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AN ADECUATE DIETARY CRUDE PROTEIN LEVEL FOR LOCAL MAMOURAH LAYING HENS

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ABSTRACT

The present study was conducted to determine an adequate dietary crude protein level for local Mamourah laying hens. One hundred and seventy five (25 males and 150 females) Mamourah chickens of 30 weeks old were used. The birds were randomly distributed into five experimental groups and individually caged in laying batteries. Five experimental diets were formulated to be isocaloric (ME, of about 2700 Kcal/ Kg) and having different crude protein (CP) levels (16 % CP; control, 14, 15, 17 or 18 % CP). The birds were fed the experimental diets from 30 to 54 weeks. Males were used, however, for semen collection. Hens were artificially inseminated twice a week throughout the experimental period.

The criteria of response were laying performance, egg quality, egg fertility, hatchability, and some carcass characteristics. Digestibility of nutrients of the experimental diets were determined using adult cockerels. Some blood constituents were also determined. In addition, an economic efficiency was calculated at the end of the experiment.

The obtained results showed that there were no significant differences among the experimental chicken groups in laying performance, egg quality, fertility and hatchability, or in the studied blood parameters. Also, there were no significant differences among dietary treatments in digestibility coefficients of nutrients of the experimental diets.

From an economic point of view, the diets having 14 % or 15 % CP and 2700 Kcal ME/Kg could efficiency be used for Mamourah layers without any adverse effects on their productive or reproductive performance.

INTRODUCTION

Over the past decade, there has been increasing interest in the quantitative assessment of nutrient requirements for local laying hens as they widely differ from other breeds and strains in this respect. Attention has been focused on dietary protein as it constitutes the most expensive component in poultry diets.

Even though, energy level of the diet appears to be the most important factor determining feed intake. This fact leads one to speculate that the most efficient feeding of the chicken can be obtained when the diet contains the proper proportion of energy to the other nutrients needed to produce the desired growth, and satisfactory egg and meat production.

Laying hens need a specified quantity of protein per hen per day. However, it is necessary to understand the relationship between the minimum protein needs of laying hens and their daily feed consumption. As a result of this knowledge it is possible to adjust the energy content of the diet so that under an environment a reasonable prediction of the daily feed consumption of a hen can be made. Abou-Hassera (1986) reported that the level of 15% crude protein in layer diets was suggested to be a suitable requirement for both Fayoumi and Dandarawi local chickens.

Mamourah is a recent local strain of chickens. It has been developed from Dokki-4 and Alexandria local breeds. Some nutritional problems still need investigations particularly those concerning suitable feed mixtures which could be formulated from local feeds, and would even ensure a suitable efficiency of feed utilization as well as an economic efficiency of production. Therefore, this experiment aimed to determine an adequate dietary protein level for Mamourah chickens during the laying period.

MATERIALS AND METHODS

The present study was performed at EL-Serw Poultry Research Station, Animal Production Research Institute, Ministry of Agriculture, Egypt. One hundred and seventy five Mamourah chickens (25 males and 150 females), of 30 weeks old were used. The birds were randomly distributed into five experimental treatments. The birds were housed individually in battery cages. Batteries were situated inside an open-sided laying house. The birds had free access to feed and water throughout the experimental period elapsed from 30 to 54 weeks of age. Five experimental diets (Table 1) were formulated to be isocaloric (ME of about 2700 kcal/kg) with different crude protein (CP) levels (16% CP; served as a control diet, 14, 15, 17, or 18 % CP).

