

## EFFECT OF DIETARY GARLIC ON PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE IN MAMOURAH LAYING HENS

Salem, Amina A.; Eman, M. Abo- Etta and M.E. Nofal.

Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Dokki, Giza.

### ABSTRACT

The present study was performed in order to investigate the effect of dietary supplementation of different minced garlic levels and regimes on productive and physiological performance in Mamourah laying hens. One hundred and five 28-wk.-old Mamourah hens were divided into five equal groups according to the following design: group A; received the commercial diet only (control); groups B and C received control diet plus 3% and 5% fresh minced garlic respectively which given continuously for 12 weeks; whereas groups D and C received the same levels of garlic 3% and 5% respectively but intermittent 15:15 days for 12 weeks.

At the end of the first four weeks of experiment egg albumin percentage was significantly ( $P<0.05$ ) increased while egg yolk was significantly ( $P<0.05$ ) decreased by feeding 5% garlic either continuous or intermittent as compared with other dietary treatments and control. However shell percent at all stages, albumen percent, yolk percent and yolk/ albumen ratio at the two late stages of experimental period, also haugh unite score, yolk index, egg specific gravity, shell surface area, shell thickness were not affected by dietary garlic. Adding garlic to the diet significantly ( $P<0.01$ ) reduced cholesterol and total lipids in serum, egg yolk and liver. Serum total protein at the third period and albumin at the second period were significantly decreased by the two treatments of 5% garlic.

Body weight significantly ( $P<0.05$ ) increased by dietary garlic groups at all periods of experiment as compared with control specially those of intermittent system of feeding than those under continuous system. No significant differences were obtained between groups in egg number and hen-day percentage except, group (D) from 4 to 8 wk, which recorded significantly decreased either in egg production or in hen-day percentage. Egg weight for all treated groups were significantly ( $P<0.05$ ) increased during the periods studied as compared with control. Hen- day percentage, egg mass (g) hen/day, feed conversion, were not affected by the dietary treatments.

Conclusively, it can be concluded that supplementation garlic in layer diets produce eggs with low cholesterol and total lipids content. These eggs may be more desirable for consumers, especially those who suffer from heart diseases.

**Keywords:** layer, garlic, egg cholesterol, egg total lipids, serum cholesterol, serum total lipids, economical efficiency).

### INTRODUCTION

Garlic (*Allium Sativum*) has a long history of flock use; it has been used as spice and flock medicine since antiquity. In ancient medical literature, the use of garlic was advocated against various diseases. In recent years garlic has emerged as potent natural hypocholesterolemic agents. Also possess, insecticidal, antibacterial, antitumor, hypoglycemic and antiatherosclerotic properties (Kendler, 1987 and Leu, 1989) moreover it was antifungal (Prasad and Sharma, 1981), antioxidant and antimycotic (Ekram, 1972). In chicken,

when garlic paste at 3.8% were incorporated in the diet / or garlic oil equivalent to this amount (0.014%), the activity of hepatic, 3-hydroxyl-3-methyl glutaryl coenzyme A reductase (HMG-coA reductase) was increased by 54% in broiler chickens, and 75% in 12-wk- old Leghorn pullets with a concomitant decrease in serum cholesterol of 18 and 23 % respectively (Qureshi *et al* 1983). Sharma *et al* ( 1979) concluded that garlic enhanced the productivity of eggs . On contrary, EL- Habbak *et al* (1989) obtained depression in egg production of Japanese quail when they used fresh garlic in their diets. Dietary garlic oil did not affect on egg production, egg weight, feed efficiency, body weight, feed intake, feed conversion, total plasma lipids, cholesterol and yolk cholesterol when birds fed diet with / or without 0.02% garlic oil for 8 weeks (Rajasekhara *et al*,1991 and Reddy *et al* ,1991). Day and Samanto (1993) concluded that garlic could be used as growth promoter in broiler diets. Final body weight, weight of edible parts (liver, heart and gizzard), intestine weight, egg mass, egg quality (Haugh unit and egg shell thickness) , feed conversion and average egg weight were not affected by feeding garlic ( El- Deeb,1994). Mohamed *et al* (2000) reported that garlic significantly ( $P<0.01$ ) increased body weight, feed consumption and egg production (egg number), in contrast plasma, yolk and liver cholesterol and total lipids decrease with addition garlic to the diet. The rationale for dietary manipulation of egg cholesterol generally is based on the reduction of lipid or cholesterol in plasma or liver by nutrient ingredients or drugs. Egg yolk has high level of cholesterol, and this level was less sensitive to changes due to tight regulatory mechanisms inherited in the laying hens (El- Nawawy, 1991). Garlic powder at 3% in the diet of White Leghorn hens, fed for three weeks reduced egg cholesterol by 5.45% mg/g yolk, and at 2% inclusion reduced yolk cholesterol by 2.83% mg/g. These changes in yolk cholesterol were associated with marked changes in egg production and food consumption (Sharma *et al*, 1979).

