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ESTIMATION OF THE NUTRITIONAL REQUIREMENTS OF PROTEIN AND ENERGY ACCORDING TO THE BODY WEIGHT AND ITS EFFECTS ON PRODUCTIVE AND *REPRODUCTIVE PERFORMANCE OF GIMMIZAH LAYING* HENS

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ABSTRACT

An experiment was conducted to investigate the effect of different dietary energy and protein levels with small or large body weight on performance of Gimmizah layers. Two hundred and eighty eight laying hens at 24 weeks of age laying hens were randomly distributed into twelve equal groups, each one composed of 24 females. Birds were housed in individual cages, fed on twelve experimental diets containing 2 levels of metabolizable energy (2600 and 2800 kcal /kg feed) and 3 levels of crude protein (12, 14 and 16%) with small or large body weight in a factorial arrangement design (2 body weight x 2 energy level x 3 protein levels).

The obtained results can be summarized as follows:

1- Regardless of dietary protein levels and dietary energy levels body weight class did not significantly affected in feed intake (FI), average egg weight (EW), egg mass (EM), feed conversion (FC), feed conversion (FC), egg quality traits and hatchability and fertility percentages.

2- Independently of the effect of body weight class and dietary energy levels, Significant improvement was recorded in egg production (EP), egg number (EN), egg weight (EW), and egg mass (EM) with the increase in dietary protein level. Feed conversion (FC) was improved as dietary protein levels increased. Egg quality traits were not significantly affected by feeding different levels of crude protein (CP), except egg shell weight % and Haugh Units score. Fertility and hatchability of total eggs of low CP level were significantly lower than those of the other levels.

3- Regardless of body weight class and dietary protein levels, dietary energy levels had no effect on change in body weight. Feed intake significantly decreased due to increasing dietary energy levels. The increase in dietary energy level significantly improved EW, and EM. FC was improved as dietary energy increased. Egg quality traits were not affected significantly by feeding different levels of CP except egg shell weight % and Haugh Units score. Hatchability and fertility percentages did not significantly differ in body weight categories and dietary energy levels

In conclusion. the diet containing 2800 kcal/kg diets and 16 or 14% CP levels were suggested to be suitable requirement and satisfactory for egg production of Gimmizah hens at the laying period (during the 90 days in production after 24 weeks of age). Such results will help to reduce the cost of the diets for Gimmizah strain. Dietary energy level is the main factor determining the efficiency of feed utilization.

Keywords: requirements, protein levels, energy levels, laying hens.

INTRODUCTION

Many attempts have been undertaken to improve growth, feed conversion efficiency and egg production of local breeds to reduce the cost of feeds by determining intermediating energy and protein requirements.

Mahmoud *et al.*, (1982 a, b) and Abdel-Gawad., (1983). Establishing the optimum body weight for each given strain could help toward improving productive and reproductive capacity of these strains and increasing their profit. Body weight at onset of laying is an important factor for maximize egg output. McDaniel *et al.*, (1981) reported that increasing body weight of laying hens usually compound with increasing nutrient requirements of maintenance that raising the cost of production and hinder the reproductive capacity. The problem with lighter body weight of breeding hens is to produce smaller eggs, resulting in small pullet weight. Small body weight hens consume less feed and converted it into eggs more efficiently assuming equal egg output could be obtained (Bell *et al.*, 1981 and Ruiz *et al.*, 1983). Leeson and Summers (1990) showed that body weight was of importance for maximum egg mass output. Abd El-Ghani (1996) reported that feed conversion, egg production, egg mass and egg quality were affected by body weight of hens. Protein and energy requirements of laying hens are influenced by many factors as breed, size, stage of production, environmental temperature and other managerial factors. Moreover, investigation concerning the effect of dietary protein or energy on egg weight and egg production has been the subject of many researches with contradictory results (Hussein *et al.*, 1996 and Keshavarz, 1998). Dietary energy and protein levels have the greatest effect on the feeding and laying performance of hens. Dietary energy level is the most important factor in determining feed intake of layers which consume feed to satisfy an inner craving for energy (Scott et al., 1982, and Leeson et al., 2001). Average egg weight of layers increased also by increasing the metabolizable energy (ME) level of diet (Doran et al., 1980, and Harms et al., 2000). There was an inclusive effect on egg production rate due to the dietary energy level variation. Summers (1993) showed that egg production percentage reduced by increasing dietary energy level, while Harms *et al.* (2000) didn't find any effect on egg production due to increasing dietary energy level.

