improve the productive performance of Domyati ducks during laying period.

Table (1): Composition and calculated analysis of experimental diets .

Ingredients %	ME (Kcal/kg)								
	2750			2850			2950		
	CP%								
	15	17	19	15	17	19	15	17	19
Yellow corn	67.75	64.65	60.55	71.25	67.1	63.0	73.55	69.55	65.5
Soya bean meal(44%)	19.55	24.35	25.45	16.55	17.75	18.35	9.30	10.0	10.4
Gluten meal (60%)	0.0	1.0	4.0	2.4	5.35	8.7	7.25	10.5	14.0
Wheat bran	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Di-calcium phosphate	1.70	1.70	1.70	1.80	1.70	1.70	1.80	1.80	1.80
Limestone	7.20	7.50	7.50	7.20	7.30	7.45	7.30	7.35	7.50
Vit & Min. premix *	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt (NaCl)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
DL. Methionine (97%)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	100	100	100	100	100
Calculated Analysis **									
Crude protein %	15.02	17.01	19.00	15.01	17.01	19.00	15.02	17.00	19.00
ME (Kcal / kg)	2752	2752	2752	2853	2851	2853	2951	2954	2958
Calcium (%)	3.18	3.29	3.29	3.19	3.21	3.27	3.21	3.23	3.29
Av. phosphorus (%)	0.43	0.44	0.44	0.44	0.43	0.43	0.43	0.43	0.44

*Each 3 kg of the Vit and Min. premix containing: Vitamin A 10 MIU, Vit. D 2 MIU, Vit E 10 g, Vit. K 2 g, Thiamin 1 g, Riboflavin 5 g, Pyridoxine 1.5 g, Niacin 30 g, Vit. B_{12} 10 mg, Pantothenic acid 10 g, Folic acid 1.5 g, Biotin 50 mg, Choline chloride 250 g, Manganese 60 g, Zinc 50 g, Iron 30 g, Copper 10 g, Iodine 1g, Selenium 0. 10 g, Cobalt 0.10 g. and carrier $CaCO_3$ to 3000 g..
** According to NRC (1994)

Table (2): Effect of dietary energy and protein levels on egg number during laying period of Domyati ducks.

Treatments		Period (wks)						
		20-24	25-28	29-32	33-36	37-40	41-44	Overall period (20-44)
ME (Kcal/kg)								
2750		14.03±0.51	22.06±0.64 ^{a}	18.49±0.51 ^{a}	16.61±0.35 ^{a}	15.64±0.69 ^{a}	16.94±1.06	103.76±2.09 ^{a}
2850		15.36±0.79	19.93±1.00 ^{b}	16.22±0.99 ^{b}	14.53±0.53 ^{b}	14.91±0.65 ^{a}	15.55±1.10	96.49±4.23 ^{b}
2950		15.30±0.56	17.99±0.92 ^{c}	15.61±0.43 ^{b}	13.54±0.71 ^{b}	12.54±0.78 ^{b}	15.26±0.58	90.25±3.20 ^{c}
Significance		NS	0.01	0.01	0.01	0.01	NS	0.01
CP (%)								
15		14.15±0.40 ^{b}	19.14±0.56 ^{b}	17.31±0.57 ^{a}	15.08±0.79 ^{ab}	14.51±1.27	15.69±1.02 ^{b}	95.88±3.69 ^{b}
17		13.81±0.54 ^{b}	18.41±1.31 ^{c}	15.56±1.01 ^{b}	13.96±0.41 ^{b}	13.43±0.26	14.40±0.66 ^{b}	89.56±3.00 ^{c}
19		16.73±0.51 ^{a}	22.43±0.33 ^{a}	17.46±0.60 ^{a}	15.64±0.73 ^{a}	15.15±0.55	17.65±0.85 ^{a}	105.05±2.49 ^{a}
Significance		0.05	0.01	0.05	0.05	NS	0.05	0.01
Interactions								
ME (Kcal/kg)	CP (%)							
2750	15	13.18±0.51	19.57±0.33 ^{bc}	18.29±0.12 ^{ab}	17.62±0.31	17.20±1.23 ^{a}	13.96±0.55 ^{cd}	99.82±2.40 ^{a}
	17	13.51±0.82	23.60±0.17 ^{a}	18.23±1.60 ^{ab}	15.36±0.03	13.51±0.54 ^{bc}	16.35±1.02 ^{bc}	100.54±2.48 ^{a}
	19	15.40±0.89	23.02±0.28 ^{a}	18.97±0.60 ^{a}	16.84±0.14	16.22±0.51 ^{ab}	20.50±1.06 ^{a}	110.94±1.42 ^{a}
2850	15	14.96±0.88	20.71±0.51 ^{bc}	18.49±0.67 ^{ab}	15.40±0.18	16.21±1.69 ^{ab}	18.40±2.33 ^{ab}	104.15±6.26 ^{a}
	17	13.17±0.92	16.28±0.53 ^{de}	12.64±0.68 ^{d}	13.32±0.74	13.73±0.10 ^{bc}	12.56±0.32 ^{d}	81.68±0.70 ^{b}
	19	17.95±0.13	22.79±0.70 ^{a}	17.54±0.94 ^{abc}	14.87±1.28	14.80±0.81 ^{abc}	15.70±0.75 ^{bcd}	103.65±3.21 ^{a}
2950	15	14.31±0.22	17.15±0.40 ^{d}	15.17±0.19 ^{cd}	12.22±0.28	10.14±0.50 ^{d}	14.73±1.10 ^{cd}	83.69±1.51 ^{b}
	17	14.76±1.11	15.36±0.15 ^{e}	15.81±1.16 ^{bc}	13.21±0.12	13.05±0.60 ^{c}	14.29±0.64 ^{cd}	86.48±2.34 ^{b}
	19	16.84±0.82	21.47±0.07 ^{b}	15.86±0.81 ^{bc}	15.21±1.90	14.44±1.35 ^{abc}	16.76±0.84 ^{bc}	100.57±5.79 ^{a}
Significance		NS	0.01	0.05	NS	0.05	0.05	0.05