The present study examined the effect of dietary garlic on productive, physiological, and economical efficiency traits of Mamourah laying hens.

## MATERIALS AND METHODS

The present study was carried out at Gimmizah Research Station, Animal production Research Institute Agric. Res. Center, Ministry of Agric. One hundred and five, Mamourah hens (28 weeks old ) were randomly chosen from a large flock reared in the floor. Birds were housed in individual wire cages. During the experimental period feed and water were provided *ad-libitum* and hens were exposed to 16 hr. lighting daily. Fresh minced garlic was supplemented at 3 % and 5 % to layer diets (Table 1). Birds were divided into 5 equal groups (21birds in each); group A: received the control diet without garlic supplementation; group B: fed control diet plus 3% garlic, group C: control diet plus 5 % garlic, both groups B and C were given garlic continuously for 12 weeks whereas groups D and E contained the same levels of garlic respectively at intermittent feeding system for 15 days in each month during experimental period which lasted for 12 weeks.

All birds were individually weighed at the initial of the experiment and monthly during the experimental period. Egg number and weight were recorded daily, feed intake was recorded and feed conversion was calculated weekly. 30 eggs (6 eggs for each group) were taken three times after 4, 8, and 12 weeks for measuring egg quality. Egg specific gravity (Sp.gr) was calculated by Harms *et al* (1990) using the following equation:  $Sp.gr = EW/0.968(EW-shW) + (0.4921 \times shW)$  where EW = egg weight, shW= shell weight. Shell surface area (SA) was computed from the egg weight using the formula of Paganelli *et al* (1974).  $SA = 4.835W^{0.662}$  Where SA= surface area per  $cm^2$ , W= egg weight per gm.

To get a good mixture the amount of garlic was mixed with small amount of Basal diet by using gradual mixing system by mix the amount of garlic (for each 100 kg ration) until it completely mixed and distributed in the ration.

**Table( 1a) : Composition of the basal diet**

Ingredient	%
Yellow corn	65.40
Soya been meal 44 %	22.00
Wheat bran	3.00
Di - Cal - Ph	1.39
Lime stone	7.44
Salt (Nacl )	0.30
Vit + Minerals	0.30
DL - Methonine	0.17
Total	100
Calculated analysis	
Crude protein %	16.05
ME K Cal	2726.76
Crude fiber %	3.375
Ca %	3.204
Total Ph %	0.619
Lysine %	0.820
Methonine %	0.449

Each 2.5kg . of Vit & Min . Mixture contain : Vit A 12000.000 IU, Vit D3 2000.000 IU ,Vit E 10.000 mg ,Vit k3 2000 mg , Vit B1 1000 mg , Vit , B2 4000mg , Vit B6 1500 mg , Vit b12 10 mg , Niacin 50.000mg , Pantothenic acid 10.000 mg , Choline chloride 500.000 mg , Capper 10.000, Iodine 1.000 mg , Iron 30. 00mg , Manganese 55.000 mg , Zinc 55.000 mg and Selenium 100 mg .

Table (1b): Chemical constituents of garlic .

Item	Garlic	
	Fresh basis	DM
Moisture	72.08	-
DM	27.92	100
Ash	1.30	4.66
OM	26.62	95.34
EE	0.42	1.05
CF	7.3	26.15
CP	8.13	29.12
NFE	10.77	38.57

DM= Dry matter, OM= Organic matter, EE= Ether extract,  
CF = Crude fiber, CP= Crude protein, NFE= Nitrogen free extract.

#### Physiological parameters:

Six eggs were collected every 4 weeks from six hens in each group to determine yolk cholesterol and total lipids using the method of Folch *et al* (1957). Also blood samples were individually drawn from wing vein of three layers from each group after 4, 8, and 12 weeks to estimate serum cholesterol, total lipids, total protein and albumen.

#### Statistical analysis.

Data were analyzed using randomly design according to Snedecor and Cochran (1982) using the following model :  $Y_{ij} = \mu + T_i + e_{ij}$  . Where  $Y_{ij}$  = An observed treat.  $\mu$  = Over all mean .  $T_i$  = The  $i$  th treatment effect ( $i= 1, \dots ; 5$ ) .  $e_{ij}$  = The random residual error . Percentages were transformed to arcsine before being analyzed to approximate normal distribution . Multiple range tests (Duncan's 1955) were used to determine the significant differences.