Dietary protein content takes much consideration due to its high cost and its great effect on the production parameters of laying hens. Aitken et al., (1973) and Fernandez et al., (1973), reported that increasing dietary protein level lead to an increase in egg production percentage. Also, average egg weight of layers increased as dietary protein level increased Summers (1993). Moreover, Aitken *et al.* (1973) and Calderon and Jensen (1990) observed an improvement in feed efficiency ratio due to increasing dietary protein level. El-Dakroury and Mahmoud (1982) revealed that the optimum rate of laying occurred for Silver Montazah and Gimmizah pullets when fed dietary protein level of 16.4 and 15.4%, respectively. Kang *et al.* (1996) reported that laying hens fed diet with 12% protein resulted in significant lower hen-day egg production than that fed 16% protein.

The present study was conducted to investigate the effect of body weight, protein levels and energy levels on the productive and reproductive performance of Gimmizah laying hens (during the 90 days in production after 24 weeks of age).

MATERIALS AND METHODS

This study was carried out at El-Gimmizah Poultry Station, Animal Production Research Institute, Ministry of Agriculture. Two hundred and eighty eight pullets Gimmizah strain at 24 weeks of age were used in the study in 2x2x3 factorial arrangement. Pullets were classified according to its body weight into two categories. Large body weight W1 (1548 g) and small body weight W2 (1295 g) and each category received two different levels of metabolizable energy E1 (2600 kcal/kg feed) and E2 (2800 kcal/kg feed) and under each energy level three different levels of protein P1 (16%), P2 (14%) and P3 (12%) Table 1.

Table (1): Composition and chemical analyses of the basal diets.

Ingredients (%)	Diet 1 16%cp 2600 kcal	Diet 2 16%cp 2800 kcal	Diet 3 14%cp 2600 kcal	Diet 4 14%cp 2800 kcal	Diet 5 12%cp 2600 kcal	Diet 6 12%cp 2800 kcal
Yellow corn	60.00	67.90	62.50	72.00	66.00	74.03
Soybean meal, 44 %	21.70	23.00	15.30	17.19	9.25	11.00
Wheat bran	8.60	00.00	12.35	1.00	14.65	5.00
Limestone	7.50	7.00	7.50	7.50	7.60	7.50
Dicalcium phosphate	1.60	1.50	1.60	1.60	1.65	1.60
Common salt	0.30	0.30	0.30	0.30	0.30	0.30
Vit. & Min. mix.*	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.00	0.00	0.10	0.08	0.20	0.22
Methionine	0.05	0.05	0.10	0.08	0.10	0.10
Total	100	100	100	100	100	100
Calculated values**:						
Crude protein, %	16.21	16.12	14.35	14.19	12.47	12.43
ME,Kcal/kg	2607	2787	2603	2814	2620	2802
Crude fiber,%	3.78	3.10	3.80	2.89	3.71	2.95
Ether Extract,%	2.71	2.76	2.87	2.90	3.02	3.05
Calcium, %	3.34	3.30	3.32	3.32	3.36	3.31
Available phosphorus %	0.42	0.40	0.41	0.40	0.41	0.41
Total phosphorus %	0.72	0.67	0.65	0.58	0.56	0.51
Lysine, %	0.79	0.79	0.75	0.73	0.71	0.72
Methionine,%	0.31	0.31	0.33	0.32	0.31	0.31
Methionine + cysteine %	0.59	0.59	0.59	0.56	0.54	0.54
Determined values***:						
Dry matter, %	89.58	90.11	89.13	88.98	88.33	88.58
Crude protein,%	15.89	15.81	14.11	13.89	12.22	12.11
Crude fiber,%	4.32	3.86	4.26	3.95	4.21	4.10
Ether Extract,%	2.24	2.51	2.63	2.58	2.67	2.68
NFE%	58.28	58.36	59.15	58.97	59.37	59.80
Ash,%	8.85	9.57	8.98	9.59	9.86	9.89

***Vit.& Min. mix:. each 1kg diet contains: 10,000 IU Vit. A; 2,000 IU Vit D_3 10 mg Vit. E;1mg Vit. K3 ; 1mg Vit. B1; 5mg Vit. B2; 1,5mg Vit B6; 0.1mg Vit. B12; 0.3mg; Niacin, 10 mg ; Panatothenic acid, 0.5 mg, Biotin; I mg Folic acid;250 mg choline; 60 mg manganese; 30 mg iron; 50 mg zinc; 4 mg copper;0.3 mg iodine; 0.1 mg Seleinium and 0.1mg cobalt.**

**** Calculated according to NRC (1994).**

***** Determined according to the methods of A.O.A.C (1980)**

Twelve groups each one contained 24 birds were housed in an individual cages and received one of sex Corn-Soy experimental diets which were formulated as shown in Table (1). All birds were kept under similar conditions and fresh water was supplied all the time and all hens were fed *ad libitum* for 90 days of production. Also, the birds were exposed to 16 hr of

continuous light. Body weight and egg production were individually recorded/hen/day (HD), egg weight and feed intake were recorded weekly and presented based on 30 day period. Egg production was recorded per treatment. Egg quality measurements were determined once every month for two successive days included shape index, albumen weight percentage, yolk weight percentage, Haugh unit (HU), shell weight percentage and shell thickness. The eggs were collected for 7 days, starting after one month of the experimental period and 3 times during the rest of the experimental period to measure the reproductive efficiency (fertility and hatchability) percentage.

