J. Agric. Sci. Mansoura Univ., 26 (9): 5293 - 5305, 2001

PERFORMANCE OF LAYING HENS FED DIETS CONTAINING GRADED LEVELS OF SUNFLOWER MEAL

Sherif, Kh. El.*; M. H. Rabie*; M. A. A. Hussein: M. G. Kassem** and A. M. Abbas****

*** Dept. Poultry Prod., Faculty of Agric., Mansoura University.**

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

ABSTRACT

The present study was conducted to investigate the effects of feeding sunflower meal on Mamourah laying hen performance, egg quality, egg fertility and hatchability and some blood constituents. Two hundred and ten (30 males and 180 females), 23-week-old Mamourah laying hens were used. Five isocaloric (ME; of about 2700 kcal/kg) and isonitrogenous (CP; of about 16%) experimental diets containing graded levels of sunflower meal (0.00, 6.75, 13.50, 20.25 and 27.00% of the diet) were formulated and used. The birds were randomly distributed into five groups; each with three replicates and fed the experimental diets from 23 to 39 weeks of age. The criteria of response were laying performance (egg production rate, egg weight, total egg mass, feed intake and feed conversion), economic efficiency, egg quality (egg components and certain parameters of exterior and interior quality), egg fertility, hatchability and embryonic mortality. Some blood parameters (serum glucose, total protein, total lipids and cholesterol as well as activities of serum transaminases; ALT and AST) were also determined. The statistical analyses of the data indicated that no significant differences were detected among treatments in all studied criteria. These results indicated that, practically and economically, sunflower meal could be used in laying hen diets up to 27% of the diet without any adverse effects on the productive and reproductive performance of the laying hens.

Keywords: Laying hens, Sunflower meal, productive, reproductive performance.

INTRODUCTION

In recent years there has been an increased interest in growing sunflower (*Helianthus annuus L*.) for oil production in many parts of the world, including Egypt. Accordingly, several studies have been made on the use of sunflower meal as a protein supplement in poultry diets. Surveying the literature has provided conflicting conclusions because the nutritive value of sunflower meal; which contains less protein, lysine and energy than soybean meal, depends on the method of processing. Rose *et al.* (1972) reported that sunflower meal replaced 50% of soybean meal protein without adversely affecting laying hen performance, however, 100% replacement ratio resulted in less performance for egg production and feed efficiency. Hegedüs and Fekete (1994) reported that extracted soybean meal could be partly or entirely replaced with extracted sunflower meal in broiler and laying hen diets when supplemented with lysine and methionine; providing equal energy levels. Gippert (1994) indicated that extracted sunflower meal, after mechanical processing, at levels of 10 – 15% of the diet, supplemented with lysine could be used in broiler diets with good results.

However, Rad and Keshavarz (1976), Raya *et al*. (1989) and Gippert (1994) demonstrated that lysine is the first limiting amino acid in poultry

rations containing high levels of sunflower meal. Cuca *et al*. (1973) reported that threonine appears to be the second limiting amino acid for broiler chicks and laying hens fed high levels of sunflower meal. Michel and Sunde (1985) found that sunflower meal, supplemented with lysine and methionine instead of soybean meal in pullet developer diets, improved both feed efficiency and economic efficiency. El-Deek *et al*. (1999) used sunflower meal in grower and pullet diets instead of soybean meal up to 100%. They concluded that sunflower meal could be fed without adverse effects on the growth performance measurements.

Nowadays, large amounts of sunflower seeds are produced in Egypt, mainly for oil production. The locally produced sunflower meal is commonly used for poultry and animal nutrition. The aim of the present study was to investigate the effects of feeding sunflower meal on Mamourah laying hen performance, egg quality, egg fertility and hatchability and some blood constituents.

MATERIALS AND METHODS

The present work was performed at El-Serw Poultry Research Station, Animal Production Research Institute, Ministry of Agriculture. Two hundred and ten (30 males and 180 females), 23-week-old Mamourah laying hens were used. The birds were randomly distributed into five experimental treatments of 42 birds each (6 males and 36 females) in three equal replications per treatment. The birds of each replication were housed in a floor pen measuring 2 $\times$ 3 m. and supplied with a daily photo-period of 16 h. Each floor pen was equipped with a unit of six trap-nests. All floor pens were inside an open-sided laying house. The birds had free access to feed and water throughout the experimental period elapsed from 23 to 39 weeks of age.