## RESULTS AND DISCUSSION

#### Egg quality

The trend of change in albumen percentage due to treatments was presented in (Table 2) albumen percentage was significantly ( $P < 0.05$ ), increased while yolk percent was significantly ( $P < 0.01$ ) decreased by feeding 3% garlic either continuous or intermittent during first 4 weeks as compared with both groups of 5% garlic and control . On the other hand shell percent at all experimental periods also, albumen percent, yolk percent and yolk/albumen ratio at 8 and 12 weeks of experimental periods were not affected significantly by dietary garlic. Moreover, no effect was detected due to feeding garlic on averages of haugh unit scores, yolk index, specific gravity, shell surface area and shell thickness at all sampling times at 4, 8 and 12 weeks (Table 3). These findings were agreed with the results obtained by El - Deeb (1994).

Table 2: Means ( $X \pm SE$ ) of shell, albumen, yolk percentages and yolk/albumen ratio as affected by garlic supplementation to the diets of Mamourah laying hens.

Traits	Control (A)	Garlic continuous		Garlic intermittent		Overall mean	Sig
		3 % (B)	5 % (C)	3 % (D)	5 % (E)		
Shell % at							
4 weeks	13.51±.002	13.55±.003	14.19±.008	13.69±.011	13.77±.001	13.74	NS
8 weeks	12.77±.003	13.63±.001	12.98±.007	13.98±.006	13.36±.001	13.30	NS
12 weeks	13.64±.003	14.28±.004	14.17±.003	13.35±.002	13.92±.002	13.87	NS
Average	13.31	13.82	13.98	13.67	13.68	13.64	
Albumen % at							
4 weeks	57.33±.006ab	58.41±.001a	55.61±.003 b	58.87±.004a	56.43±.002b	57.33	*
8 weeks	55.57±.010	54.93±.006	55.98±.007	56.47±.007	56.46±.004	55.88	NS
12 weeks	55.19±.031	54.63±.009	55.75±.009	56.92±.016	56.25±.009	55.75	NS
Average	56.03	55.99	55.72	57.42	56.38	56.32	
Yolk % at							
4 weeks	29.16±.002ab	28.04±.005bc	30.20±.001 a	27.44±.003c	29.80±.003a	28.93	**
8 weeks	31.63±.014	31.35±.065	30.43±.002	29.92±.004	30.21±.007	30.71	NS
12 weeks	31.17±.033	31.09±.013	30.08±.013	29.73±.011	29.83±.018	30.38	NS
Average	30.65	30.16	30.24	29.03	29.95	30.01	
Yolk/ Albumen ratio at							
4 weeks	0.510±.013ab	0.481±.015bc	0.538±.008 a	0.467±.011c	0.529±.012a	0.505	**
8 weeks	0.579±.028	0.591±.081	0.544±.007	0.544±.016	0.536±.020	0.557	NS
12 weeks	0.574±.047	0.575±.023	0.542±.029	0.571±.024	0.533±.030	0.559	NS
Average	0.554	0.549	0.541	0.527	0.533	0.540	

Means within the same raw followed by different letters are significantly different at NS ;Not significant. \* ; ( $P<0.05$ ) \*\* ; ( $P<0.01$ ) Sig = Si

### Physiological parameters

#### Yolk cholesterol and total lipids:

It is obvious from (Table 4) that there was a significant ( $P<0.01$ ) decrease in the levels of both yolk cholesterol and total lipids due to dietary garlic. These results are close agreement with those revealed by El-Habbak *et al* (1989) in laying quails, in addition to , El-Deeb (1994) and Mohamed *et al* (2000) in laying hens. The reduction was more in groups fed garlic continuously than those fed intermittent. At the end of 12 weeks, the proportional reduction of yolk cholesterol was 18.58, 30.33%, 7.38% and 16.10% for treatments B, C, D and E respectively. El-Habbak *et al* (1989) found that the reduction of yolk cholesterol in quail eggs was 59.5% after four weeks of feeding 4% fresh garlic. Also El-Deeb (1994) reported the reduction of yolk cholesterol in Hy-line layer eggs was 23.3% after 60 days of feeding 5gm/hen /day fresh garlic. On contrary, Rajasekhara *et al* (1991) showed that the dietary garlic oil did not affect on yolk cholesterol. Moreover, yolk total lipids were decreased at the end of experiment by 33.51%, 42.65%, 15.90% and 24.55% for treatments B,C , D and E respectively as compared with control.

Table 3: Means ( $\bar{X} \pm SE$ ) of haugh unite score , yolk index, specific gravity , shell surface area and shell thickness as affected by garlic supplementation to the diets of Mamourah laying hens