A completely randomized design, with a factorial arrangement of treatments (2x2x3) was used. Data were analyzed using the General Linear Model (GLM) procedure of Statistical Analysis System (SAS, 1994). Significant differences among means were separated by Duncan s multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Body weight (BW) and change in body weight:

Results in Table (2) indicated that, layers fed the lowest dietary protein level (12 % CP) put on a significantly (P?0.05) less body weight compared to those fed either 14 or 16% CP diets. While, there was no significant effect of dietary energy (ME) level on body weight of laying hens during the 90 days in production. Change in body weight gain of layers was not significantly affected by feeding different treatments.

This result is in agreement with Hassan *et al.* (2000), who reported that the differences were highly significant for the strain and protein level. The hens fed higher protein level (17.5 %) had higher overall BW mean than those fed on lower protein level (13.67 %). El-Sayed *et al.* (2001) found that BW for birds fed a control diet with higher percentages of protein was significantly higher than for those fed higher level of energy for the suggested dietary regimens during the fourth week up to sixteen weeks of age. On the contrary, Abd El-Ghani (1996) reported that the lightest BW class gained significantly more weight than those of the other groups. The increases in BW of the light categories are expected based on continuous growth to achieve mature BW. However, it should be pointed out that hens do not necessarily have to gain weight throughout the laying period, rather than maintaining their body weight, in order to perform satisfactorily. In this respect, Summers and Leeson (1977) stated that any gain in body weight after commencement of egg production should be minimal as the hen is essentially at her mature body weight.

Daily feed intake:

Results in Table (3) indicated that neither body weight (W1 and W2), nor dietary protein levels (P1, P2 and P3) had significant effect on daily feed intake during the 90 days in production after 24 weeks of age. Concerning the dietary energy levels, the daily feed consumption values of layers significantly decreased due to increasing dietary energy levels. These results are in agreement with those reported by El Alaily *et al.* (2003) who found that the daily FI values of Hy line layers decreased significantly due to increasing dietary energy levels (2750, 2850 and 2950 kcal/kg diet).

Table (2): Effects of different body weight categories, dietary energy levels and dietary protein levels on body weight (kg) and change of body weight (kg) of Gimmizah laying hens.

Body weight	Small body weight (W1)						Large body weight (W2)						SEM
Dietary ME kcal/kg	2600 kcal (E1)			2800 kcal (E2)			2600 kcal (E1))			2800 kcal (E2)			
% Protein	16%	14%	12%	16%	14%	12%	16%	14%	12%	16%	14%	12%	
Initial body weight	1.28b	1.31b	1.29b	1.29b	1.30b	1.29b	1.54a	1.55a	1.53a	1.55a	1.54a	1.55a	0.01
1 month	1.46cd	1.41d	1.45cd	1.48cd	1.51c	1.40d	1.73ab	1.72ab	1.67b	1.73ab	1.78a	1.69b	0.01
2 month	1.56fg	1.49g	1.50fg	1.58efg	1.61def	1.48g	1.80ab	1.75abc	1.68cde	1.82a	1.69bcd	1.78abc	0.01
3 month	1.56b	1.58b	1.56b	1.61b	1.63b	1.58b	1.87a	1.82a	1.79a	1.87a	1.79a	1.85a	0.01
Change of body weight	0.28	0.27	0.27	0.32	0.33	0.29	0.33	0.27	0.26	0.32	0.25	0.30	0.01
Overall body weight	1.59b (W1)						1.83a (W2)						0.01
Overall ME effect	1.70 (E1)						1.72 (E2)						0.01
Overall protein effect	1.73a (P1)				1.71ab (P2)				1.69b (P3)				0.01

a-g Means with different letters within the same row are significantly different at P?0.05

Table (3): Effect of different body weight categories, dietary energy levels and dietary protein levels on daily feed intake (g) of Gimmizah laying hens.