Five experimental diets containing graded levels of sunflower meal (0.00, 6.75, 13.50, 20.25 and 27.00% of the diet) were formulated and used (Table 1). The chemical composition and the energy content of sunflower meal used in this study were as follows: 33% crude protein, 24.67% crude fiber, 1.4% ether extract, 0.3% calcium, 0.4% available phosphorus, 1.2% lysine, 0.65% methionine, 0.55% cystine and metabolizable energy of 1800 kcal/kg. The control group was fed on a corn-soybean meal-based diet and the other experimental groups were fed on their respective experimental diets. The experimental diets were formulated to be iso-energetic (ME of about 2700 kcal/kg) and iso-nitrogenous (CP of about 16%).

Daily records of egg production and individual egg weight were maintained. The laying hen performance, expressed as feed intake, egg production rate, egg weight, total egg mass and feed conversion, was determined during four 28-day periods on a pen basis. Means of change in body weight of birds and economic efficiency were computed during the entire experimental period.

Table 1: Composition and chemical analyses of the experimental diets

Ingredients %	Experimental diets				
	(Control) 1	2	3	4	5
Yellow corn	64.5	64.8	59.96	59.93	57.9
Soybean meal (44% CP)	16.44	12.33	8.22	4.11	0.00
Wheat bran	6.0	3.07	3.90	1.24	0.00
Fish meal (72 % CP)	3.0	3.0	3.0	3.0	3.0
Sunflower meal (33 % CP)	0.0	6.75	13.5	20.25	27.00
Dicalcium phosphate	2.5	2.5	2.5	2.5	2.5
Limestone	7.0	7.0	7.0	7.0	7.0
Vegetable oil	0.0	0.00	1.38	1.4	2.0
Common salt	0.25	0.25	0.25	0.25	0.25
Vit. & Min. Premix*	0.25	0.25	0.25	0.25	0.25
Methionine	0.06	0.05	0.04	0.02	0.00
Lysine	0.0	0.0	0.0	0.05	0.10
Total	**100**	**100**	**100**	**100**	**100**
Calculated analyses:					
Crude protein %	15.82	15.80	15.94	15.94	15.99
ME; kcal/kg	2701	2703	2703	2699	2697
Crude fiber %	3.25	4.31	5.67	6.76	7.96
Ether extract %	3.06	3.05	4.33	4.33	4.88
Calcium %	3.35	3.35	3.36	3.37	3.37
Total phosphorus %	0.87	0.88	0.91	0.92	.93
Available phosphorus %	0.62	0.63	0.64	0.65	0.66
Lysine %	0.81	0.76	0.74	0.75	0.76
Methionine %	0.36	0.36	0.37	0.36	0.36
Meth. + Cyst. %	0.62	0.63	0.65	0.64	0.64
Price/ kg diet, P.T.	**61.7**	**60.3**	**61.7**	**61.0**	**61.5**
Determined analyses:					
Dry matter %	90.0	90.12	90.15	90.13	90.19
Crude protein %	15.75	15.73	15.89	15.90	15.91
Crude fiber %	3.33	4.26	5.55	6.60	7.82
Ether extract %	3.11	3.15	4.25	4.29	4.73

***: Each three kilograms contains: Vit. A 10000000 I. U; Vit. D_3 2000000 I. U; Vit. E 10000 mg; Vit, K_3 1000 mg; Vit. B_1 1000 mg; Vit. B_2 5000 mg; Vit. B_6 1500 mg; Vit. B_{12} 10 mg; Biotin 50 mg; Choline chloride 250000 mg; Pantothenic acid 10000 mg; Nicotinic acid 30000 mg; Folic acid 1000 mg; Mn 60000 mg; Zn 50000 mg; Fe 30000 mg; Cu 4000 mg; I 300 mg; Se 100 mg; Co 100 mg.**

Two egg quality tests were carried out when the birds were 32 and 39 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 and yolk color score (by means of the Roche yolk color

fan). 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 of mm. 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 the equation of Carter (1975) as follows: ESA = [3.9782 $\times$ egg weight (g)$^{0.7056}$].

For evaluating egg fertility and hatchability, three hatches of eggs (total number of 2465 eggs, Table 5) were made when the birds were 36, 37 and 38 weeks of age. The hatching eggs were collected for one week in each hatch. The eggs were examined two weeks after setting them into the incubator. Records of fertile and infertile eggs and the eggs with dead embryos were maintained. Weights of healthy hatched chicks were also recorded.

At the end of the experiment (39 weeks of age), five blood samples were taken from the wing veins of birds of each group. The concentrations of serum glucose, total protein, total lipids and cholesterol were determined using commercial kits according to the methods of Trinder (1969), Henry, R. J. (1964), Frings and Dunn (1970) and Allain *et al*. (1974), respectively. Activities of serum aspartate-aminotransferase (AST; EC. 2.6.1.1.) and alanine-aminotransferase (ALT; EC. 2.6.1.2.) were also determined colorimetrically by kits according to the methods of Reitman and Frankel (1957).