a,b,c,d,e :means in the same column within each item bearing different superscript are significantly different ($P \leq 0.05$).
NS = not significant

Table (3): Effect of dietary energy and protein levels on egg mass (g) during laying period of Domyati ducks.

Treatments		Period (wks)						
		20-24	25-28	29-32	33-36	37-40	41-44	Overall period (20-44)
ME (Kcal/kg)								
2750		863±28 ^{b}	1680±60 ^{a}	1327±37 ^{a}	1125±24 ^{a}	1111±59 ^{a}	1158±69	7267±139 ^{a}
2850		953±50 ^{a}	1479±83 ^{b}	1140±56 ^{b}	992±40 ^{b}	1044±53 ^{a}	1065±78	6677±309 ^{b}
2950		947±32 ^{a}	1368±74 ^{b}	1070±26 ^{b}	962±55 ^{b}	888±53 ^{b}	1060±39	6297±222 ^{c}
Significance		0.05	0.01	0.01	0.01	0.01	NS	0.01
CP (%)								
15		870±25 ^{b}	1430±46 ^{b}	1196±47 ^{a}	1026±53	1048±96 ^{ab}	1079±70 ^{b}	6651±269 ^{b}
17		859±27 ^{b}	1402±94 ^{b}	1104±60 ^{b}	971±34	926±15 ^{b}	990±47 ^{b}	6254±229 ^{c}
19		1034±35 ^{a}	1696±25 ^{a}	1237±51 ^{a}	1082±49	1069±39 ^{a}	1215±53 ^{a}	7337±155 ^{a}
Significance		0.01	0.01	0.01	NS	0.05	0.01	0.01
Interactions								
ME (Kcal/kg)	CP (%)							
2750	15	795±26 ^{b}	1457±26 ^{d}	1287±40 ^{ab}	1189±25	1252±114 ^{a}	960±32 ^{cd}	6941±133 ^{b}
	17	868±43 ^{b}	1858±15 ^{a}	1278±92 ^{ab}	1037±13	931±36 ^{bcd}	1125±67 ^{bc}	7099±154 ^{ab}
	19	927±52 ^{b}	1727±31 ^{b}	1417±20 ^{b}	1150±2	1150±30 ^{abc}	1391±66 ^{a}	7763±53 ^{a}
2850	15	930±45 ^{b}	1559±60 ^{cd}	1282±45 ^{ab}	1057±14	1167±129 ^{ab}	1264±161 ^{ab}	7260±456 ^{ab}
	17	806±49 ^{b}	1176±10 ^{e}	934±5 ^{e}	896±71	930±11 ^{bcd}	839±20 ^{d}	5582±72 ^{c}
	19	1124±11 ^{a}	1704±73 ^{b}	1205±55 ^{bc}	1023±87	1036±55 ^{abc}	1094±45 ^{bc}	7188±180 ^{ab}
2950	15	887±16 ^{b}	1273±28 ^{e}	1019±9 ^{de}	832±15	725±34 ^{d}	1013±76 ^{cd}	5751±105 ^{c}
	17	902±49 ^{b}	1173±10 ^{e}	1100±76 ^{cd}	980±65	917±35 ^{cd}	1006±43 ^{cd}	6081±79 ^{c}
	19	1053±42 ^{a}	1657±16 ^{bc}	1091±27 ^{cd}	1073±131	1022±96 ^{abc}	1162±55 ^{abc}	7059±336 ^{ab}
Significance		0.05	0.01	0.01	NS	0.05	0.01	0.01

a,b,c,d,e :means in the same column within each item bearing different superscript are significantly different ($P \leq 0.05$).
NS = not significant

Table (4): Effect of dietary energy and protein levels on feed consumption per duck (g) during laying period of Domyati ducks.