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

Ingredients %	Experimental diets				
	1(control)	2	3	4	5
Yellow corn	64.35	66.98	65.70	62.80	61.40
Soybean meal (44 % CP)	16.08	9.96	13.00	19.50	22.60
Fish meal (Herring, 72% CP)	3.00	3.00	3.00	3.00	3.00
Wheat bran	6.95	10.30	8.60	5.10	3.40
Limestone	7.60	7.60	7.60	7.60	7.60
Dicalcium phosphate	1.50	1.50	1.50	1.50	1.50
Vit & Min premix*	0.30	0.30	0.30	0.30	0.30
Salt	0.20	0.20	0.20	0.20	0.20
DL- Methionine	0.02	0.12	0.10-	0.00	0.00
Lysine	0.00	0.04	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated analyses:**					
Crude protein, %	16.01	14.09	15.03	17.08	18.05
ME, kcal/kg	2700.8	2700.5	2701.7	2700.7	2700.8
Crude fiber, %	3.38	3.36	3.36	3.39	3.39
Ether extract, %	3.08	3.24	3.16	3.00	2.92
Ca%	3.34	3.33	3.34	3.35	3.36
Available P, %	0.46	0.46	0.46	0.46	0.46
Total P, %	0.69	0.70	0.70	0.69	0.69
Lysine, %	0.84	0.68	0.76	0.92	1.00
Methionine, %	0.31	0.28	0.29	0.32	0.34
Meth.+ Cyst., %	0.55	0.50	0.52	0.58	0.61

***: Each 3 kg of Vit. and Min. premix contains: 10000000 IU Vit. A; 2000000 IU Vit. D3; 10000 mg Vit. E; 1000 mg Vit. K_3; 1000 mg Vit. B_1; 5000 mg Vit. B_2; 10 mg Vit B_{12}; 1500 mg Vit. B_6; 30000 mg Niacin; 10000 mg Pantothenic acid; 1000 mg Folic acid; 50 mg Biotin; 300000 mg Choline chloride; 4000 mg copper; 300 mg Iodine; 30000 mg Iron; 50000 mg Zinc; 60000 mg Manganese; 100 mg Selenium; and 100 mg cobalt.**

****: According NRC (1994).**

The laying hen performance, expressed as feed intake, egg production rate, egg weight, total egg mass and feed conversion, were determined during six 28–day periods. Means of change in body weight of birds were computed during the entire experimental period.

Two egg quality tests were carried out when the birds were 40 and 50 weeks of age. In each test, one hundred freshly collected eggs (20 per treatment) were broken out and used for egg quality measurements. Egg quality was measured in terms of some exterior and interior parameters as well as egg components. The exterior parameters of egg quality included egg shape index, egg specific gravity according to Harms *et al.* (1990), shell thickness (mm) and shell weight per unit surface area (SWUSA). Those of interior quality were albumen height (measured by a standard tripod micrometer, mm), Haugh unit score (using the equation adopted by Haugh, 1937), yolk index was calculated as yolk height times 100 divided by yolk diameter.

Egg components were determined, according to the procedure described by Keshavarz and Nakajima (1995). Shell thickness was measured by a special micrometer at two corresponding positions on the equator of the egg shell and the average was recorded to the nearest 0.001 mm. Shell weight per unit of egg surface area (SWUSA) was computed by dividing shell weight (including the adhering membranes) in mg by egg surface area (ESA) in cm^2. ESA was calculated according to Carter (1975) as follows:

ESA = [3.9782 x egg weight (g)$^{0.7056}$].

At 30 weeks of age and onwards, the hens were artificially inseminated twice a week; using freshly-collected undiluted semen from Mamourah cockerels of the same age and fed the control diet. For evaluating egg fertility and hatchability, three hatches of eggs (total number of 1266 eggs) were made when the birds were 47, 48 and 49 weeks of age. In each setting eggs were collected daily and stored for one week. The eggs were examined two weeks after setting them into the incubator. Records of fertile eggs, infertile eggs, and eggs with dead embryos were maintained. Fertility was calculated as percentage of fertile to total eggs set in the incubator. Hatchability was calculated as percentage of healthy hatched chicks to fertile or total eggs. Weights of healthy hatched chicks were also recorded. To evaluate the nutrient metabolizability and digestibility of the experimental diets, a metabolism trial was conducted using 15 adult cocks. Each experimental diet was fed to three individual cocks for three days as a preliminary period, followed by a three-day collection period, where excreta were quantitatively collected. Simultaneously, records on daily feed consumption for each bird were maintained. The daily excreta voided by cocks in each treatment were pooled and thoroughly mixed. Then, representative excreta samples were taken and dried immediately. The procedure described by Jakobsen *et al.* (1960) was used for separating fecal protein in excreta samples. Urinary organic matter (UOM) was determined according to the equation developed by Abou-Raya and Galal (1971) as follows: UOM % = Urinary nitrogen % x 2.62. Digestion coefficients of organic matter, crude protein, crude fiber,