Proximate analyses of the experimental diets (Table 1) and sunflower meal were determined according to the official methods (A.O.A.C., 1984). Data were processed using Quattro Program software (Borland International, Inc., 1990). Statistical analyses of results were performed using 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 performance data of Mamourah laying hens fed sunflower meal-containing diets from 23 to 39 weeks of age, are summarized in Table 2. Analysis of variance of the data revealed that dietary treatments had no significant effects on feed intake, egg production rate, egg weight, total egg mass or feed conversion, either during the four 28-day intervals studied or during the entire experimental period. Average body weight change ranged between 281 and 335 g, with no significant differences among dietary treatments. Mortality of birds was not related to dietary treatments. As shown in Table 2, the inclusion of sunflower meal into the laying hen diets resulted in a numerical improvement, but not significant, in the economic efficiency of egg production. These results are in line with the findings reported by

Hegedüs and Fekete (1994), who found that extracted soybean meal could be partly or entirely replaced with extracted sunflower meal in laying hen diets when supplemented with lysine and methionine. Similarly, Deaton *et al*. (1979) indicated that body weight change, mortality rate, egg production rate and egg weight were not affected by the addition of sunflower meal at levels of 10 to 30% of laying hen diets. However, Vieira *et al*. (1992) observed positive linear effects on feed intake and feed conversion efficiency of laying hens in response to the inclusion level of sunflower meal in their diets (up to 40.5%). On the other hand, Sherif *et al*. (1997) reported that inclusion of sunflower meal up to 15% of laying hen diets did not affect laying hen performance.

Egg components and egg quality

Data on egg components and egg quality parameters of Mamourah laying hens fed sunflower meal-containing diets at 32 and 39 weeks of age are presented in Tables 3 and 4, respectively. No significant differences were observed among the experimental groups in egg components and egg quality measurements. The insignificant results of egg quality measurements, reported herein, agree with those obtained by Vieira *et al.* (1992) and Sherif *et al*. (1997). The absence of significant differences among dietary treatments with respect to egg production and egg quality measurements may indicate that birds could utilize sunflower meal as efficiently as soybean meal in their diets.

Egg fertility and hatchability

Fertility and hatchability of eggs are the major parameters evaluating the reproductive performance of chickens and other poultry species. Nutrition is an important factor affecting egg fertility and hatchability. Overall results of egg fertility and hatchability and embryonic mortality of eggs produced by Mamourah laying hens fed sunflower meal-containing diets are presented 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 of fertile eggs), embryonic mortality or chick weight at hatch in all hatches studied. These results are in agreement with the findings reported by Singh *et al.* (1981) who investigated the effect of inclusion of sunflower meal up to 20% in laying hen diets on fertility and hatchability of eggs. Their results indicated that sunflower meal had no any detrimental effect on egg fertility and hatchability.

Table 2: Performance and economic efficiency of 23 to 39-week-old Mamourah laying hens fed diets containing graded levels of sunflower meal