Treatments		Period (wks)						
		20-24	25-28	29-32	33-36	37-40	41-44	Overall period (20-44)
ME (Kcal/kg)								
2750		4223±151	3954±227 ^{b}	3850±158	4027±163	4333±132	3892±179	24052±875
2850		4290±107	4829±238 ^{a}	3678±119	3813±147	4469±151	4137±138	25211±616
2950		4212±278	4708±217 ^{a}	4091±171	4234±202	4314±215	4260±178	25706±923
Significance		NS	0.01	NS	NS	NS	NS	NS
CP (%)								
15		3818±115 ^{b}	4407±269	3679±162	3784±178 ^{b}	4226±139	3832±177	23517±724 ^{b}
17		4139±139 ^{b}	4682±245	3996±156	4012±160 ^{ab}	4351±187	4216±162	25282±824 ^{a}
19		4769±146 ^{a}	4402±270	3944±146	4278±166 ^{a}	4540±165	4241±145	26170±721 ^{a}
Significance		0.01	Ns	NS	0.05	NS	NS	0.05
Interactions								
ME (Kcal/kg)	CP (%)							
2750	15	3800±273	3430±199 ^{c}	3607±190	3520±65 ^{c}	4370±262	3380±101	21430±727
	17	4216±112	4793±169 ^{ab}	4343±151	4397±132 ^{ab}	4553±188	4457±167	26756±726
	19	4653±68	3640±115 ^{c}	3600±246	4163±303 ^{abc}	4077±216	3840±235	23970±1016
2850	15	3990±136	5110±240 ^{a}	3620±272	3550±377 ^{c}	4187±368	3950±316	24403±1293
	17	4357±160	4047±232 ^{bc}	3547±186	3980±224 ^{bc}	4590±190	4217±307	24733±1004
	19	4523±164	5330±316 ^{a}	3867±181	3910±118 ^{bc}	4630±205	4243±102	26497±781
2950	15	3663±198	4680±107 ^{ab}	3810±438	4283±220 ^{abc}	4120±105	4167±318	24717±890
	17	3843±353	5207±543 ^{a}	4097±266	3660±321 ^{bc}	3910±453	3973±369	24357±2223
	19	5130±360	4237±162 ^{bc}	4367±105	4760±194 ^{a}	4913±244	4640±161	28043±606
Significance		NS	0.01	NS	0.05	NS	NS	NS

a.b. :means in the same column within each item bearing different superscript are significantly different ($P \leq 0.05$)
.NS= not significant

Table (5): Effect of dietary energy and protein levels on feed conversion (g feed/g egg) during laying period of Domyati laying ducks.

Treatments		Period (wks)						
		20-24	25-28	29-32	33-36	37-40	41-44	Overall period (20-44)
ME (Kcal/kg)								
2750		4.91±0.18	2.35±0.09^{b}	2.94±0.19^{b}	3.61±0.20^{b}	4.02±0.30^{b}	3.43±0.22^{b}	3.32±0.14^{b}
2850		4.58±0.23	3.29±0.11^{a}	3.27±0.16^{b}	3.91±0.26^{ab}	4.35±0.25^{ab}	4.03±0.29^{a}	3.83±0.18^{a}
2950		4.44±0.24	3.55±0.30^{a}	3.83±0.15^{a}	4.49±0.29^{a}	4.95±0.29^{a}	4.01±0.08^{a}	4.09±0.12^{a}
Significance		NS	0.01	0.01	0.05	0.05	0.01	0.01
CP (%)								
15		4.42±0.20	3.11±0.22^{b}	3.12±0.22^{b}	3.82±0.35	4.30±0.39	3.60±0.16^{b}	3.58±0.19^{b}
17		4.86±0.22	3.48±0.30^{a}	3.66±0.14^{a}	4.19±0.24	4.72±0.26	4.31±0.23^{a}	4.07±0.15^{a}
19		4.66±0.24	2.60±0.15^{c}	3.25±0.22^{b}	4.01±0.23	4.30±0.25	3.55±0.21^{b}	3.59±0.16^{b}
Significance		NS	0.01	0.05	NS	NS	0.01	0.05
Interactions								
ME (Kcal/kg)	CP (%)							
2750	15	4.81±0.51	2.36±0.18^{d}	2.81±0.23	2.96±0.09^{c}	3.59±0.55^{c}	3.53±0.18^{bc}	3.09±0.15
	17	4.87±0.23	2.58±0.07^{cd}	3.45±0.36	4.24±0.10^{ab}	4.92±0.39^{ab}	4.00±0.38^{b}	3.78±0.17
	19	5.05±0.29	2.11±0.09^{d}	2.55±0.21	3.62±0.27^{bc}	3.54±0.11^{c}	2.76±0.07^{d}	3.09±0.11
2850	15	4.30±0.16	3.30±0.28^{b}	2.81±0.12	3.35±0.31^{bc}	3.61±0.14^{c}	3.17±0.21^{cd}	3.37±0.10
	17	5.42±0.16	3.44±0.20^{b}	3.79±0.18	4.51±0.47^{ab}	4.94±0.27^{ab}	5.02±0.25^{a}	4.43±0.23
	19	4.03±0.16	3.12±0.07^{bc}	3.20±0.09	3.89±0.43^{bc}	4.51±0.44^{abc}	3.89±0.20^{b}	3.70±0.19
2950	15	4.14±0.29	3.68±0.10^{b}	3.74±0.46	5.13±0.17^{a}	5.69±0.17^{a}	4.11±0.05^{b}	4.29±0.08
	17	4.27±0.41	4.43±0.43^{a}	3.73±0.16	3.81±0.59^{bc}	4.31±0.08^{bc}	3.93±0.20^{b}	4.00±0.31
	19	4.91±0.54	2.56±0.08^{cd}	4.01±0.12	4.53±0.44^{ab}	4.86±0.28^{ab}	4.00±0.12^{b}	3.99±0.20
Significance		NS	0.01	NS	0.05	0.05	0.05	NS

a,b,c :means in the same column within each item bearing different superscript are significantly different ($P \leq 0.05$).
NS = not significant

Table (6): Effect of dietary energy and protein levels on egg quality parameters of Domyati laying ducks at 35 wk of age.