Traits	Control (A)	Garlic continuous 3% (B)	5% (C)	Garlic intermittent 3% (D)	5% (E)	Overall mean	Sig
<b>Haugh unite score (HU)</b>							
4 weeks	89.43±1.283	89.16±1.520	93.73±1.796	93.38±2.592	90.24±2.928	91.19	NS
8 weeks	84.61±3.211	89.18±2.550	88.41±1.150	89.59±2.400	89.25±2.480	88.21	NS
12 weeks	81.83±2.612	80.77±2.841	80.98±2.802	84.58±2.788	76.78±3.615	80.99	NS
Average	85.29	86.37	87.70	89.18	82.10	86.13	
<b>Yolk index</b>							
4 weeks	56.23±0.008	48.58±0.017	53.29±0.043	51.85±0.034	51.36±0.071	52.26	NS
8 weeks	50.86±0.011	50.39±0.018	49.80±0.016	51.07±0.015	50.50±0.015	50.52	NS
12 weeks	49.03±0.011	45.82±0.006	45.87±0.014	45.54±0.005	45.08±0.011	46.27	NS
Average	52.04	48.26	49.65	49.49	48.98	49.68	
<b>Specific gravity (gm/cm<sup>3</sup>) at</b>							
4 weeks	1.087±0.002	1.087±0.004	1.091±0.004	1.088±0.004	1.088±0.002	1.088	NS
8 weeks	1.082±0.002	1.087±0.002	1.083±0.003	1.089±0.003	1.085±0.001	1.085	NS
12 weeks	1.087±0.002	1.090±0.003	1.090±0.002	1.086±0.002	1.090±0.002	1.089	NS
Average	1.085	1.088	1.088	1.088	1.088	1.087	
<b>Shell Surface area (cm<sup>2</sup>)</b>							
4 weeks	64.31±1.338	64.85±1.061	67.16±1.550	67.29±1.405	66.05±1.230	65.43	NS
8 weeks	65.43±1.541	66.83±1.208	69.64±1.049	68.48±1.268	66.67±1.478	66.91	NS
12 weeks	65.04±1.337	67.47±1.309	67.15	68.57±0.791	67.99±0.831	67.74	NS
Average	64.93	66.29		68.11	66.90	66.69	
<b>Shell thickness (mm)</b>							
4 weeks	0.42±0.016	0.44±0.014	0.44±0.011	0.40±0.009	0.42±0.029	0.424	NS
8 weeks	0.37±0.012	0.39±0.008	0.38±0.020	0.37±0.018	0.37±0.011	0.376	NS
12 weeks	0.37±0.023	0.36±0.020	0.36±0.012	0.36±0.014	0.36±0.013	0.362	NS
Average	0.387	0.397	0.393	0.377	0.383	0.387	

Means within the same row followed by different letters, are significantly different at ( $P < 0.05$ ).

NS ; Not significant \* ; ( $P < 0.05$ ) . \*\* ; ( $P < 0.01$ ) Sig; Significance

### Serum cholesterol and total lipids:

Serum cholesterol and total lipids showed the same pattern observed in both yolk cholesterol and yolk total lipids. (Table 4), that cholesterol levels were significantly ( $P < 0.01$ ) reduced by all dietary garlic treatments at all periods of experiment. However, feeding continuous garlic (Treatments C and B) exhibited the highest reduction of serum cholesterol. It could be concluded that the high and low levels of garlic which used in continuous regimen were more effective in reducing serum cholesterol as compared with control. The reduction percentages of serum cholesterol at the end of experiment were about 27.74%, 42.41%, 17.70% and 26.98% for treatments B, C, D and E groups, respectively than control.

These results are similar to those obtained by El-Habbak *et al* (1989) in laying quails, El-Deeb (1994), Mohamed *et al* (2000) in laying hens and Nofal *et al* (2001) in cocks. On contrary, Rajasekhara *et al* (1991) found that plasma cholesterol was not affected by dietary garlic oil. The reduction in serum cholesterol by feeding garlic may be attributed to garlic contains cholesterol suppressive agents (allin and allicin) these compounds in garlic reported to lower plasma cholesterol by their suppressing effect on the function of (HMG-COA) reductase. (Qureshi *et al* 1983) and (Mesbah and Aboul-Ela 1991).

It is clearly noted, that serum total lipids (Table 4) showed pattern similar to that obtained for serum cholesterol, whereas the dietary garlic continuous treatments (Treatments C and B) caused a significant ( $P < 0.01$ ) reduction in total lipids at all periods of the experiment as compared with control.

Generally according to the averages of serum total lipids the percentages of reduction in serum total lipids were 34.57% and 48.84% for treatments B and C, respectively while it was being 20.03% and 24.95% for treatments D and E, respectively when compared with the control as shown in. The reduction in serum total lipids by feeding garlic may be due to the higher content of sulfur compounds in garlic, these compounds are responsible for inhibiting biosynthesis of lipids. Addition of garlic in the diet caused significant reduction in serum total lipids in laying hens (Mohamed *et al*, 2000) and cocks (Nofal *et al*, 2001). Vice versa Rajasekhara *et al* (1991) showed total plasma lipids were not affected by feeding garlic oil.