Body weight	Small body weight (W1)						Large body weight (W2)						SEM
Dietary ME kcal/kg	2600 kcal/kg (E1)			2800 kcal (E2)			2600 kcal (E1)			2800 kcal (E2)			
% Protein	16%	14%	12%	16%	14%	12%	16%	14%	12%	16%	14%	12%	
1 month	125.24ab	125.58ab	12744a	109.13c	109.84c	111.06c	124.86b	123.36b	124.23b	109.81c	109.04c	111.16c	1.30
2 month	124.87ab	125.23ab	125.97a	109.59d	110.27d	110.46d	122.45c	122.34c	123.71bc	109.98d	109.16d	109.59d	1.22
3 month	124.94a	123.87ab	125.66a	112.12e	113.42de	115.15cde	125.83a	126.59a	128.77a	115.34cde	117.39cd	119.32bc	1.02
Overall period	125.02ab	124.89ab	126.36a	110.2d	111.17d	112.22cd	124.38ab	124.09b	125.57ab	111.71cd	111.86cd	113.36c	1.14
Overall body weight	118.32 (W1)						118.49 (W2)						1.14
Overall ME effect	125.05a (E1)						111.76b (E2)						1.14
Overall protein effect	117.84 (P1)				118.01 (P2)				119.38 (P3)				1.14

a-g Means with different letters within the same row are significantly different at P?0.05

Table (4): Effect of different body weight categories, dietary energy levels and dietary protein levels on egg production of Gimmizah laying hens.

Body weight	Small body weight (W1)						Large body weight (W2)						SEM
Dietary ME kcal/kg	2600 kcal/kg (E1)			2800 kcal (E2)			2600 kcal (E1)			2800 kcal (E2)			
% Protein	16%	14%	12%	16%	14%	12%	16%	14%	12%	16%	14%	12%	
1 month	41.76b	32.987abcd	30.79cd	40.37abc	41.76ab	32.32bcd	37.73abcd	34.96abcd	30.37d	43.43a	39.95abcd	34.82abcd	1.01
2 month	57.31ab	54.95ab	49.53b	59.25ab	61.06ab	49.53b	55.92ab	58.56ab	55.78ab	63.14a	58.00ab	55.50ab	1.05
3 month	65.92	64.67	58.56	65.23	67.59	54.25	61.48	62.17	66.48	64.11	68.14	64.39	1.25
Overall period	54.99ab	51.20abc	46.29bc	54.95ab	56.80a	45.37c	51.71abc	51.89abc	50.87abc	56.89a	55.37a	51.57abc	0.87
Overall body weight	51.60 (W1)						53.05 (W2)						0.87
Overall ME effect	51.16 (E1)						53.49 (E2)						0.87
Overall protein effect	54.64a (P1)				53.82a (P2)				48.53b (P3)				0.87

a-d Means with different letters within the same row are significantly different at P?0.05

Egg production (EP) and egg number (EN):

The effect of body weight (W) dietary energy levels (E) by dietary protein levels (P) on hen-day egg production (EP) and eggs number (EN) in Gimmizah laying hens during the 90 days in production after 24 weeks of age are presented in Tables (4 and 5). The effect of body weight categories was not significant on EP and EN. Kader *et al.* (1981) showed that pullets of large body weight produced fewer number of eggs than those of the light weight. Doornenbal *et al.* (1970) showed negative correlation between body weight and egg production. On the other hand, Abd El-Ghani (1996) showed that body weight categories had significant effect on egg production, in which the intermediate group laid significantly more egg than those of the lightest one. Also, EP and EN were not significantly affected by feeding different energy Summers (1993) didn't find significant difference in egg production of layers fed different energy and protein levels. On the other hand, EP and EN were significantly higher with 16 and 14% CP than with 12% CP. Significant improvement was recorded in EP and EN with the increase in dietary protein level. These results are in agreement with those reported by Hassan *et al.* (2000) who found that the egg production percentages were significantly higher with 17.5% CP than with 13.67% CP.

The EP and EN of 16 and 14% CP and 2800 kcal/kg diet with either small or large body weight being significantly superior than the other groups. While, the worst value recorded by layers fed the 12% CP level and 2800 or 2600 kcal/kg diet with small body weight. These results are in agreement with those reported by El Alaily *et al.* (2003) who found that the ME level of 2850 kcal/kg has the highest effect on egg production with the different levels of protein (16,18 and 20% in diet) in Hy line W36 layers. Soliman (1996). reported that, Hy line layers fed on 2850 kcal/kg ME gave the highest egg production percentage during winter season under Egyptian conditions.

It can be concluded that the dietary energy level of 2800 kcal/kg and 16 or 14% CP with either small or large body weight were satisfactory for egg production of Gimmizah layers during the 90 days in production after 24 weeks of age.