Criteria[1]	Experimental diets				
	(control) 1	2	3	4	5
Initial body weight, g	1591±38	1594±30	1589±39	1566±40	1637±38
Final body weight, g	1882±47	1877±42	1870±52	1885±45	1972±47
Body weight change, g	291±59	283±18	281±74	319±22	335±36
B. W. C., %[2]	18.3±4	17.8±1	17.7±5	20.4±2	20.5±2
Number of dead birds	4	zero	2	7	1
Period 1 (23-27 wk-old)					
Feed intake, g / bird	2184±55	2190±60	2232±52	2258±8	2202±12
Egg production rate, %	32.91±4	39.58±5	35.89±5	35.44±9	34.82±2
Mean egg weight, g	40.4±0.6	41.6±0.6	40.6±0.5	39.8±0.3	41.1±0.2
Total egg mass, g / hen	373±52	459±56	408±60	396±99	400±25
Feed conversion, g/g	6.09±0.88	4.91±0.63	5.76±0.96	6.45±1.54	5.54±0.31
Period 2 (27-31 wk-old)					
Feed intake, g / bird	3207±36	3167±72	3234±69	3128±119	3000±71
Egg production rate, %	65.48±7	72.12±4	76.12±2	69.07±4	70.14±2
Mean egg weight, g	44.0±0.4	44.7±0.4	43.4±1.0	43.3±0.4	44.2±0.8
Total egg mass, g / hen	807±90	903±50	923±18	838±58	869±36
Feed conversion, g/g	4.09±0.51	3.52±0.13	3.50±.0.01	3.77±0.31	3.46±0.14
Period 3 (31-35 wk-old)					
Feed intake, g / bird	3046±138	2988±43	3174±67	3220±59	3324±37
Egg production rate, %	70.38±3	66.37±3	70.30±3	72.52±4	72.09±1
Mean egg weight, g	45.9±0.4	46.5±0.6	46.4±0.9	45.3±0.1	46.2±0.8
Total egg mass, g / hen	904±42	863±29	912±26	919±49	933±22
Feed conversion, g/g	3.39±0.27	3.48±0.16	3.48±0.09	3.53±0.22	3.57±0.12
Period 4 (35-39 wk-old)					
Feed intake, g / bird	3264±7	3000±129	2940±156	3184±112	2815±47
Egg production rate, %	69.19±2	65.28±5	68.25±3	65.98±2	67.14±3
Mean egg weight, g	47.1±0.4	47.9±0.7	48.4±0.9	47.4±0.4	47.9±1.0
Total egg mass / hen, g	913±32	874±48	925±32	875±37	899±19
Feed conversion, g/g	3.58±0.12	3.46±0.30	3.20±0.27	3.64±0.03	3.14±0.09
Total experimental period (23-39 wk-old)					
Feed intake, g / bird	11701±207	11345±134	11581±300	11790±125	11341±107
Egg production rate, %	59.49±4	60.84±3	62.64±2	60.75±3	61.05±1
Mean egg weight, g	44.9±0.4	45.5±0.6	45.2±0.9	44.3±0.2	45.4±0.8
Total egg mass, g / hen	2992±200	3099±141	3165±60	3016±160	3100±40
Feed conversion, g/g	3.95±0.32	3.68±0.20	3.67±0.17	3.93±0.19	3.66±0.08
EE, %*	85.0±14	99.5±13	96.9±11	89.1±9	96.2±5
Relative EE	100	117	114	105	113

[1]: No significant differences were observed among treatments in all criteria.
[2]: B. W. C., % = Body weight change as percent of initial body weight.
***: Economic efficiency (EE) was calculated as follows:**
EE = 100 (price /kg eggs – feed cost /kg eggs) ÷ (feed cost / kg eggs).

Table 3: Egg components and egg quality parameters for 32-wk-old Mamourah laying hens fed diets containing graded levels of sunflower meal

Criteria[1]	Experimental diets				
	(control)1	2	3	4	5
Egg components					
Egg weight, g	45.96 ±0.45	47.17 ±0.52	47.26 ±0.72	45.82 ±0.28	47.16 ±0.51
Shell weight, g	5.08 ±0.10	5.15 ±0.09	5.26 ±0.09	5.13 ±0.09	5.36 ±0.07
Shell weight, %	11.05 ±0.16	10.92 ±0.13	11.14 ±0.16	11.20 ±0.17	11.37 ±0.17
Yolk weight, g	13.18 ±0.24	13.19 ±0.21	13.54 ±0.26	12.77 ±0.20	13.35 ±0.23
Yolk weight, %	28.66 ±0.36	27.97 ±0.38	28.66 ±0.36	27.87 ±0.39	28.31 ±0.43
Albumen weight, g	27.69 ±0.26	28.83 ±0.39	28.50 ±0.50	27.91 ±0.28	28.46 ±0.43
Albumen weight, %	60.29 ±0.39	61.10 ±0.40	60.19 ±0.38	60.93 ±0.51	60.31 ±0.46
Exterior quality					
Egg shape index	79.79 ±0.71	79.48 ±0.53	80.76 ±0.70	79.32 ±0.38	79.62 ±0.69
Egg specific gravity	1.092 ±0.001	1.092 ±0.001	1.093 ±0.001	1.093 ±0.001	1.094 ±0.001
Shell thickness, mm	0.350 ±0.006	0.344 ±0.005	0.352 ±0.005	0.362 ±0.006	0.358 ±0.005
SWUSA♣, mg/cm^2	85.71 ±1.3	85.38 ±1.2	87.08 ±1.2	86.84 ±1.4	88.84 ±1.2
Interior quality					
Albumen height, mm	6.46 ±0.265	6.99 ±0.303	6.95 ±0.248	6.52 ±0.265	6.60 ±0.287
Haugh units	84.08 ±1.7	86.79 ±1.7	86.69 ±1.5	84.50 ±1.6	84.47 ±1.7
Yolk height, mm	17.04 ±0.25	16.99 ±0.19	17.21 ±0.13	17.18 ±0.16	17.52 ±0.21
Yolk diameter, mm	39.30 ±0.24	38.86 ±0.31	39.02 ±0.29	38.67 ±0.20	39.55 ±0.21
Yolk index	43.41 ±0.73	43.75 ±0.57	44.16 ±0.47	44.44 ±0.51	44.31 ±0.48
Yolk color score	7.15 ±0.131	7.25 ±0.099	7.40 ±0.112	7.10 ±0.100	7.25 ±0.099