Treatments		Egg quality parameters						
		Egg wt. g	Yolk wt %	Albumin wt.%	Shell wt.%	Yolk index	Shape index	Shell thickness
ME (Kcal/kg)								
2750		66.81±1.35	29.10±0.56^{b}	58.75±0.58^{a}	12.14±0.20	47.70±1.27^{b}	0.79±0.01	0.41±0.01
2850		68.36±1.20	29.67±0.53^{b}	58.36±0.55^{a}	11.97±0.20	46.31±0.71^{b}	0.78±0.01	0.40±0.01
2950		66.66±1.17	31.55±0.83^{a}	56.23±0.89^{b}	12.22±0.36	51.41±1.36^{a}	0.79±0.01	0.39±0.01
Significance		NS	0.05	0.05	NS	0.05	NS	NS
CP (%)								
15		66.83±1.38	29.52±0.67	57.54±0.67	12.53±0.30^{a}	48.70±1.28	0.79±0.01^{ab}	0.41±0.01^{a}
17		67.47±1.39	29.71±0.65	58.68±0.65	11.61±0.19^{b}	49.47±1.64	0.77±0.01^{b}	0.39±0.01^{b}
19		67.53±1.19	30.68±0.76	57.12±0.86	12.19±0.21^{ab}	47.25±0.67	0.80±0.01^{a}	0.40±0.01^{ab}
Significance		NS	NS	NS	0.05	NS	0.05	0.05
Interactions								
ME (Kcal/kg)	CP (%)							
2750	15	64.96±2.58	29.34±1.48	58.25±1.44	12.41±0.38	49.32±0.72	0.79±0.01	0.41±0.01
	17	65.28±2.95	28.82±0.80	59.51±0.86	11.66±0.37	46.52±1.75	0.78±0.02	0.40±0.01
	19	66.20±1.73	29.14±0.64	58.50±0.70	12.36±0.18	47.27±1.14	0.79±0.02	0.42±0.01
2850	15	66.50±1.89	31.10±1.01	56.84±0.80	12.06±0.38	43.87±0.84	0.78±0.01	0.39±0.01
	17	70.74±1.69	28.73±0.72	59.50±0.91	11.76±0.41	47.58±0.95	0.76±0.01	0.40±0.01
	19	70.84±2.39	29.18±0.77	58.74±0.89	12.08±0.28	47.48±1.21	0.79±0.01	0.40±0.01
2950	15	67.04±2.87	29.34±1.10	57.53±1.33	13.13±0.74	52.92±1.35	0.79±0.01	0.40±0.01
	17	67.38±2.46	31.58±1.43	57.02±1.34	11.40±0.26	54.32±2.11	0.77±0.01	0.38±0.01
	19	65.56±1.41	33.75±1.26	54.13±1.75	12.12±0.59	47.00±1.37	0.81±0.01	0.39±0.01
Significance		NS	NS	NS	NS	NS	NS	NS

a,b :means in the same column within each item bearing different superscript are significantly different ($P \leq 0.05$).
NS = not significant

Table (7): Effect of dietary energy and protein levels on chemical analysis of egg (%) at 35 wk of age.

Treatments		Chemical egg solids %		
		Fat	Protein	Ash
ME (Kcal/kg)				
2750		32.87±0.70	30.72±0.67 ^{c}	26.04±0.34 ^{a}
2850		33.14±0.34	31.98±0.72 ^{b}	24.90±0.25 ^{b}
2950		32.51±0.38	34.08±0.88 ^{a}	24.37±0.37 ^{b}
Significance		NS	0.01	0.01
CP (%)				
15		33.32±0.36	31.54±0.99 ^{b}	25.67±0.53 ^{a}
17		33.01±0.23	31.09±0.56 ^{b}	25.07±0.25 ^{ab}
19		32.19±0.71	33.15±0.62 ^{a}	24.56±0.28 ^{b}
Significance		NS	0.01	0.01
Interactions				
ME (Kcal/kg)	CP (%)			
2750	15	34.25±0.17 ^{a}	28.66±0.38 ^{e}	27.04±0.16 ^{a}
	17	33.18±0.36 ^{bc}	30.45±0.32 ^{de}	26.28±0.32 ^{ab}
	19	31.17±1.79 ^{d}	33.07±0.46 ^{abc}	24.81±0.10 ^{de}
2850	15	31.99±0.19 ^{bcd}	31.74±1.39 ^{cd}	24.27±0.18 ^{de}
	17	33.36±0.32 ^{ab}	30.11±0.63 ^{de}	25.56±0.28 ^{bc}
	19	34.07±0.31 ^{a}	34.08±0.18 ^{ab}	24.87±0.46 ^{cde}
2950	15	33.73±0.25 ^{ab}	32.72±1.12 ^{bc}	24.01±0.69 ^{de}
	17	32.48±0.44 ^{bcd}	34.87±0.32 ^{a}	25.18±0.52 ^{bcd}
	19	31.32±0.25 ^{cd}	34.64±0.61 ^{ab}	23.92±0.59 ^{e}
Significance		0.05	0.01	0.05

a,b,c :means in the same column within each item bearing different superscript are significantly different ($P \leq 0.05$).
NS = not significant