Egg weight (EW):

Results in Table (6) indicated that body weight (W1 and W2) had no effect on EW. While, dietary energy levels (E1and E2) and dietary protein levels (P1, P2 and P3) during the 90 days in production after 24 weeks of age had significant effect on egg weight (EW). The large body weight recorded significant higher average egg weight than the small body weight. On the contrary Abd El-Ghani (1996) who Showed a significant linear positive increase in egg weight with increasing body weight. Also, Scheele (1988) showed that heavier hens produced heavier eggs and consumed more feed per dozen eggs.

The average egg weight of layers fed the highest energy diet (2800 kcal/kg diet) was significantly (P?0.05) higher than those fed the low one. These results are in good agreement with those reported by El Alaily *et al.* (2003). Significant differences were found in egg weight due to the level of protein. Egg weight increased with increasing the dietary protein as reported by Totsuka *et al.* (1993) and Hassan *et al.* (2000).

Table (5): Effect of different body weight categories, dietary energy levels and dietary protein levels on egg number of Gimmizah laying hens.

Body weight	Small body weight (W1)						Large body weight (W2)						SEM
Dietary ME kcal/kg	2600 kcal (E1)			2800 kcal (E2)			2600 kcal (E1)			2800 kcal (E2)			
% Protein	16%	14%	12%	16%	14%	12%	16%	14%	12%	16%	14%	12%	
1 month	12.53ab	10.19abcd	9.24cd	12.12abc	12.53ab	9.69bcd	11.32abcd	10.49abcd	9.11d	13.03a	11.99abcd	10.44abcd	0.30
2 month	17.19ab	16.48ab	14.86b	17.77ab	18.32ab	14.86b	16.77ab	17.57ab	16.73ab	18.94a	17.40ab	16.65ab	0.31
3 month	19.78	19.40	17.57	19.57	20.28	16.28	18.44	18.65	19.94	19.23	20.44	19.32	0.37
Overall period	49.45ab	46.08abc	41.66bc	49.45ab	51.12a	40.83c	46.54abc	46.70b	45.79abc	51.20a	49.83a	46.41abc	0.78
Overall body weight effect	46.44 (W1)						47.75 (W2)						0.78
Overall ME effect	46.04 (E1)						48.14 (E2)						0.78
Overall protein effect	49.17a (P1)			48.43a (P2)			43.67b (P3)						0.78

a-d Means with different letters within the same row are significantly different at P?0.05

Table (6): Effect of different body weight categories, dietary energy levels and dietary protein levels on egg weight(g) of Gimmizah laying hens.

Body weight	Small body weight (W1)						Large body weight (W2)						SEM
Dietary ME kcal/kg	2600 kcal (E1)			2800 kcal (E2)			2600 kcal (E1)			2800 kcal (E2)			
% Protein	16%	14%	12%	16%	14%	12%	16%	14%	12%	16%	14%	12%	
1 month	46.39def	45.81ef	44.59h	4.99bc	47.48ab	44.89gh	46.35de	45.81ef	44.81gh	47.85a	46.47cd	45.40fg	0.18
2 month	46.72bcd	46.5cd	45.28e	48.56a	48.16a	45.66e	47.32bc	47.17bcd	45.70e	48.75a	47.40b	46.45d	0.19
3 month	48.20bc	48.31bc	47.22c	49.93abc	51.85ab	46.94c	49.23abc	48.17bc	46.39c	52.22a	49.53abc	47.53c	0.40
Overall period	47.10de	46.89def	45.70g	48.49bc	49.16ab	45.86fg	47.63cd	47.05de	45.83fg	49.61a	47.84cd	46.46efg	0.26
Overall body weight effect	47.19 (W1)						47.37 (W2)						0.23
Overall ME effect	46.67b (E1)						47.89a (E2)						0.23
Overall protein effect	48.21a (P1)			47.73a (P2)			45.91b (P3)						0.23

a-h Means with different letters within the same row are significantly different at P?0.05

The average egg weight of layers fed the high energy diet (2800 kcal/kg diet) and 16 or 14% CP with either body weight was significantly (P?0.05) higher than that of the other groups. Simultaneously, decreasing of dietary protein level (12% CP) and high or low energy level (2800 or 2600 kcal) with both body weight have a negative effect (P?0.05) on average egg weight of layers.

Egg mass (g. egg/hen/day):

Results in Table (7) indicated that, body did not have any significant effect on egg mass. These results are in contrast of the results of El-Samra (1970) showed differences on egg production and egg mass due to body weight.