[1]: 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 for 39-wk-old Mamourah laying hens fed diets containing graded levels of sunflower meal

Criteria[1]	Experimental diets				
	(control)1	2	3	4	5
Egg components					
Egg weight, g	49.29 ±0.93	48.78 ±0.79	48.71 ±0.79	49.40 ±0.75	48.80 ±0.73
Shell weight, g	5.36 ±0.11	5.18 ±0.07	5.19 ±0.11	5.34 ±0.09	5.50 ±0.13
Shell weight, %	10.89 ±0.19	10.65 ±0.16	10.66 ±0.16	10.84 ±0.20	11.29 ±0.26
Yolk weight, g	14.67 ±0.24	14.57 ±0.23	14.62 ±0.30	15.04 ±0.25	14.78 ±0.21
Yolk weight, %	29.80 ±0.28	29.88 ±0.17	30.03 ±0.45	30.44 ±0.14	30.30 ±0.10
Albumen weight, g	29.27 ±0.67	29.03 ±0.55	28.90 ±0.55	29.02 ±0.49	28.52 ±0.49
Albumen weight, %	59.31 ±0.34	59.46 ±0.24	59.32 ±0.46	58.73 ±0.25	58.41 ±0.30
Exterior quality					
Egg shape index	76.53 ±0.63	75.52 ±0.62	77.16 ±0.46	75.67 ±0.63	76.88 ±0.94
Egg specific gravity	1.092 ±0.001	1.090 ±0.001	1.090 ±0.001	1.091 ±0.001	1.094 ±0.001
Shell thickness, mm	0.347 ±0.006	0.339 ±0.006	0.353 ±0.006	0.358 ±0.007	0.349 ±0.006
SWUSA♣, mg/cm^2	86.13 ±1.4	83.97 ±1.1	84.06 ±1.3	85.78 ±1.4	89.05 ±2.0
Interior quality					
Albumen height, mm	6.71 ±0.259	6.36 ±0.134	6.46 ±0.231	6.10 ±0.238	6.24 ±0.231
Haugh units	84.38 ±1.9	82.86 ±0.89	83.19 ±1.6	80.57 ±1.6	81.80 ±1.5
Yolk height, mm	17.97 ±0.20	17.29 ±0.20	17.96 ±0.21	17.98 ±0.19	17.66 ±0.26
Yolk diameter, mm	40.33 ±0.30	39.65 ±0.24	39.88 ±0.31	40.30 ±0.12	40.37 ±0.25
Yolk index	44.60 ±0.57	43.59 ±0.40	45.08 ±0.63	44.63 ±0.50	43.73 ±0.59
Yolk color score	7.10 ±0.100	7.05 ±0.114	7.10 ±0.124	7.15 ±0.109	6.95 ±0.135

[1]: No significant differences were observed among treatments in all criteria.

♣: SWUSA: Refers to shell weight per unit of egg surface area.

Table 5: Egg fertility and hatchability and embryonic mortality of eggs produced by Mamourah laying hens fed diets containing graded levels of sunflower meal