**Table 4: Means ( $\bar{X} \pm SE$ ) of serum, yolk and liver cholesterol and total lipids as affected by garlic supplementation to the diets of Mamourah laying hens.**

Traits	Control (A)	Garlic continuous		Garlic intermittent		Overall Mean	Sig
		3% (B)	5% (C)	3% (D)	5% (E)		
<b>Serum cholesterol mg/100ml</b>							
4 weeks	188.07±15.084 a	147.85±11.809 a	134.23± 9.672 b	184.62±19.012 a	138.41±10.348 b	158.64	*
8 weeks	196.74± 9.514 a	144.97±12.556 b	121.75± 6.309 b	148.04±15.419 b	148.38±12.074 b	151.98	**
12 weeks	202.94± 8.697 a	131.88±10.813 b	82.50±12.702 c	151.09±13.074 b	142.39±10.595 b	142.16	**
Average	195.92	141.57	112.83	161.25	143.06	150.93	
<b>Serum total lipids mg/ 100ml</b>							
4 weeks	1539.59±98.93 a	1212.98±31.15 b	1017.33±63.02 c	1383.48±41.81 a	1321.60±67.31 b	1294.96	**
8 weeks	1866.51±53.41 a	1217.78±52.79 c	1174.61±30.56 c	1456.68±48.30 b	1236.04±80.76 c	1390.33	**
12 weeks	1897.66±75.71 a	1039.89±69.73 c	521.42±32.60 d	1401.44±46.37 b	1422.88±30.26 b	1256.66	**
Average	1767.92	1156.82	904.45	1413.87	1326.84	1313.98	
<b>Yolk cholesterol mg/gm</b>							
4 weeks	15.42± 0.305 a	15.03±0.763 a	11.65±0.723 b	14.03±0.416 a	14.06±0.595 a	14.00	**
8 weeks	16.29± 0.347 a	13.59± 0.565 bc	11.46±0.459 c	14.93±0.616 a	13.99±0.482 ab	14.05	**
12 weeks	18.04±0.982 a	11.73±0.853 b	11.41±0.838 b	16.94± 0.220 a	13.52±0.325 b	14.33	**
Average	16.52	13.45	11.51	15.30	13.86	14.13	
<b>Yolk total lipids mg/ gm</b>							
4 weeks	264.13±10.311 a	207.34±16.643 bc	189.20±10.190 c	238.35± 4.527 ab	229.36± 7.956 b	225.676	**
8 weeks	289.62±27.801 a	182.69± 2.410 c	160.35±11.654 c	232.50±11.640 b	183.02± 2.270 c	209.636	**
12 weeks	340.07±12.842 a	204.27±14.492 c	163.05±5.055 c	280.85±17.270 b	261.98±18.060 b	250.050	**
Average	297.94	198.10	170.87	250.57	224.79	228.454	
<b>Liver mg/gm /gm</b>							
Cholesterol	89.99±5.739 a	64.82±2.057 bc	54.62±3.809 c	83.42±4.213 a	77.86±4.495 ab	74.140	**
Total lipids	268.15±10.442 a	212.58±11.899 b	170.65±11.114 c	245.60±13.180 a	245.87±15.070 a	228.569	**

Means within the same row followed by different letters, are significantly different at ( $P < 0.05$ ) NS; Not significant \* ; ( $P < 0.05$ ) . \*\* ; ( $P < 0.01$ ) Sig; Significance

**Liver cholesterol and total lipids:**

Liver cholesterol and total lipids were significantly ( $P < 0.01$ ) reduced by dietary garlic (Table 4). These findings are closely with those revealed by Qureshi *et al* (1983a) who showed that the level of liver total lipids was reduced by about 10 to 26% in white leghorn layers administered garlic extraction. Also similar results were obtained by, EL- Habbak *et al* (1989); Konjufca *et al* (1997); Mohamed *et al* (2000) and Khashaba *et al* (2001).

**Serum total protein:**

Results concerning the effect of garlic on serum total proteins, albumen and globulin are shown in (Table 5). According this table, it could be noticed that there is a significant ( $P<0.05$ ) decrease in the level of serum total protein during the third period and in the level of serum albumen during the second period caused by the high continuous level of garlic (treatment C). The rate of reduction was about 20.4% for total protein and 23.3% for albumen. However, on bases of averages all dietary treatments caused slight increase in serum globulin as compared with control group. The most pronounced effect was noticed for intermittent garlic treatments (D and E). These results are closely agreement with those obtained by El-Deeb (1994) in laying hens.