Table (8): Effect of dietary energy and protein levels on nutrient digestibility (%) of Domyati duck.

Treatments		Nutrients digestibility %						
		DM	CP	CF	EE	NFE	TDN	ME (Kcal)
ME (Kcal/kg)								
2750		82.18±1.31	77.08±2.09	60.63±2.87^{b}	75.00±2.61	90.24±0.93	71.30±1.16	2984±48
2850		83.82±0.98	79.25±2.27	67.53±1.52^{a}	78.38±2.32	91.49±0.69	72.08±0.87	3017±36
2950		83.60±0.80	79.50±1.31	64.80±1.89^{ab}	74.57±1.84	91.04±0.61	72.40±0.64	3030±27
Significance		NS	NS	0.05	NS	NS	NS	NS
CP (%)								
15		81.47±1.13^{b}	72.41±1.53^{b}	62.39±2.94	74.21±1.72^{b}	90.06±0.76^{b}	70.24±0.86^{b}	2939±36^{b}
17		84.92±0.85^{a}	81.11±1.05^{a}	67.29±2.05	73.34±2.74^{b}	92.33±0.48^{a}	73.32±0.80^{a}	3068±33^{a}
19		83.21±0.88^{ab}	82.31±0.97^{a}	63.28±1.61	80.40±1.56^{a}	90.37±0.79^{b}	72.23±0.77^{a}	3023±32^{a}
Significance		0.05	0.01	NS	0.05	0.05	0.05	0.05
Interactions								
ME (Kcal/kg)	CP (%)							
2750	15	79.29±2.66	70.36±3.65	53.75±5.77	76.83±2.86	88.48±1.44	68.24±1.81	2856±76
	17	85.64±1.29	80.79±1.78	67.22±3.16	68.32±5.68	93.07±0.57	74.87±0.99	3133±42
	19	81.61±1.21	80.08±1.43	60.92±3.19	79.84±2.34	89.19±1.37	70.80±0.89	2963±37
2850	15	81.47±1.88	71.11±2.41	66.08±3.62	77.33±0.73	89.68±1.21	70.20±1.26	2938±53
	17	84.23±1.08	81.72±1.08	69.32±2.11	72.83±4.85	92.10±0.70	71.33±0.80	2985±34
	19	85.76±1.49	84.92±1.56	67.19±2.74	84.98±1.64	92.68±1.10	74.72±1.14	3127±47
2950	15	83.66±0.18	75.76±0.52	67.33±0.94	68.47±1.50	92.04±0.31	72.26±0.13	3024±60
	17	84.88±2.31	80.82±2.94	65.34±5.66	78.86±2.57	91.83±1.25	73.76±1.67	3087±70
	19	82.26±0.81	81.93±0.96	61.72±1.31	76.39±1.57	89.25±0.66	71.16±0.61	2978±25
Significance		NS	NS	NS	NS	NS	NS	NS

a.bc :means in the same column within each item bearing different superscript are significantly different ($P \leq 0.05$).

Table (9): Effect of dietary energy and protein levels on plasma constituents of Domyati laying ducks at 44 wk of age.