Criteria[1]	Experimental diets				
	(control)1	2	3	4	5
Hatch 1 (during 36th week of birds' age)					
Total eggs set	156	166	170	154	171
Egg fertility, %	97.4 ±0.6	95.6 ±2.3	93.5 ±1.0	90.1 ±5.8	97.0 ±0.6
Fertile hatchability, %	92.7 ±2.4	95.0 ±0.6	88.9 ±1.4	89.0 ±7.0	96.0 ±2.1
Total hatchability, %	90.4 ±2.9	90.8 ±2.4	83.1 ±1.2	80.8 ±10.8	93.2 ±2.2
Embryonic mortality, %	7.2 ±2.4	5.0 ±0.6	11.1 ±1.4	11.0 ±7.0	4.0 ±2.1
Mean chick weight, g	31.5 ±0.3	32.4 ±0.3	32.2 ±0.2	31.5 ±0.5	32.0 ±0.5
Hatch 2 (during 37th week of birds' age)					
Total eggs set	162	174	166	135	179
Egg fertility, %	96.4 ±0.8	97.5 ±1.8	91.0 ±2.4	96.1 ±1.1	97.2 ±1.5
Fertile hatchability, %	88.8 ±2.2	90.6 ±3.9	93.7 ±1.9	93.8 ±2.2	90.4 ±2.7
Total hatchability, %	85.7 ±2.8	88.2 ±3.3	85.3 ±1.8	90.1 ±2.4	87.7 ±1.3
Embryonic mortality, %	11.2 ±2.2	9.4 ±3.9	6.3 ±1.9	6.2 ±2.2	10.0 ±2.7
Mean chick weight, g	32.8 ±1.1	33.3 ±0.2	32.7 ±0.6	32.5 ±0.2	32.8 ±1.1
Hatch 3 (during 38th week of birds' age)					
Total eggs set	173	164	183	133	179
Egg fertility, %	96.0 ±2.2	93.8 ±1.7	92.1 ±1.3	95.5 ±3.4	96.5 ±2.0
Fertile hatchability, %	92.3 ±2.8	87.0 ±10.2	87.7 ±0.6	82.4 ±6.7	91.5 ±5.3
Total hatchability, %	88.6 ±4.3	82.0 ±10.9	80.7 ±0.9	79.1 ±8.7	88.5 ±6.5
Embryonic mortality, %	7.7 ±2.8	13.0 ±10.2	12.3 ±0.6	17.6 ±6.7	8.5 ±5.3
Mean chick weight, g	32.0 ±0.5	33.5 ±0.3	33.7 ±0.4	32.6 ±0.2	32.9 ±1.0

[1]: No significant differences were observed among treatments in all criteria.

Blood parameters

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. Data on some blood constituents and activities of serum AST and ALT enzymes of 39-week-old Mamourah laying hens, fed sunflower meal-containing diets, are given in Table 6. Analysis of variance of these data showed that dietary treatments had no significant effects on any of the blood parameters studied. Irrespective of the dietary treatments, mean values of blood parameters of laying hens, obtained in the current study, fell within the normal physiological range and agree with those

reported by Gildersleeve *et al.* (1983), Freeman (1984), Cerolini *et al*. (1990), Raya *et al*. (1990), Terveni-Gousi *et al*. (1995) and Raya *et al*. (1998).

Table 6: Means ± standard errors of blood constituents for 39-wk-old Mamourah laying hens fed diets containing graded levels of sunflower meal from 23 to 39 weeks of age

Measurements*	Experimental diets				
	(control)1	2	3	4	5
Glucose, mg/dL	298±18	276±13	274±12	281±5	252±9
Total protein, g/dL	4.08±0.3	4.29±0.3	4.42±0.3	4.60±0.2	4.23±0.2
Total lipids, g/L	15.7±1.2	16.7±0.3	17.3±0.5	16.0±0.5	16.6±0.5
Cholesterol, mg/dL	114±2	122±8	109±4	127±8	107±7
AST, U/L	130±9	136±11	124±11	130±16	130±16
ALT, U/L	5.6±1.0	4.8±0.8	5.6±1.0	4.8±0.8	5.6±1.0

***: No significant differences were observed among treatments in all criteria.**

As far as the authors aware, one study has been performed to investigate the effects of using graded levels of dietary fiber, furnished mainly by sunflower meal, on plasma cholesterol of laying hens (McNaughton, 1978). He observed no significant differences in plasma cholesterol level due to increasing the inclusion level of sunflower meal up to 30.07% of the diet (providing a range of dietary fiber level from 2.05 to 8.79%). Similarly, the range of dietary fiber levels (3.33 to 7.82%) of the experimental diets, used in the present study (Table 1), did not exert significant effects in this respect. However, dietary fiber has been shown to be hypocholesterolemic (Lirette *et al.,* 1993); but this effect depends, to a large extent, on level and source of the dietary fiber (McNaughton, 1978).

CONCLUSION

Based on the results of this study, practically and economically, sunflower meal can be incorporated into the laying hen diets up to 27% of the diet without any adverse effects on the productive and reproductive performance of laying hens.

REFERENCES

Allain, C. A.; L. S. Poon; C. S. G. Chang; W. Richmond and P. C. Fu (1974). Enzymatic determination of total serum cholesterol. Clinical Chemistry, 20: 470-475.

Association of Official Analytical Chemists (1984). Official Methods of Analysis 14th Ed, A.O.A.C., Arlington, Virginia, USA.

Borland International, Inc., (1990). Quattro Program, Version 1.0

Carter, T. C. (1975). The hen's egg. Estimation of shell superficial area and egg volume using measurements of fresh egg weight and shell length

and breadth alone or in combination. British Poultry Science, 16: 541-543.