**Table 5: Means ( $\bar{X} \pm SE$ ) of serum total protein, albumen, and globulin as affected by garlic supplementation diets of Mamourah laying hens.**

Traits	Control (A)	Garlic continuous		Garlic intermittent		Overall mean	Sig.
		3% (B)	5% (C)	3% (D)	5% (E)		
<b>Total protein mg/dl</b>							
4 weeks	7.94±0.462	7.04±0.395	7.60±0.147	8.60±0.700	8.20±0.828	7.877	NS
8 weeks	7.04±0.496	7.38±0.510	7.55±0.451	8.76±0.614	7.94±1.010	7.735	NS
12 weeks	7.65±0.463 a	7.10±0.369 ab	6.09±0.360 b	7.67±0.320 a	6.47±0.395 b	6.933	*
Average	7.544	7.173	7.079	8.344	7.534	7.565	
<b>Albumen mg/dl</b>							
4 weeks	4.28±0.153	3.98±0.221	4.20±0.172	4.50±0.287	4.57±0.474	4.309	NS
8 weeks	5.14±0.384 ab	4.08±0.333 b	3.94±0.274 b	5.62±0.322 a	4.21±0.625 b	4.597	*
12 weeks	3.48±0.309	3.68±0.336	3.10±0.358	3.43±0.118	2.90±0.251	3.318	NS
Average	4.299	3.915	3.747	4.513	3.893	4.074	
<b>Globulin mg/dl</b>							
4 weeks	3.66±0.572	3.06±0.540	3.40±0.199	4.11±0.576	3.63±0.484	3.569	NS
8 weeks	1.90±0.490	3.31±0.363	3.61±0.479	3.14±0.603	3.73±0.731	3.137	NS
12 weeks	4.17±0.211	3.41±0.551	2.99±0.079	4.24±0.366	3.57±0.484	3.677	NS
Average	3.243	3.258	3.332	3.831	3.641	3.461	

Means in the same row followed by different letters are significantly different at ( $P<0.05$ ). NS; Not significant \* ; ( $P<0.05$ ) . \*\* ; ( $P<0.01$ ) Sig; Significa

**Productive performance****Egg production**

Egg number and hen-day percentage were significantly ( $P<0.05$ ) decreased by feeding 3% intermittent garlic (group D) during the period of 4-8 weeks as compared with control. On the other hand egg number and hen-day percentages at the periods of 0-4, 8-12 and 0-12 weeks were not affected by dietary garlic (Table 6). Similar results were reported by EL- Habbak *et al* (1989) who obtained a depression in egg production in Japanese quails when they fed fresh garlic in their diets. In contrary Mohamed *et al* (2000) reported that dietary garlic enhanced egg production in ISA brown and Fayoumi laying hens at the beginning period of production.

Egg weight was significantly ( $P<0.05$ ) heavier for hens fed garlic at all periods of production studied, comparable with the controls (Table 6). The heaviest average egg weight was recorded for birds of group D (3% intermittent garlic), this is logic due to the decrease happened in the number



Table 6: Means (X ± SE ) of body weight, egg number, egg weight and hen day percent as affected by garlic supplementation to the diets of Mamourah laying hens.

Traits	Control (A)		Garlic continuous		Garlic intermittent		Over all mean	Sig
	3% (B)	5% (C)	3% (D)	5% (E)				
Initial body weight (28weeks)	1.580±0.029	1.630±0.050	1.670±0.050	1.631±0.028	1.636			NS
Body weight at 4 weeks	1.808±0.416 b	1.889±0.346 ab	1.935±0.415 ab	1.967±0.547 a	1.906			*
Body weight at 8 weeks	1.841±0.438 b	1.950±0.478 ab	1.950±0.378 ab	2.034±0.608 a	1.955			*
Final body weight (12 weeks)	1.816±0.332 b	1.934±0.302 ab	1.945±0.352 ab	2.042±0.469 a	1.941			*
Average	1.761	1.860	1.928	1.874	1.860			
Weight gain (g)	236.00	266.00	315.00	349.00	305.00			
Egg number at								
0-4 weeks	18.78±0.999	17.94±0.992	18.22±1.089	18.06±0.830	18.28			NS
4-8 weeks	20.06±0.641 a	19.06±0.688 ab	18.50±0.590 ab	17.12±1.306 b	18.61			*
8-12weeks	17.39±0.561	16.67±0.676	16.89±0.530	16.13±1.541	16.93			NS
0-12weeks	56.22±1.083	53.67±1.617	53.61±1.601	53.21±2.91	54.21			NS
Egg weight at								
0-4 weeks	47.73±0.734 b	49.84±0.583 a	50.04±0.591 a	50.47±0.873 a	49.59			*
4-8 weeks	49.82±0.378 b	52.14±0.617 a	51.66±0.590 ab	52.50±0.853 a	51.51			*
8-12 weeks	50.13±0.556 b	52.48±0.777 a	52.47±0.875 ab	53.25±0.466 a	52.01			*
0-12 weeks	49.23±0.314 b	51.49±0.456 a	51.38±0.503 a	51.58±0.560 a	50.94			**
Hen-day percentage at								
0-4 weeks	67.07±3.566	64.09±3.542	65.08±3.890	64.49±2.985	65.43			NS
4-8 weeks	71.63±2.300 a	68.06±2.458 ab	66.07±2.107 ab	61.14±4.664 b	66.66			*
8-12 weeks	62.10±2.004	59.53±2.416	60.32±1.871	57.59±5.502	60.47			NS
0-12 weeks	66.93±5.472	63.89±8.167	63.82±8.086	63.35±12.990	64.54			NS

Means within the same row followed by different letters are significantly different at (P<0.05). \*\*, ; (P<0.01)

of eggs produced in this group. It can be concluded that garlic increased egg weight. Similar results were reported by El-Habbak *et al* (1989) in Japanese quails, when they used fresh garlic in their diets. Hence, there is no significant difference in egg weight between hens fed garlic either continuous or intermittent.