ether extract and nitrogen-free extract were calculated according to the following equation:

Digestion coefficient % = (nutrient intake, g –fecal nutrient, g / nutrient intake, g) x 100 .

At the end of the experiment (54 weeks of age) 5 females from each treatment, whose body weights were near the average value of the respective treatment were selected for slaughter test. In addition, some blood constituents (plasma glucose, total protein, total lipids, cholesterol, calcium and phosphorus) were measured using commercial kits according to the methods of Trinder (1969), Henry (1964). Frings and Dunn (1970), Allain *et al.* (1974), Moorhead and Biggs (1974) and Daly and Ertingshausen (1972), respectively. Proximate analyses of experimental diets (Table 1) was carried out according to the official methods of analysis (AOAC, 1984).

Data were processed using Quattro program software (Borland International, Inc., 1990). Statistical analyses of results were performed using a Statgraphics program software, Version 5.0 STSC (Rockville, 1991). One–way analysis of variance was used to estimate the significant differences among treatments. Differences were considered significant at $P \leq 0.05$.

RESULTS AND DISCUSSION

Laying hen performance:

The overall means of body weight (BW), change in body weight (WG), feed intake (FI), total eggs produced (TEP), egg production percentage (EP, %), egg weight (EW), egg mass (EM) and feed conversion (FC) of Mamourah laying hens fed the experimental diets are presented in Table 2.

As shown in Table 2 the average initial live body weight values at the beginning of the experiment (30 weeks of age) were 1594, 1578, 1545, 1540.67 and 1534.33 g for birds fed the experimental diets containing the CP levels of 15, 16, 14, 18 or 17 %, respectively, without significant differences among them.

The values of average live body weight of laying hens at the end of the experimental period (54 weeks of age) were 1948.0,1898.3, 1886.2, 1881.4 and 1860.7 g for T2, T1, T3, T5 and T4, respectively. Statistical analyses revealed that no significant differences were observed among dietary treatments in final live body weight. The insignificant results of live body weight, found herein, agree with those obtained by Thornton *et al.* (1957). They reported that feeding Single Comb White Leghorns with high energy type diets containing 17, 15, 13, or 11 % protein levels had no effect on live body weight. Similar observations had been shown by Hochreich *et al.* (1958), Berg (1959), Owings (1964), Lillie and Denton (1965); and Thatle *et al.* (1981 a,b). However, Coligado and Quisenberry (1961) and Doran *et al.* (1980) reported that body size increased as protein level of the diet increased.

Analysis of variance of the data revealed that dietary treatments had no significant effects on change in body weight and total egg production. In contrast, Raya *et al.*, (1990a) found that increasing protein level from 11 to 20

% of diets for Dokki-4 and Rhode Island Red chickens resulted in an increase in weight gain during the laying period from 20 to 42 weeks of age. Also, egg production for Mamourah laying hens of the present study; which recorded during the whole experimental period (from 30-54 weeks of age), was not significantly affected by the dietary protein level. This result is in line with that of Thornton *et al.* (1957) who reported that Single Comb White Leghorns fed diets containing 17, 15, 13 or 11% CP, exhibited no significant differences in egg production. Similar results were obtained by MacIntre and Aitken (1957), Smith and Lewis (1964), Owings (1964), Hamilton (1978), Vedhanayagam *et al.* (1978), and Aly (1982) which confirmed the same observation.