There were significant (P?0.05) differences in egg mass due to dietary protein level. These results are in agreement with those reported by Hassan *et al.* (2000) who found that the pullets fed high protein level (17.5%) produced heavy egg mass when compared with the other group fed low level (13.67%), which indicated that increasing protein levels in layer diet affected positively egg mass. Amer (1990) reported similar results. On the contrary, El Alaily *et al.* (2003) showed that the daily egg mass of layers was not significantly affected by feeding different levels of crude protein.

The average egg mass of layers fed the high energy diet (2800 kcal/kg diet) was significantly (P?0.05) higher than the low energy one (2600 kcal/kg diet). Simultaneously, decreasing dietary protein level (12% CP) at low or high energy level (2600 or 2800 kcal) with both body weights have a negative effect (P?0.05) on average egg mass.

Feed conversion FC (g. feed/g. egg mass):

Irrespective of the effect of dietary energy levels (E) and dietary protein levels (P), body weight categories had no significant effect on feed conversion (FC). However, FC of layers were significantly (P?0.05) affected by the dietary energy levels. Layers fed on the 2600 kcal/kg diets consumed more feed and exhibited a significantly (P?0.05) poorer feed conversion compared to those fed the 2800 kcal/kg diets (Table 8) during the 90 days in production after 24 weeks of age. Abd El-Ghani (1996) reported that, feed conversion ratio as well as feed efficiency of energy utilization were significantly impaired by the light body weight group as compared to the others and there were strain differences in feed and metabolizable energy efficiency.

On the other hand, layers fed on the 16% CP-diets were significantly (P?0.05) superior in FC followed by layers fed on the 14% CP-diets. While, layers fed the 12% CP-diets recorded the poorest FC. These results are in agreement with those reported by Hassan *et al.* (2000) Who found that decreasing dietary protein level resulted in poor FC compared with those given the high protein level. This poor utilization could be attributed to the more consumption of feed in an attempt to meet hen requirement from protein.

Table (7): Effect of different body weight categories, dietary energy levels and dietary protein levels on egg mass (gm/hen/day) of Gimmizah laying hens.

Body weight	Small body weight (W1)						Large body weight (W2)						SEM
Dietary ME kcal/kg	2600 kcal (E1)			2800 kcal (E2)			2600 kcal (E1)			2800 kcal (E2)			
% Protein	16%	14%	12%	16%	14%	12%	16%	14%	12%	16%	14%	12%	
1 month	19.38ab	15.57bcd	13.73d	18.97ab	19.82ab	14.51cd	17.49abc	16.01bcd	13.61d	20.78a	18.57abc	15.81bcd	0.51
2 month	26.77ab	25.58ab	22.43b	28.78a	29.41a	22.62b	26.45ab	27.61ab	25.50ab	30.80a	27.52ab	25.76ab	0.56
3 month	31.72ab	30.28ab	27.66ab	32.71ab	35.10a	25.37b	30.23ab	29.88ab	30.89ab	33.48a	33.79a	30.55ab	0.70
Overall period	25.96abc	24.14abcd	21.27d	26.63abc	28.11ab	20.83d	24.72abcd	24.50abcd	23.34bcd	28.35a	26.63abc	24.04bcd	0.49
Overall body weight	24.52 (W1)						25.26 (W2)						0.49
Overall ME effect	23.99b (E1)						25.79a (E2)						0.49
Overall protein effect	26.46a (P1)			25.85a (P2)			22.37b (P3)						0.49

a-d Means with different letters within the same row are significantly different at P?0.05

Table (8): Effect of different body weight categories, dietary energy levels and dietary protein levels on feed conversion of Gimmizah laying hens.

Body weight	Small body weight (W1)						Large body weight (W2)						SEM
Dietary ME kcal/kg	2600 kcal (E1)			2800 kcal (E2)			2600 kcal (E1)			2800 kcal (E2)			
% Protein	16%	14%	12%	16%	14%	12%	16%	14%	12%	16%	14%	12%	
1 month	6.49bcde	8.09cde	9.34a	5.86cde	5.55de	7.84abc	7.34bcde	7.73bcd	9.38a	5.29e	6.09cde	7.04bcde	0.26
2 month	4.66bc	4.91ab	5.62a	3.83cd	3.77cd	4.98ab	4.66bc	4.44bcd	4.89ab	3.61d	4.06bcd	4.26bcd	0.11
3 month	3.94abc	3.98abc	4.60ab	3.55bc	3.25c	4.74a	4.21abc	4.24abc	4.20abc	3.46c	3.49c	3.91abc	0.11
Overall period	4.71bcd	5.18ab	5.95a	4.16de	3.98e	5.54abc	5.04bc	5.06bc	5.39ab	3.95e	4.23cde	4.71bcde	0.12
Overall body weight	4.94 (W1)						4.73 (W2)						0.12
Overall ME effect	5.24a (E1)						4.43b (E2)						0.12
Overall protein effect	4.49b (P1)			4.61b (P2)			5.40a (P3)						0.12

a-f Means with different letters within the same row are significantly different at P?0.05