Egg mass g/ hen/ day was not affected during the periods studied or at the end of 12 weeks of feeding garlic (Table 7), as obtained by Rajasekhara *et al* (1991), while these results disagreed with those revealed by El-Deeb (1994) and Khashaba *et al.*, (2001). They stated that egg mass was improved by feeding garlic.

Feed intake was significantly ( $P < 0.01$ ) affected by dietary garlic during periods of 8-12 and 0-12 weeks of experimental periods the highest amount of feed intake was recorded for hens of treatment (B) while the lowest amount was recorded for those of treatment E as shown in (Table 7). The present results are in harmony with those of Sharma *et al.*, (1979) and Khashaba *et al.*, (2001) reported that, feeding 3% garlic significantly increased feed intake. However, garlic did not affect on feed intake during periods of 0-4 and 4-8 weeks. In this respect similar results were close agreement with those obtained by Qureshi *et al.*, (1983), Rajasekhara *et al.*, (1991) and El-Deeb, (1994) they did not find any affect of dietary garlic on feed intake. On the other hand Mohamed *et al.*, (2000) found that garlic supplementation increased feed consumption during early ages.

**The price of ton ration at the time of experiment was 750 LE.**

**The price of kg garlic was 1 LE.**

Feed conversion was not affected by dietary garlic at all periods studied (Table 7). These results were accordance with those obtained by Qureshi *et al.*, (1983), Rajasekhara *et al.*, (1991) and El-Deeb, (1994) they did not find any affect of dietary garlic on feed conversion. Alm El-Dien (1999) failed to find any significant effect on feed / egg mass ratio by fresh garlic with two layer chicken strains. On the contrary Khashaba *et al.*, (2001) showed better feed conversion in Japanese quail that fed garlic.

### **Body weight**

The results in (Table 6) show that body weight was significantly ( $P < 0.05$ ) increased by about 9.5% and 6.4% for treatments D and E respectively as compared with the control groups. These findings agreed with those obtained by El-Afify (1997) and Mohamed *et al* (2000), while disagreed with Rajasekhara *et al* (1991), El-Deeb (1994) and Nofal *et al.*, (2001).

Weight gain was increased by dietary garlic at different levels and systems (Table 6). This indicates that garlic may be stimulate the growth rate and increase body weight of hens, as reported by Day and Samanto (1993).

### **Economic efficiency:**

Results of economical efficiency for hens fed the experimental diets are summarized in (Table 8). The results indicated that all diets supplemented with garlic had lower economic efficiency than the basal diet. This may be due to decrease egg mass of treated birds compared to control group.

Table 7 : Means (X ±SE) of egg mass, feed intake and feed conversion as affected by garlic supplementation to the diets of Mamourah laying hens .

Traits	Control (A)	Garlic continuous			Garlic intermittent 5% (E)	Over all Mean	Sig
		3% (B)	5% (C)	3% (D)			
Egg mass (g/ hen /day) at							
0-4 weeks	32.01±1.787	32.10±1.991	32.57±1.924	32.57±1.557	33.09±1.221	32.47	NS
4-8 weeks	35.69±1.183	35.55±1.484	34.20±1.484	32.64±2.330	33.47±1.470	34.33	NS
8-12weeks	31.29±1.232	31.38±1.309	31.78±1.344	32.49±2.516	32.44±1.320	31.86	NS
0-12weeks	33.00±0.763	33.01±1.051	32.85±1.083	32.57±1.821	33.00±0.917	32.96	NS
Feed intake (g/ hen/ day)							
0-4 weeks	97.72±1.425	99.25±1.433	99.12±1.893	99.67±1.815	96.84±1.360	98.51	NS
4-8 weeks	104.24±1.491	107.31±1.115	104.46±1.611	105.69±1.970	104.96±1.347	105.32	NS
8-12weeks	99.74±1.311 ab	101.66±0.715 a	100.52±0.718 ab	100.61±1.084 ab	98.14±1.321 b	100.13	*
0-12weeks	100.57±0.739 ab	102.74±0.684 a	101.37±0.879 ab	101.90±1.067 ab	100.03±0.935 b	101.30	*
Feed conversion at							
0-4 weeks	3.25±0.235	3.32±0.258	3.29±0.271	3.21±0.212	3.05±0.145	3.223	NS
4-8 weeks	2.99±0.138	3.11±0.137	3.13±0.125	3.27±0.230	3.26±0.176	3.147	NS
8-12 weeks	3.27±0.125	3.34±0.150	3.25±0.129	3.53±0.438	3.14±0.153	3.299	NS
0-12weeks	3.07±0.068	3.18±0.126	3.14±0.102	3.04±0.331	3.09±0.098	3.108	NS

Means within the same row followed by different letters are significantly different at (P < 0.05) NS ;Not significant.  
 \* ; (P<0.05) \*\* ; (P<0.01) Sig = Significance.