Table (2): Performance of Mamourah laying hens fed the experimental diets of different crude protein levels during the period from 30 to 54 weeks of age (mean ± SE)

Performance criteria	Treatments				
	1(control)	2	3	4	5
	16 %	14 %	15 %	17 %	18 %
Initial body weight, g	1578 ± 19.74	1545 ± 21.96	1594 ± 28.91	1534.33± 18.82	1540.67± 20.80
Final body weight, g	1898.33± 47.06	1948.0 ± 53.57	1886.15± 49.65	1860.74± 46.88	1881.43± 54.61
Change in body weight, g	320.33± 37.82	403.0 ±41.54	292.15± 40.65	326.41± 40.23	340.76± 49.24
Total egg produced/bird	112.33 ± 3.45	109.00 ±3.06	108.28 ± 3.35	107.52 ± 2.20	102.86 ± 2.26
Egg production % (hen – day)	66.86 ± 2.05	64.88 ± 1.82	64.45 ± 1.99	64.00± 1.31	61.23± 134
Average egg weight, g	49.28 ± 0.33	48.73 ± 0.28	48.42 ± 0.27	49.17± 0.34	48.28 ± 0.30
Total egg mass, Kg.	5.536 ± 176.9	5.312 ± 151.9	5.243± 164.7	5.287± 103.6	4.966 ± 108.4
Total feed intake, kg / bird	16.074 ± 576.8	16.185 ± 370.6	15.926± 414.3	16.574 ±402.2	16.460 ± 479.0
Daily feed intake, g/bird	106.19 ± 1.7	101.04 ± 1.5	99.77± 1.6	100.88± 1.7	100.44 ± 1.8
Feed conversion Kg feed / Kg eggs	2.904 ± 0.14	3.047 ± 0.11	3.038± 0.12	3.135± 0.08	3.314± 0.10

No significant differences were observed among treatments in all criteria.

Analysis of variance of the data revealed that dietary treatments had no significant effects on egg weight, total egg mass, feed intake or feed conversion. These results are in agreement with those obtained by Thornton *et al.* (1957) and Thatle *et al.* (1981a). The present results indicated that the diets containing 14 or 15% CP and ME of 2700 kcal/kg are likely seem to be adequate for local Mamourah laying hens in order to support a satisfactory performance for egg production and feed conversion.

Egg components and egg quality:

Data on egg components and egg quality parameters of Mamourah laying hens fed the experimental diets containing different CP levels at 40 to

50 weeks of age are presented in Tables 3 and 4, respectively. No significant differences were observed among the experimental groups in egg components or egg quality measurements.

Table 3: Egg components and egg quality parameters for 40-wk-old Mamourah laying hens fed the experimental diets containing different crude protein levels.

Criteria	Control (1)	2	3	4	5
Egg components					
Egg weight, g	49.51±0.62	50.10±0.65	50.41±0.48	51.06±0.55	49.21±0.89
Shell weight, g	5.53±0.15	5.62±0.14	5.46±0.11	5.52±0.11	5.46±0.11
Shell weight, %	11.17±0.21	11.22±0.22	10.83±0.20	10.81±0.22	11.10±0.21
Yolk weight, g	15.80±0.20	15.56±0.28	15.67±0.13	16.08±0.38	16.01±0.31
Yolk weight, %	31.91±0.27	31.06±0.39	31.03±0.34	31.49±0.62	32.53±0.57
Albumen weight, g	28.18±0.36	28.92±43	29.28±0.42	29.46±0.42	27.74±0.72
Albumen weight, %	56.92±0.27	57.72±0.42	58.08±0.38	57.70±0.56	56.37±0.68
Exterior quality					
Egg shape index	81.02±0.68	81.30±0.98	81.93±0.66	80.52±0.87	79.82±0.76
Egg specific gravity	1.093±0.001	1.093±0.001	1.091±0.001	1.091±0.001	1.093±0.001
Shell thickness, mm	0.36±0.007	0.36±0.005	0.35±0.004	0.36±0.004	0.35±0.005
SWUSA, mg/ cm^2	88.39±1.84	89.28±1.8	86.34±1.59	86.46±1.72	87.84±1.54
Interior quality					
Albumen height, mm	7.29±0.28	7.13±0.23	7.42±0.24	7.60±0.26	7.42±0.25
Haugh units	87.87±1.61	86.97±1.27	88.49±1.29	89.21±1.51	88.81±1.44
Yolk height, mm	16.99±0.24	16.94±0.36	17.45±0.20	16.92±0.34	19.72±0.28
Yolk diameter, mm	36.78±0.35	36.82±0.32	36.2±0.29	36.58±0.38	36.47±0.32
Yolk index, %	46.28±0.78	46.04±1.02	48.27±0.72	46.28±0.89	45.91±0.81