Cerolini, S.; A. Baldi and L. G. Cavalchini (1990). Blood and plasma biochemical variables in laying hens of different strains and ages. Arch. Geflügelk, 54: 190-194.

Cuca, M.; E. Avila and E. Sosa (1973). Threonine supplementation to diets for chicks. Poultry Science, 52: 2016-2017.

Deaton, J. W.; J. L. McNaughton and D. Burdick (1979). High-fiber sunflower meal as a replacement for soybean meal in layer diets, British Poultry Science, 20: 159-162.

El-Deek, A. A.; M. A. Abaza; M. Osman; Y. A. Attia and A. M. Khalaf (1999). Inclusion of sunflower meal and commercial enzymes to egg type strain ration during growth period. 1- Effects on growth performance, mortality rate, blood parameters and economic returns. Egyptian Poultry Science Journal, 19: 529-547.

Freeman, B. M. (1984). Appendix: Biochemical and physiological data. In Physiology and Biochemistry of the Domestic Fowl, Vol. 5: 407-424, B. M. Freeman, Ed, Academic Press, London, UK.

Frings, C. S. and R. T. Dunn (1970). A colorimetric method for determination of total serum lipids based on the sulfo-phosphovanillin reaction. Amer. J. Clin. Pathol., 53: 89-91.

Gildersleeve, R. P.; D. G. Satterlee; W. A. Johnson and T. R. Scott (1983). The effects of forced molt treatment on blood biochemicals in hens. Poultry Science, 62: 755-762.

Gippert, T. (1994). Some current questions of the broiler chicken nutrition. 3rd International Symposium of Animal Nutrition, Kaposvár, 43-52.

Harms, R. H.; A. F. Rossi; D. R. Sloan; R. D. Miles and R. B. Christmas (1990). A method for estimating shell weight and correcting specific gravity for egg weight in eggshell quality studies. Poultry Science, 69: 48-52.

Haugh, R. R. (1937). The Haugh unit for measuring egg quality. U.S. Egg Poultry Magazine, 43: 552-555.

Hegedüs, M and S. Fekete (1994). Nutritional and animal health aspects of the substitution of soybean meal with sunflower meal. (In Hungarian) Magyar Állatorvosok Lapja, 49: 597-604.

Henry, R. J. (1964). Clinical Chemistry: Principles and Techniques, Harper and Row Publishers, New York.

Keshavarz, K. and S. Nakajima (1995). The effect of dietary manipulations of energy, protein and fat during the growing and laying periods on early egg weight and egg components. Poultry Science, 74: 50-61.

Lirette, A.; A. R. Robinson; D. C. Crober; P. D. Lawson and N. L. Firth (1993). Effect of oat bran, cotton seed hulls and guar gum on chicken egg and blood lipids during the early laying period. Can. J. Anim. Sci., 73: 673-677.

McNaughton, J. L. (1978). Effect of dietary fiber on egg yolk, liver and plasma cholesterol concentrations of the laying hen. J. Nutr., 108: 1842-1848.

Michel, J. N. and M. L. Sunde (1985). Sunflower meal in pullet developer diets. Poultry Science, 64: 669-674.

Rad, F H. and K. Keshavarz (1976). Evaluation of the nutritional value of sunflower meal and the possibility of substitution of sunflower meal for soybean meal in poultry diets. Poultry Science, 55: 1757-1765.

Raya, A. H.; T. Gippert; L. Halmágyi and S. Hèjja (1989). The possibilities of using sunflower meal to replace soybean meal in broiler rations and its effect on the performance of chicks and nutrient digestibility. J. Agric. Sci., Mansoura University, 14 (2): 1336-1348.

Raya, A. H.; M. M. Khalifah and M. H. Rabie (1990). Effects of dietary protein levels in grower and layer diets on the performance of Dokki-4 and Rhode Island Red laying hens. 2- Fertility and hatchability of eggs, some properties of egg quality and blood constituents. J. Agric. Sci. Mansoura University, 15 (7): 1069-1085.

Raya, A. H.; A. A. El-Serwy; T. M. Dorra and E. A. El-Sherbini (1998). The nutritional value of raw full-fat soybean in diets for local Gimmizah laying hens. J. Agric. Sci. Mansoura University, 23 (12): 5877-5890.

Reitman, S. and S. Frankel (1957). A colorimetric method for the determination of serum glutamic oxaloacetic and glutamic pyruvic transaminases. American. J. Clin. Path., 28: 56-63.

Rockville (1991). Statgraphics program, version 5.0 STSC.

Rose, R. J.; R. N. Coit and J. L. Sell (1972). Sunflower seed meal as a replacement for soybean meal protein in laying hen rations. Poultry Science, 51: 960-967.