**Table 8: Economical evaluation of dietary garlic in the diets.**

Treatment	Cost of kg eggs / Feed cost			Income LE/kg eggs	Net income LE /kg eggs	Economical Efficiency %
	Ration	Garlic	Total			
Control	6.34	---	6.34	13.84	7.5	100
Continuous garlic						
3%	6.473	.26	6.73	13.81	7.08	94.4
5%	6.386	.43	6.82	13.77	6.95	92.7
Intermittent Garlic						
3%	6.42	0.13	6.55	13.35	6.80	90.7
5%	6.30	.22	6.52	13.83	7.31	97.5

It could be concluded that fresh garlic was effective in reducing total lipids and cholesterol in serum, egg yolk and liver. Hence it could be used to produce hypocholesterolemic table eggs.

It is interesting to note that the decrease of economic efficiency can be compensate by increasing the price of egg which contain lower level of cholesterol.

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## تأثير استخدام الثوم على الأداء الإنتاجي والفسيزيولوجي في دجاج المعموره البياض

أمينة عبده سالم ، إيمان محمد أبو عيطة ، محمد عيسى نوفل  
معهد بحوث الإنتاج الحيواني ، مركز البحوث الزراعية ، الجيزة ، الدقى

أجري هذا البحث لدراسة تأثير إضافة مستويات ونظم مختلفة من الثوم المفروم على الصفات الإنتاجية والفسيزيولوجية في دجاج المعموره البياض. تم تقسيم عدد ١٠٥ دجاجة بياضه عمر ٢٨ أسبوعا من سلالة المعموره إلى ٥ مجموعات بكل مجموعة ٢١ دجاجة في بطاريات فردية. تم إضافة الثوم المفروم بمستوى ٣% للمجموعة الأولى والثالثة بينما تم إضافته إلى المجموعة الثانية والرابعة بمستوى ٥% . تم إضافة الثوم إلى المجموعة الأولى والثانية باستمرار لمدة ١٢ أسبوعا وإلى المجموعة الثالثة والرابعة متقطعة أسبوعين من كل ٤ أسابيع لنفس فترة التجربة. وقورنت هذه المجموعات بالمجموعة الخامسة والمستخدمه كمجموعة قياسية. وكانت النتائج كالتالي:

- ١- فيما يتعلق بصفات البيضة ادي استخدام المستوى ٥% من الثوم سواء تحت النظام المستمر او المتقطع إلى ارتفاع معنوي في نسبة الالبومين بينما انخفضت نسبة الصفار لهذه المعامله وذلك مقارنة بالمعاملات الأخرى والكنترول بينما لم تتأثر بقية الصفات الأخرى المدروسة معنويا بأى من المعاملات المستخدمة .
  - ٢- أدي إضافة الثوم إلى انخفاض مستوى الكولسترول والدهون الكلية معنويا في كلا من صفار البيض و السيرم والكبد كما انخفضت الكفاءة الاقتصادية للمعاملات المستخدمة مقارنة بالكنترول.
  - ٣- انخفض عدد البيض ونسبة الإنتاج معنويا (٥%) بإضافة ٣% ثوم مفروم طازج للعليقة على فترات متقطعة خلال الفترتين ٤-٨ أسبوعا من المعاملة. ولكن لم يكن هناك تأثير معنويا بالنسبه لبقيه المعاملات مقارنة بالكنترول.
  - ٤- أزداد وزن البيضة معنويا (٥%) لجميع المعاملات المستخدمة خلال فترات التجربة مقارنة بالكنترول.
  - ٥- أزداد وزن الجسم معنويا (٥%) بإضافة الثوم المفروم خلال الفترات المدروسة وكان أعلى معدل لهذه الزيادة عند التغذية المتقطعة على المستويين ٣,٥%.
  - ٦- ادي إضافة الثوم للعليقه الى خفض الكفاءه الاقتصاديه لجميع المعاملات المستخدمه مقارنة بالكنترول.
- عموما إضافة الثوم إلى علائق الدجاج البياض يؤدي إلى إنتاج بيض منخفض في الكوليستيرول والدهون الكلية ويكون هذا مرغوب للمستهلك خصوصا مرضى القلب