Treatment		T. protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Cholesterol (mg/dl)	T. lipids (mg/dl)	AST (U/ml)	ALT (U/ml)
ME(Kcal/kg)								
2750		4.11±0.27^{b}	2.34±0.18^{b}	1.77±0.14^{b}	197.01±15.25	477.37±51.1^{b}	29.22±2.77	25.78±3.0^{b}
2850		5.08±0.20^{a}	2.85±0.06^{a}	2.23±0.17^{ab}	168.09±11.95	711.47±58.6^{a}	35.33±2.94	41.11±3.18^{a}
2950		5.15±0.28^{a}	2.86±0.12^{a}	2.29±0.23^{a}	186.79±16.39	838.64±49.1^{a}	38.67±2.17	43.22±2.13^{a}
Significance		0.01	0.01	0.01	NS	0.01	NS	0.01
CP %								
15		4.80±0.21	2.55±0.19^{b}	2.25±0.24	175.79±20.66	682.30±73.47^{b}	35.44±2.94	38.78±3.59
17		4.55±0.25	2.54±0.13^{b}	2.00±0.18	193.18±13.74	561.82±71.4^{ab}	31.44±3.15	37.33±4.46
19		5.00±0.19	2.91±0.08^{a}	2.10±0.14	182.92±7.96	783.36±57.32^{a}	36.33±2.54	34.00±3.46
Significance		NS	0.05	NS	NS	0.05	NS	NS
Interaction								
ME (Kcal/kg)	CP (%)							
2750	15	3.49±0.18	1.91± 0.14^{c}	1.58±0.15	176.2±39.0	469.6± 88.9	27.00±5.0	29.00±5.57
	17	3.80±0.27	2.10± 0.09^{c}	1.70±0.19	231.2±19.38	364.6± 57.8	24.00±3.06	20.00±2.00
	19	5.05±0.34	3.01± 0.10^{a}	2.04±0.36	183.6±1.54	597.9± 79.3	36.67±3.76	28.33±6.94
2850	15	5.29±0.47	2.91± 0.06^{ab}	2.38±0.24	140.3±22.92	724.0± 88.1	36.33±3.76	45.33±2.67
	17	5.29±0.47	2.76± 0.04^{b}	2.15±0.44	192.1±4.87	550.0± 59.8	36.00±7.0	46.67±1.33
	19	5.05±0.45	2.88± 0.19^{a}	2.17±0.26	171.9±22.0	860.4± 75.19	33.67±6.17	31.33±6.33
2950	15	5.61±0.82	2.82± 0.31^{ab}	2.79±0.51	210.9±42.74	853.4± 104.8	43.00±1.02	42.00±6.51
	17	4.94±0.14	2.78± 0.17^{b}	2.16±0.30	156.2±21.38	770.9± 112.6	34.33±4.33	45.33±2.67
	19	4.90±0.31	2.83± 0.13^{ab}	2.07±0.18	193.2±12.63	891.7± 38.23	38.67±4.33	42.33±1.20
Significance		NS	0.05	NS	NS	NS	NS	NS

a,b,c :means in the same column within each item within each item bearing different superscripts are significantly different ($P \leq 0.05$).
NS = not significant

RFERENCES

Abdel-Azeem, F.A.; A.A.El-Shafei and E. A. Abdullah (2007). *Studies on the effect of different dietary metabolizable energy levels on some performance of local baladi pigeons. Egypt poult. Sci. Vol. 27:595-611.*

Abou- Raya, A. K. and A. Gh. Galal (1971). *Evaluation of poultry feeds in digestion trails with reference to some factors involved. U.A.R. (Egypt), Animal production, 11: 207 – 221.*

AOAC. (1995). *Official Methods of Analysis. 16th ed. Assoc. Off. Anal. Chem., Washington, DC.*

Atteh, j.O. and S. Leeson, (1985). *Response of laying hens to dietary saturated and unsaturated fatty acids in the presence of varying dietary calcium levels. Poultry Sci., 64: 520–528.*

Bohnsack, C.R., R.H. Harms, W.D. Merkel and G.B.Russell(2002). *Performance of commercial layers when fed diets with four levels of corn oil or poultry fat. J. Appl. Poult. Res., 11: 68-76.*

Ciftci, I.; E.Yenice; D.Gokceyrek and E.Ozturk (2003). *Effects of energy level and enzyme supplementation in wheat based layer diets on hen performance and egg quality. Acta Agriculture Scandinavica, Section-A Animal Science, 53: 113 -119.*

Duncan,D.B.(1955). *Multiple range and multiple F tests. Biometrics, 11:1-42.*

El-Husseiny, O.M., A.Z., Soliman; M.O., Abd-Elsamee and I.I., Omara (2005). *Effect of dietary energy, methionine, Choline and folic acid levels on Layers performance. Egypt poult. Sci. 25: 931-956*

El-Sayed, A. Nadia; R.E. Rizk; M. Bahie El-Deen and Shalan, M. Hedaia (2001). *Effect of strain and dietary regimen on the performance of local Chickens. Egypt. Poult. Sci. 21 (IV): 1021-1038.*

Fan, H. P. (2003). *Comparative study of the digestion of feed nutrients between cockerel and drake. Master degree diss. Chin. Acad. Agric. Sci., Beijing, China.*

Grobas S, J. Mendez, C. De Blas and G.G. Mateos (1999). *Laying hen productivity as affcted by energy, supplemental fat, and linoleic acid concentration of the diet. Poultry Science, 78: 1542-1551*

Gunawardana P. , G. Wu , Kun Yuan, M.M. Bryant and D.A. Roland(2009). *Effect of Dietary Protein and Peptide in Corn-Soy Diets on Hen Performance, Egg Solids, Egg Composition and Egg Quality of Hy-Line W- 36 Hens During Second Cycle Phase Three. International Journal of Poultry Science 8: 317-322*

Gunawardana, P. , D. A. Roland and M. M. Bryant (2008). *Effect of Energy and Protein on Performance,Egg Components, Egg Solids, Egg Quality, and Profits in Molted Hy-Line W-36 Hens. J. Appl. Poult. Res. 17:432–439*

Harms, R. H., G. B. Russell, and D. R. Sloan (2000). *Performance of four strains of commercial layers with major changes in dietary energy. J. Appl. Poult. Res. 9:535–541.*

Jakobsen, P.E.; S.G. Kirston and H. Nielsen, (1960) *.Digestibility trails with poultry. 322-bretning fra foprsgs labratriet udgivest statens .Husdybug sudvalg kobenhann.*