No significant differences were observed among treatments in all criteria
SWUSA: Refers to shell weight per unit of egg surface area.

Table 4: Egg components and egg quality parameters of 50-wk-old Mamourah laying hens fed the experimental diets containing different crude protein levels.

Criteria	Control (1)	2	3	4	5
Egg components					
Egg weight, g	51.13±0.66	50.06±0.66	49.6±0.53	49.94±0.26	49.32±0.84
Shell weight, g	5.32±0.12	5.41±0.13	5.34±0.13	5.50±0.17	5.42±0.12
Shell weight, %	10.40±0.23	10.81±0.21	10.77±v0.28	11.01±0.21	10.99±0.18
Yolk weight, g	17.46±0.28	17.11±0.28	17.02±0.17	17.64±0.33	16.84±0.24
Yolk weight, %	34.15±0.61	34.18±0.59	34.31±0.41	35.32±0.62	34.14±0.52
Albumen weight, g	28.35±0.61	27.54±0.55	27.24±0.48	26.80±0.94	27.06±0.66
Albumen weight, %	55.45±0.60	55.01±0.65	54.92±0.46	53.66±0.69	54.87±0.57
Exterior quality					
Egg shape index	80.08±0.97	80.98±0.91	82.11±0.63	82.54±0.90	81.46±0.67
Egg specific gravity	1.089±0.001	1.091±0.001	1.091±0.002	1.092±0.001	1.092±0.001
Shell thickness, mm	0.335±0.006	0.348±0.007	0.331±0.006	0.342±0.007	0.351±0.006
SWUSA, mg/ cm^2	83.24±1.83	85.84±1.77	85.50±2.11	87.42±1.77	86.96±1.43
Interior quality					
Albumen height, mm	6.32±0.35	6.52±0.23	6.76±0.17	6.68±0.20	6.04±0.37
Haugh units	80.90±2.27	83.13±1.61	84.98±1.12	84.34±1.35	79.38±2.59
Yolk height, mm	16.94±0.31	16.92±0.27	16.71±0.23	16.32±0.24	16.68±0.21
Yolk diameter, mm	40.38±0.67	41.92±0.47	42.47±0.54	41.15±0.69	40.84±0.32
Yolk index, %	42.17±1.00	40.48±0.82	39.46±0.74	39.92±1.00	40.89±0.60

No significant differences were observed among treatments in all criteria.