It is noticed that feed conversion for layers fed the 2800 kcal/kg diets in 16 and 14% CP levels either small or large body weight were improved showing significant improvement in FC (P?0.05) compared with those fed low protein (12% CP) and low energy (2600 kcal). This result is in harmony with those obtained by El Alaily *et al.* (2003) who reported that a large part of this improvement was attributed to the reduction in feed intake associated with increasing dietary metabolizable energy level. The lowest dietary protein level (12%) had reduced the efficiency of feed utilization significantly .

The present results in dictated that a diet containing 2800 kcal/kg and 16 or 14% CP levels were suggested to be suitable requirements for Gimmizah hens at the laying period during the 90 days in production after 24 weeks of age. Dietary energy level is the main effect in determining the efficiency of feed utilization.

Egg Quality Traits:

Results in Table (9) showed that body weight categories and dietary energy levels (2600 and 2800 kcal/kg diet) had no significant effect on egg quality traits. While, increasing dietary level of CP to 16 or 14 % significantly (P?0.05) improved most of the egg quality traits. With the exception of Haugh Units, layers fed the 12 % CP-diets produced eggs of significantly (P?0.05) lower values for egg shape index, shell weight %, shell thickness and yolk index, compared to those produced by layers on the 16 or 14 % CP-diets. On the other hand, layers fed on the 12 % CP-diets produced eggs of significantly (P?0.05) higher Haugh Units score during the 90 days experimental period.

Egg quality traits were not significantly affected by either body weight (W1 and W2) or feeding different levels of metabolizable energy (ME), except egg shell weight % and Haugh Units score. High dietary CP level (16 %) and dietary ME level (2800 kcal/kg diet) with either body weight significantly (P?0.05) increased egg shell weight % but the effect of dietary CP level (12 %) and dietary ME level (2600 kcal/kg diet) with either body weight significantly (P?0.05) decreased eggs shell weight %. Conversely significant (P?0.05) differences were observed with Haugh Units score. These results are not in agreement with those reported by Abd El-Hakim (2001) who showed that feeding systems, body weight and their interaction had no effect on the egg quality traits. Scheele (1988) found also no effects of body weight on shell percentage, shell thickness, specific gravity or Haugh unit score of eggs from White Leghorn hens. Abd El-Ghani (1996) reported that Haugh unit score of the lightest body weight group was significantly higher than other body weight groups. On the other hand, Abd El-Ghani (1996) showed significant effect of strain, body weight and interaction between them on egg shape index, shell weight %, shell thickness, albumen percentages and yolk percentage. Also, Hassan *et al.* (2000) reported that increasing the dietary protein had no effect on eggshell thickness.

Table (9): Effect of different body weight categories, dietary energy levels and dietary protein levels on egg quality, fertility and hatchability of Gimmizah laying hens.

Variables			Egg shape index (%)	Shell weight (%)	Shell thickens mmx100	Albumen weight (%)	Yolk weight (%)	Haugh Units	Fertility (%)	Hatchability (%)
BW	ME	CP%								
Small body weight (W1)	2600 kcal (E1)	16%	74.82	12.00ab	34.20	32.68	56.77	81.39abcd	82.62ab	72.22abc
		14%	73.58	12.03ab	30.60	31.56	55.66	79.18bcd	80.59abc	73.35a
		12%	73.52	11.06ab	32.60	31.01	55.32	83.22abc	80.59abc	67.49e
	2800 kcal (E2)	16%	75.98	12.85a	35.20	31.85	58.07	77.66d	80.29abc	68.59bcde
		14%	73.82	12.23ab	33.00	31.63	55.86	79.08bcd	81.39abc	70.39abcd
		12%	72.45	11.90ab	30.60	31.13	55.48	84.66a	799.09c	64.89e
Large body weight (W2)	2600 kcal (E1)	16%	76.28	12.89a	35.00	32.29	57.08	80.79abcd	82.92a	74.09a
		14%	74.17	12.48ab	34.40	31.42	56.55	79.35abcd	79.92bc	64.65e
		12%	73.03	10.08b	30.60	31.54	54.85	82.41abcd	81.05abc	65.55de
	2800 kcal (E2)	16%	75.000	13.22a	35.20	32.30	57.33	78.09cd	81.02abc	70.20abcd
		14%	74.39	12.60ab	34.20	31.35	55.96	78.75bcd	81.65abc	72.72ab
		12%	72.58	11.32ab	32.60	31.22	55.88	83.65ab	80.72abc	67.85cde
Body weight (W)										
Small body weight (W1)			74.03	12.01	32.70	31.64	56.19	80.87	80.78	69.49
Large body weight (W2)			74.24	12.09	33.67	31.69	56.28	80.51	81.21	69.15
Energy level (E)										
Overall 2600 kcal (E1)			74.23	11.85b	32.90	31.75	56.04	81.01a	81.29	69.56
Overall 2800 kcal (E2)			74.04	12.35a	33.47	31.58	56.43	80.31b	80.69	69.07
Protein level (P)										
Overall 16% (P1)			75.52a	12.74a	34.90a	32.28	57.31a	79.48b	81.71a	71.23a
Overall 14% (P1)			73.99ab	12.34ab	33.00ab	31.49	56.01ab	79.09b	80.91ab	70.28a
Overall 12% (P1)			72.893b	11.23b	31.60b	31.23	55.384b	83.49a	80.36b	66.44b
SEM			0.37	0.24	0.52	0.21	0.30	0.52	0.27	0.63