Jalal, M.A., S.E. Scheideler and D. Marx(2006). *Effect of bird cage space and dietary metabolizable energy level on production parameters in laying hens. Poult. Sci., 85: 306-311.*

Keshavarz, K. (2003). *Effects of reducing dietary protein, methionine, choline, folic acid, and vitamin B12 during the late stages of the egg production cycle on performance and eggshell quality. Poult. Sci. 82:1407–1414.*

Kout El-Kloub. M.El.Moustafa; M. A.A. Hussein; M.K. Gad El-hak (2005). *A study on the energy and protein Requirements of mamoura local strain Chickens during laying period. Egypt Poult. Sci. Vol .25: 637- 651.*

Leeson, S., J. D. Summers, and L. J. Caston (2001). *Response of layers to low nutrient density diets. J. Appl. Poult. Res. 10:46–52.*

Liu, Z., G. Wu, M.M. Bryant and D.A. Roland, Sr., (2004). *Influence of added synthetic lysine for first phase second cycle commercial leghorns with the methionine +cystine/ lysine ratio maintained at 0.75. Int. J. Poult. Sci., 3: 220-227.*

Liu, Z., G. Wu, M.M. Bryant and D.A. Roland, Sr., (2005). *Influence of added synthetic lysine in low-protein diets with the methionine plus cystine to lysine ratio maintained at 0.75. J. Appl. Poult. Res., 14: 174- 182.*

Maiorka, A., A. V. F. Da Silva, E. Santin, J. M. Pizauro Jr., and M. Macari (2004). *Broiler breeder age and dietary energy level on performance and pancreas lipase and trypsin activities of 7-days old chicks. Int. J. Poult. Sci. 3:234–237.*

Nahashon, S.N.; N. Adefope; A. Amenyenu and D. Wright (2006). *Effect of varying metabolizable energy and crude protein concentrations in diets of Pearl Gray Guinea Fowl Pullets 1. Growth performance. Poult. Sci., 85:1847–1854*

Nahashon,S.N; N. A. Adefope, A. Amenyenu, and D. Wright(2007). *Effect of varying concentrations of dietary crude protein and metabolizable energy on laying performance of pearl grey guinea fowl hens. Poultry Science 86:1793–1799.*

National Research Council (NRC)(1994). *Nutrient Requirements of Poultry, 9th revised edn. National Academy Press, Washington, DC.*

SAS Institute. (2004). *SAS / DSTAT User s Guide. SAS Institute Inc., Cary,Nc*

Soliman, A. Z. M. (2002). *The bioefficacy of hot red pepper in practical layer diets varying in their energy content. Egypt Poult. Sci. 22 (IV): 1047-1062.*

Wu G, M.M. Bryant, R.A. Voitle and D.A. Roland Sr(2005). *Effect of dietary energy on performance and egg composition of Bovans White and Dekalb White hens during phase 1. Poultry Science, 84: 1610-1615*

Wu, G., P. Gunawardana, M.M. Bryant, R.A. Voitle and D. A. Roland, Sr(2007). *Effects of diatery energy and protein on performance, egg composition, egg solids, egg quality and profits of Hy-Line W-36 hens during phase 3.The Journal of Poultry Science, .44: 52-57*

Yakout, H. M.; M. M. Shehatta; M. E. Omara and E.H. El-Ganzory (2003). *The effect of energy level on the response of Mandarah hens to enzyme supplemented diets. Egypt. Poult. Sci. 23 (IV): 859-873.*

Yakout, H. M.;M.E. Omara;Y. Marie and R.A. Hassan (2004). *Effect of incorporating growth promoters and different dietary protein levels into Mandarah hens layer's diets. Egypt. Poult. Sci. 24 (IV): 977-1994.*

Zanaty, G. A. (2006). *Optimum dietary protein and energy levels for Norfa hens during the laying period. Egypt. Poult. Sci., 26: 207-220*

Zanaty, G. A. and Sh. A. M. Ibrahim (2005). *Optimum dietary protein and*

energy levels of Norfa chicks during the periods of zero to eight and eight to sixteen weeks of age. Egypt. Poult. Sci. 25 (III): 589- 612.

Zhang,J.; D. Chen and B. Yu (2008). *Effect of different dietary energy sources on induction of fatty liver-hemorrhagic syndrome in laying hens. Inte. J. of Poul. Sci. 7: 1232-1236*

Zhao,F; S. S. Hou, H. F. Zhang, and Z. Y. Zhang(2007). *Effects of dietary metabolizable energy and crude protein content on the activities of digestive enzymes in jejunal fluid of Pekin ducks. Poult. Sci., 86:1690–1695*