Egg fertility and hatchability:

Means of three hatches for eggs of Mamourah laying hens fed the experimental diets of different protein levels are shown in Table 5. Analysis of variance of these results showed that no significant differences were observed among dietary treatments in egg fertility, hatchability (as percentage of the total eggs or fertile eggs). Also, no significant differences were detected among dietary treatments in embryonic mortality or chick weight at hatch. The results of other research workers in this respect were similar and revealed that dietary protein levels had no significant effect on egg fertility and hatchability (Hochreich *et al.* 1958; Lillie and Denton, 1965 and Richter and Henning, 1979). In this connection, Raya *et al.* (1990b) found that fertility, hatchability and embryonic mortality of eggs produced by Dokki-4 and Rhode Island Red chickens were not affected by dietary protein level (11 to 20%) during the laying period from 20-42 weeks of age. Nevertheless, fertility and hatchability of eggs are the major parameters for evaluating the reproductive performance of chickens and other poultry species. Nutrition is an important factor affecting egg fertility and hatchability.

Table 5: Egg fertility, hatchability, and embryonic mortality of eggs produced by Mamourah laying hens fed the experimental diets containing different crude protein levels (Mean of three hatches).

Criteria	Experimental diets				
	Control (1)	2	3	4	5
Total eggs set	245	261	246	254	260
Egg fertility, %	82.79±3.24	87.13±2.34	86.28±1.10	86.71±3.46	85.32±3.91
Fertile hatchability, %	77.22±7.55	68.90±4.46	73.57±5.20	71.71±5.22	70.28±6.33
Total hatchability, %	64.24±8.15	60.17±5.16	63.52±4.91	62.53±7.11	60.45±8.03
Embryonic mortality, %	22.78±7.55	31.1±4.46	26.43±5.20	28.29±5.22	29.72±6.33
Mean chick hatch-weight, g	32.48±0.73	32.60±0.24	32.2±0.54	33.14±0.56	32.22±0.37

No significant differences were observed among treatments in all criteria.

Nutrients utilization and digestibility:

Data of percentages of ash and nitrogen retention and digestion coefficients of dry matter (DM), organic mater (OM), crude protein (CP), ether extract (EE), crude fiber (CF) and nitrogen–free extract (NFE) are illustrated in Table 6. There were no significant differences either in ash and nitrogen retention or in the digestibilities of DM, OM, CP, EE, CF and NFE of the experimental diets due to the effect of the dietary protein level.

Carcass yield and other slaughter traits:

Data of selected criteria of carcass yield and other slaughter traits of 54-wk-old Mamourah laying hens, as affected by feeding the experimental diets containing different CP levels from 30 up to 54 weeks of age, are shown in Table 7. Statistical analysis showed that there were no significant differences among the various experimental groups in all criteria of carcass traits studied.

Table 6: Mean ± standard errors of ash and nitrogen retention, and digestion coefficients of nutrients of the experimental diets, as determined with adult Mamourah cockerels.

Item,%	Experimental diets				
	Control (1)	2	3	4	5
Ash retained	67.70±1.82	66.12±0.86	66.67±0.64	67.95±1.63	68.05±2.39
N- retained	69.61±1.70	69.40±0.57	69.20±0.88	67.33±0.70	67.13±0.20
Digestion coefficient, %					
DM	74.55±1.70	74.11±0.99	74.09±0.70	74.11±1.16	74.08±0.98
OM	78.63±1.54	78.47±1.10	78.33±0.95	78.11±0.98	78.45±0.67
CP	88.47±0.90	87.29±0.21	87.81±0.17	87.89±0.46	87.83±0.29
EE	88.23±0.53	87.33±0.10	87.78±0.50	87.56±0.28	87.43±0.07
CF	20.41±0.26	20.13±0.10	20.31±0.24	20.0±0.15	20.37±0.29
NFE	82.48±1.72	83.11±1.62	82.44±1.50	83.23±1.28	84.13±0.98

No significant differences were observed among treatments in all criteria.

Table 7: Means ± standard errors of carcass yield and some slaughter traits for 54-wk-old Mamourah females fed diets containing different crude protein levels.