a-e Means with different letters within the same column are significantly different at P?0.05

Reproductive performance:

The data of fertility and hatchability are shown in Table (*). Hatching eggs and fertility percentage did not differ significantly due to body weight categories and dietary energy levels (2600 and 2800 kcal/kg diet). Fertility and hatchability of total eggs of low CP level (12% diet) were significantly (P?0.05) lower than that of the other levels (16 or 14 % CP diet). These results are in agreement with those reported by Abd El-Ghani (1996) who showed that the hatching eggs and fertility percentage did not differ among strains and body weight categories and no difference in total hatchability was observed among body weight groups. Moreover, Abd El-hakim (2001) found that hatching eggs and fertility percentages did not differ among either body weight categories or different feeding systems.

In conclusion. the diet containing 2800 kcal/kg diets in 16 or 14% CP levels was suggested to be suitable requirement and satisfactory for egg production of Gimmizah hens at the laying period (24-44 weeks). Such results will help to reduce the cost of the diets for these improved Gimmizah strain. Dietary energy level is the main factor in determining the efficiency of feed utilization.

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تقدير الأحتياجات الغذائية من البروتين والطاقة وفقا لوزن الجسم وتأثير ذلك على الآداء الأنتاجى والتناسلى فى دجاج الجميزة البياض

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أجريت هذة التجربة لمعرفة تاثير مستويات مختلفة من الطاقة وبروتين العليقة مع وزن الجسم المنخفض والعالى على معدلات الآداء لدجاج الجميزة البياض خلال فترة ٩٠ يوم من الانتاج بعد عمر ٢٤ أسبوع ، واستخدم فى هذة التجربة ٢٨٨ دجاجة بياضةوغذيت الطيور على ١٢ عليقه قسمت تبعا لوزن الجسم الى وزن جسم منخفض ووزن جسم مرتفع وتحت كل فئة وزنية مستويين من الطاقة الممثلة (٢٦٠٠ و ٢٨٠٠ كيلو كالورى لكل كجم عليقة) تحت كل مستوى من الطاقة ٣ مستويات من البروتين الخام (١٢ و١٤ و١٦ %) فى تصميم احصائى متداخل (٢x ٢ x٣).

ويمكن تلخيص النتائج فيما يلى :

١- وزن الجسم لم يؤثر معنويا على انتاج البيض وكتلة البيض وعدد البيض الناتج ووزن البيض معدلات التحويل الغذائى و ايضا لم يؤثر فى صفات جودة البيض وكذلك نسب الفقس والاخصاب.

٢- مستوى البروتين المرتفع يحسن كل من انتاج البيض وكتلة البيض وعدد البيض الناتج ووزن البيض ومعدلات التحويل الغذائى ،لم يؤثر فى صفات جودة البيض وكذلك نسب الفقس والاخصاب.

٣- مستوى الطاقة المرتفع يقلل كمية الغذاء المأكول ويحسن كلا من عدد البيض الناتج ووزن البيض معدلات التحويل الغذائى ولم يؤثر فى صفات جودة البيض وكذلك نسب الفقس والاخصاب.

بناء على النتائج المحصل عليها يمكن التوصية بأن مستوى ٢٨٠٠ ك كالورى مع ١٦ و ١٤% بروتين خام يغطى الاحتياجات الغذائية بنجاح مع نتائج مرضية لانتاج البيض لدجاج الجميزة من عمر ٢٤ حتى ٩٠ يوم انتاج بيض.