الملخـــص العربـــي

استجابة البط الدمياطى للعلائق المحتوية على مستويات مختلفة من الطاقة والبروتين

٢- خلال فترة انتاج البيض

عوض لطفى عوض، قوت القلوب مصطفى السيد مصطفى، أيمن ابراهيم عبده غنيم

معهد بحوث الانتاج الحيوانى – مركز البحوث الزراعية- وزارة الزراعة – دقي – جيزة

استخدم فى الدراسة عدد ٣٧٨ طائربط دمياطي عمر ٢٠ أسبوع تم وزنهم و تقسيمهم إلى تسع مجاميع تجريبية وبكل مجموعة ثلاث مكررات وذلك لدراسة تأثير إستخدام علائق تحتوى على مستويات مختلفة من الطاقة والبروتين (٣x٣) فى تغذية البط الدمياطي خلال فترة انتاج البيض (من ٢٠ - ٤٤ أسبوع) على أداء انتاج البيض ومقاييس جودة البيض وتركيبه الكيماوي وبعض صفات الدم ومعاملات هضم المركبات الغذائية. تم تكوين العلائق التجريبية المستخدمة بحيث تحتوى على ثلاث مستويات من الطاقة (٢٧٥٠ ، ٢٨٥٠، ٢٩٥٠ كيلو كالورى طاقة ممثلة/ كجم) وبكل مستوى منها ثلاث مستويات من البروتين الخام (١٥ ، ١٧ ، ١٩ %).

تم تسجيل العليقة المستهلكة خلال فترة التجربة ، و عند عمر ٣٥ اسبوع تم اجراء اختبارات جودة و التحليل الكيماوى للبيض وكذلك التحليل الكيماوى لتلك المكونات وعند ٣٨ أسبوع تم اجراء تجربة هضم لتقدير معاملات هضم المركبات الغذائية المختلفة بالعلائق . تم أخذ عينات دم من البط عند عمر ٤٤ أسبوع لتقدير محتويات بلازما الدم من البروتين الكلى والليبدات الكلية والكولسترول الكلى وإنزيمات الترانس أمينيز (AST,ALT) .

وبتحليل النتائج اتضح الآتي :

لم تؤثر المستويات المختلفة من الطاقة وكذلك التداخل بين الطاقة والبروتين (ما عدا مستوي ١٥ %) علي وزن الجسم الحي و التغير فى وزن الجسم عند نهاية التجربة. تحسن عدد البيض وكتلة البيض لكل بطة معنويا بالتغذية على عليقة تحتوى على ٢٧٥٠ كيلو كالورى لكل كجم وبروتين خام ١٩ % خلال الفترة الكلية للتجربة (٢٠-٤٤ أسبوع) بالمقارنة بالمستويات الأخرى من الطاقة. لم تتأثر كمية العليقة المستهلكة لكل بطة خلال فترة التجربة بالمستويات المختلفة من الطاقة والبروتين فى العليقة بينما تحسنت معنويا كفاءة التحويل الغذائى لانتاج البيض بالتغذية على عليقة تحتوى على ٢٧٥٠ كيلو كالورى لكل كجم وبروتين خام ١٩ % .

ارتفعت معنويا نسبة الصفار ودليل الصفار بزيادة مستوى الطاقة فى العليقة بينما انخفضت معنويا نسبة البياض ولم تتأثر مقاييس القشرة. ازدادت نسبة وزن القشرة وسمك القشرة معنويا بالتغذية على عليقة تحتوى ١٥ % بروتين خام بالمقارنة بتلك التى تحتوى ١٧ % فقط. لم تتأثر نسبة المحتويات الصلبة الكلية والصفار والبياض بالمستويات المختلفة من الطاقة والبروتين فى العليقة وكذلك التفاعل بينهم. ارتفع معنويا محتوى المواد الصلبة من البروتين بالتغذية على عليقة تحتوى على ٢٩٥٠ كيلو كالورى لكل كجم وبروتين خام ١٩ % بينما انخفض معنويا محتواها من الرماد.

لم يتأثر معنويا معامل هضم المركبات الغذائية بالمستويات المختلفة من الطاقة فى العليقة ما عدا الألياف الخام والتى تحسنت معنويا بالمستوى ٢٩٥٠ كيلو كالورى / كجم ، بينما تحسن معنويا معامل هضم البروتين الخام والمستخلص الاثيرى والمركبات الكلية المهضومه بزيادة مستوى البروتين فى العليقة.

انخفض معنويا محتوى البلازما من البروتين الكلى والألبيومين والجلوبيولين والليبيدات الكلية وانزيم الكبد ALT بينما لم يتأثر معنويا محتوي البلازما من الكوليسترول الكلي وانزيم الكبد AST بالتغذية على عليقة تحتوى على ٢٧٥٠ كيلو كالورى لكل كجم بالمقارنة بالمستويات الأخرى ولم تؤثر معنويا المستويات المختلفة من البروتين فى العليقة على محتويات البلازما المختلفة فيما عدا الألبيومين والليبدات الكلية والتى ارتفعت معنويا بالتغذية على عليقة تحتوى ١٩ % بروتين خام.

السابقة يمكن استنتاج أن إستخدام عليقة تحتوى على ٢٧٥٠ كيلو كالورى / كجم وبروتين خام ١٩ % فى تغذية البط الدمياطى خلال مرحلة انتاج البيض يمكن أن يؤدى إلى تحسن مقاييس الأداء الإنتاجي لانتاج البيض وجودة البيض بالاضافة لمعاملات هضم المركبات الغذائية بالعليقة .