Criteria, %	Experimental diets				
	1 (control)	2	3	4	5
Live body weight, g	1895.2±45.73	1936±59.97	1859.2±37.27	1867.6±30.76	1876.6±74.38
Liver, %	2.07±0.13	2.24±0.13	2.03±0.12	2.28±0.13	2.32±0.07
Gizzard, %	1.30±0.09	1.21±0.08	1.29±0.07	1.15±0.07	1.30±0.07
Heart, %	0.55±0.07	0.41±0.06	0.49±0.07	0.57±0.03	0.48±0.03
Abdominal fat, %	3.56±0.43	3.83±0.37	3.26±0.49	4.12±0.62	3.62±0.72
Giblets, %	3.92±0.21	3.86±0.15	3.81±0.17	4.00±0.05	4.1±0.11
Eviscerated weight, %	64.20±0.99	63.44±1.10	65.40±0.91	62.39±1.05	64.0±0.66
Total edible parts, %	68.12±1.02	67.29±1.02	69.21±0.92	66.39±1.08	68.09±0.75

No significant differences were observed among treatments in all criteria.
% of live body weight.
1-Giblets weight = weights of gizzard, heart and liver.
2- Eviscerated weight = carcass weight + neck weight.
3- Total edible parts= giblets weight + eviscerated carcass weight.

Blood parameters:

Data on some blood constituents of 54-week-old Mamourah laying hens, fed the dietary treatments are given in Table 8. Concentration of plasma glucose ranged between 246.88 mg/dl (T3) and 256.18 mg/dl (T2) with no significant differences among all dietary treatments. The lack of pronounced variations in the concentration of plasma glucose might be expected, since it is well known that the maintenance of stable levels of glucose in the blood is one of the most finely regulated homeostatic mechanisms. In that respect, some reports revealed that dietary treatments did not affect plasma glucose level in chicks (Raheja *et al.*, 1975), or in laying hens (Raya *et al.*, 1990b).

Data presented in Table 8 demonstrated that feeding diets of different CP levels to Mamourah layers appeared to have no significant effects on any of the blood parameters studied (total protein, total lipids, cholesterol, calcium and phosphorus). Generally, it is known that several factors, such as nutrition, season, age and physiological status of the bird and other factors may influence the levels of various blood constituents.

Table 8: Means ± standard errors of blood constituents for 54wk-old Mamourah laying hens fed diets containing protein level from 30 to 54 weeks of age.

Criteria, %	Experimental diets				
	1 (control)	2	3	4	5
Glucose, mg/dl	247.83±9.81	256.18±4.44	246.88±7.73	247.26±4.62	250.70±4.98
Total protein, g/dl	4.40±0.115	4.45±0.124	4.36±0.163	4.58±0.097	4.37±0.091
Total lipids, g/l	15.38±0.78	15.82±0.28	15.57±0.29	15.26±0.18	15.50±0.19
Cholesterol, mg/dl	110.4±3.16	114.1±3.55	110.59±3.07	115.48±2.21	110.20±2.25
Calcium, mg/dl	17.8±1.08	18.04±1.23	19.72±2.22	19.02±1.35	17.58±0.71
Phosphorus, mg/dl	6.44±0.30	6.08±0.55	6.36±0.30	6.33±0.44	7.19±0.05

No significant differences were observed among treatments in all criteria.

Economic efficiency:

Table 9 summarized the data of the economic efficiency (EEF) obtained with Mamourah birds fed the experimental diets during the entire period from 30 up to 54 weeks of age. Analysis of variance showed that the diet of control T1 (16 %CP) exhibited the best EEF value, followed by those of T2 (14 %CP), T3 (15% CP) and T4 (17 % CP) with no significant differences among them. In spite of the absence of significant differences in economic efficiency between T4 (17% CP) and T5 (18%CP), the poorest EEF value was found with T5 (18% CP) in comparison with those of T1 (16% CP), T2 (14%CP), T3 (15% CP) and T4 (18 %CP).