Sherif, Kh. El.; T. Gippert and D. Gerendai (1997). Effect of feeding sunflower meal supplemented with energy and amino acids on laying hen performance. Állattenyésztés és Takarmányozás, 46: 87-94.

Singh, K. S.; C. M. Prasad and R. D. Brahmakshatriva (1981). Feeding value of sunflower- and groundnut- cakes for laying hens. Anim. Feed Sci. Tech., 6: 63-71.

Terveni-Gousi, A. S.; A. L. Yannakopoulos; J. E. Psomas; J. J. Georgopoulou and P. N. Nikokiris (1995). Effects of locally produced cottonseed meal on some characteristics of interior egg quality and blood of hens during the whole laying period. Arch. Geflügelk, 59: 219-222.

Trinder, P. (1969). Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. Ann. Clin. Biochem, 6: 24-27.

Vieira, S. L.; A. M. Jr. Penz; E. M. Leboute and J. Corteline (1992). A nutritional evaluation of a high fiber sunflower meal. Journal of Applied Poultry Research, 1: 382-388.

J. Agric. Sci. Mansoura Univ., 26 (9), September, 2001

المظاهر الإنتاجية للدجاج البياض المغذي علي علائق محتوية علي مستويات متدرجة من كسب عباد الشمس

خليل الشحات شريف*، محمود حسن ربيع*، مجدي أحمد عوض حسين، محمد جاد الحق قاسم**، أحمد محمود عباس****

*** قسم إنتاج الدواجن – كلية الزراعة – جامعة المنصورة.**

**** معهد بحوث الإنتاج الحيواني - مركز البحوث الزراعية - وزارة الزراعة - الدقي -جيزة.**

هدفت الدراسة الحالية بحث تأثير إضافة كسب عباد الشمس في علائق دجاج المعمورة البياض بمستويات صفر، 6.75، 13.50، 20.25، 27.00% من العليقة علي المظاهر الإنتاجية للدجاج. تم استخدام عدد 210 طائر (30 ديك و 180 دجاجة) عمر 23 أسبوع. قسمت الطيور عشوائياً إلي 5 مجموعات تجريبية بكل منها 42 طائر (6 ديوك و 36 دجاجة) في ثلاثة مكررات متساوية تم تسكينها في حظائر أرضية. تم تكوين خمسة علائق تجريبية متساوية في الطاقة والبروتين وتحتوي علي المستويات السابقة من كسب عباد الشمس وتم تقديمها لمجموعات الطيور التجريبية الخمسة خلال الفترة من 23 إلي 39 أسبوع من العمر. تم تحليل عينات ممثلة من كل من كسب عباد الشمس المستخدم في هذه الدراسة وكذلك من العلائق التجريبية المختلفة لتقدير محتواها الغذائي. تم وزن الطيور فرديا عند بداية ونهاية التجربة مع أخذ قياسات عن كل من إنتاج البيض ووزن البيضة وكتلة البيض الكلية واستهلاك العلف والتحول الغذائي كل أربعة أسابيع خلال الفترة التجريبية. كذلك تم أخذ قياسات عن الجودة الداخلية والخارجية للبيض عند عمري 32، 39 أسبوع من عمر الطيور. تم تفريخ 3 دفعات من بيض المعاملات التجريبية المختلفة عند أعمار 36، 37، 38 أسبوع من عمر الطيور وذلك لتحديد نسب الخصوبة والفقس والنفوق الجنيني للبيض أثناء فترة التفريخ. وفي نهاية التجربة (عند عمر 39 أسبوع) تم أخذ عينات من دم الطيور لتقدير محتويات سيرم الدم من الجلوكوز والبروتين الكلي والدهون الكلية والكوليسترول وكذلك نشاط إنزيم أسبرتيت-أمينوترانيفيريز (AST) وإنزيم ألانين-أمينوترانسفيريز (ALT) في السيرم. وتم حساب الكفاءة الاقتصادية للتغذية للفترة التجريبية الكلية.

أوضح التحليل الإحصائي للنتائج عدم وجود فروق معنوية بين المعاملات التجريبية في أي من معايير المظاهر الإنتاجية، معايير جودة البيض، نسب الخصوبة والفقس، أو قياسات الدم. ومن هذه النتائج يمكن استنتاج أنه من الناحية العملية والاقتصادية يمكن استخدام كسب عباد الشمس في علائق الدجاج البياض حتى مستوي 27% من العليقة دون حدوث أية تأثيرات سلبية علي المظاهر الإنتاجية أو التناسلية للدجاج البياض.