Table 9: Economic efficiency of Mamourah laying hens fed the experimental diets of different crude protein levels from 30 to 54 weeks of age (mean ± SE)

Items	Experimental diets				
	1 (control)	2	3	4	5
Average F1 (Kg / bird)	16.074	16.185	15.926	16.574	16.460
Price / Kg feed, LE (1)	0.92	0.90	0.91	0.94	0.96
Total feed cost, LE (2)	14.79	14.57	14.49	15.58	15.80
NO. of eggs produced	112	109	108	108	103
Price of one egg, LE (3)	0.20	0.20	0.20	0.20	0.20
Total revenue, LE	22.4	21.8	21.6	21.6	20.6
Net revenue, LE	7.61	7.23	7.11	6.02	4.80
Economic efficiency EEF	0.514±0.06^{a}	0.496±0.06^{a}	0.490±0.06^{a}	0.386±0.05^{ab}	0.304±0.04^{b}
Relative EEF (4)	100	96.50	95.30	75.10	59.14

a-b: means within the same row with different superscripts are significantly different (P≤0.05).

(1) LE = 1 pound Egyptian currency = 100 piasters.

(2) According to price of different ingredients available in AR Egypt at the experimental time.

(3) According to the local market price at the experimental time.

(4) Assuming that relative EEF of control diet (T1) equals 100.

CONCLUSION

Based on the results of this study, it can be concluded that local Mamourah laying hen strain could be fed on diets containing 14 or 15% CP with 2700 kcal ME/kg diet; without any adverse effects on their productive or reproductive performance.

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مستوي مناسب من البروتين الغذائي لدجاج المعمورة البياض المحلى

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هدفت الدراسة الحالية إلى تحديد المستوى المناسب من بروتين الغذاء لدجاج المعمورة البياض المحلى. تم تقسيم عدد ١٧٥ طائر (١٥٠ دجاجة، ٢٥ ديك) عمر ٣٠ أسبوع عشوائيا إلى خمس مجموعات وتم وضعها في أقفاص فردية. تم تكوين خمسة علائق تجريبية ذات محتويات متماثلة من الطاقة القابلة للتمثيل (٢٧٠٠ كيلو كالوري/كجم) وتحتوى على مستويات مختلفة من البروتين [١٦% بروتين (عليقة الكنترول) أو١٤ أو ١٥أو ١٧أ و ١٨%]. تم تلقيح الدجاجات صناعيا مرتين أسبوعيا باستخدام سائل منوي طازج وغير مخفف من ديوك المعمورة من نفس العمر. تم تقديم العلائق خلال الفترة من ٣٠ إلى ٥٤ أسبوع وتم أخذ قياسات عن الأوزان الفردية للطيور عند بداية ونهاية التجربة وكذلك عن كل من إنتاج البيض ووزن البيضة وكتلة البيض الكلية و استهلاك العلف والتحول الغذائي كل أربعة أسابيع طوال فترة التجربة. كذلك تم أخذ قياسات عن الجودة الداخلية والخارجية للبيض ونسبة الخصوبة والفقس والنفوق الجنيني للبيض ومعاملات الهضم للعناصر الغذائية في ا لعلائق التجريبية المختلفة. كذلك تم أخذ قياسات عن مكونات الذبيحة وبعض مكونات بلازما الدم (الجلوكوز والبروتين الكلى والدهون الكلية والكوليستيرول والكالسيوم والفوسفور). كما تم حساب الكفاءة الاقتصادية.

أوضح التحليل الإحصائي للنتائج عدم وجود فروق معنوية بين المعاملات التجريبية المختلفة في أي من معايير المظاهر الإنتاجية أو معايير جودة البيض أو نسبة الخصوبة والفقس أو قياسات الدم أومعاملات الهضم للعناصر الغذائية.

من النتائج المتحصل عليها و من الناحية العملية والاقتصادية وجد أن العلائق المحتوية على١٤% أو١٥ % بروتين كافية لتغذية دجاج المعمورة المحلي خلال فترة إنتاج البيض دون حدوث تأثيرات سلبية على المظاهر الإنتاجية أو التناسلية للطيور.