EFFECT OF ESSENTIAL PHOSPHOLIPIDS (EPL) INJECTION ON TOTAL LIPIDS AND CHOLESTEROL CONTENTS OF GIMMIZAH LAYING HENS

By

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Abstract: *The main objectives of the present study were to determine the effects of administration of essential phospholipids (EPL) on lipids and cholesterol content of egg-yolk. One hundred and twenty, 36-week-old Gimmizah laying hens were randomly distributed into three equal groups and maintained in individual laying cages, throughout 16 weeks of the experiment. Hens of the 2nd and 3rd group were injected subcutaneous with EPL twice a week at doses of 150 and 300 mg/kg BW, respectively, while the 1st group was injected with ethanol and served as control. Treatments continued for 12 weeks (from 36 to 48 weeks of age). Results showed that*

1. *Injection of 300 mg EPL caused a significant decrease in serum total lipids allover treatment period.*
2. *Injection of EPL significantly decreased serum, cholesterol and triglyceride but significantly increased HDL.*
3. *Injection of 300 mg EPL was significantly decreased, serum calcium at 44 wks of age while GOT was significantly decreased at 44 and 48 wks of age, due to EPL injection.*
4. *High dose of EPL was more pronounced to reduce lipids and cholesterol in both yolk and liver.*
5. *Hatchability and abdominal fat were significantly reduced as affected by EPL injection, while, there was an increase in gall bladder volume.*
6. *Egg weight was significantly increased allover treatment period as a result of injection 300 mg EPL/kg BW, whereas body weight was only increased at 44 and 48 wks of age.*
7. *At 40 wks of age, injection of EPL significantly increased egg number, egg production (%) and albumen weight percentage. This effect was disappeared after this period.*

It was concluded that EPL injection to laying hens reduced total lipids and cholesterol in serum, egg yolk and liver especially high dose of EPL moreover, EPL injection had no adverse effects on layer performance except in hatchability trait.

INTRODUCTION

Consumers have become increasingly aware of the nutritional value of the food they purchase, and the relatively high cholesterol content of eggs is of primary concern due to the association in epidemiological studies of elevated plasma cholesterol concentrations with coronary artery disease (Pekkanen *et al.*, 1992). Although the role of dietary cholesterol in heart disease is subject to considerable debate, consumer interest in meeting the American Heart Association's (1986) recommendation that people consume less than 300 mg cholesterol/day necessitates reduced egg consumption.

Egg cholesterol is synthesized in the liver of laying hens and transported in plasma, where uptake into the developing follicles occurs by a receptor-mediated process (Nimpf and Schneider, 1991). To reduce the amount of cholesterol available for yolk deposition, many previous attempts to lower the cholesterol content of egg focused on limiting hepatic cholesterol synthesis. Several pharmaceuticals developed for reducing human plasma cholesterol have been tested for their ability to reduce egg cholesterol such as Probucol® (Waldroup *et al.*, 1986), Lovastatin® (Elkin and Rogler, 1990) and Triparanol® (Dam *et al.*1979).

"Essential" phospholipids (EPL) is a highly purified hosphatidylcholine fraction isolated from soybeans, the substance is particularly rich in polyunsaturated fatty acids, with linoleic acid accounting for approximately 70% (Lekim and Betzing, 1974). EPL which is suppose to increase cholesterol catabolism and excretion in chickens (Leuschner *et al.*, 1976). Moreover, EPL has been reported to reduce egg cholesterol and lipids concentrations (Szymezyk and Pisulewski, 2003; El-Sheikh, 2005). The animal studies (rat, mouse, rabbit, cockerel, miniping and rhesus monkey) on the pharmacology of EPL, the compound has been administered orally, intravenously, subcutaneously, intracardially or intraperitoneally to evaluate its effect on lipid metabolism (Gundermann and Schneider, 1990). They added that, the level of initial values, the route of administration, EPL dosage and duration of treatment seem to be the main determinants for the slope of serum cholesterol reduction. The high cost of most pharmaceuticals used in the treatment of patients with hypercholesterolemia currently limits the use of these drugs for investigating their efficacy in lowering egg cholesterol. Because EPL is readily available at reasonable cost, it was hypothesized that this compound may prove useful for this study to know effect of EPL injection as hypocholesterolemic pharmaceuticals on lowering egg yolk cholesterol and total lipids.

MATERIALS AND METHODS

This study was conducted at the El-Sabahia Poultry Research Station (Alexandria), Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture. One hundred and twenty, 36-weeks-old Gimmizah laying hens were used in this study. The hens were divided randomly into three equal groups. Hens of the 2nd and 3rd group were injected subcutaneously twice a week by 0.2 ml ethanol EPL solution to provide 150 and 300 mg EPL/kg body weight, respectively, while hens of the 1st group was injected with 0.2 ethanol and served as control. EPL was injected for 12 weeks from 36 to 48 weeks of age and the injection was stopped for 4 weeks from 49 to 52 weeks of age (recovery period), then the experiment was terminated. All birds were housed individually in layer cages. The feed was *ad-libitum* on a layer diet containing 16.2% crude protein, 2900 kcal. ME./kg. of diet. The chemical analysis of experimental diet indicated that the diet contents of ether extract, Ash, calcium and crude fiber were 3.9%, 13.5%, 3.6% and 4.3%, respectively. Water was provided all the time throughout the experimental period and the birds were exposed to 14 hours light daily.

At 40, 44, 48 and 52 wks of age, blood samples were collected through branchial veins from five birds in each group and centrifuged at 3000 r.p.m. for 10 min. to separate serum samples which were stored at -20°C until assay. Serum total lipids, total cholesterol, triglyceride, HDL, calcium, GOT and GPT were determined using available Commercial kits. Also five eggs were taken from each group (at the time of blood sampling) for egg quality measurements and determination of total lipids and total cholesterol in egg yolk extract. Averages of body weight (g), feed intake (g/hen/day), egg weight (g), egg number (egg/hen/4 weeks) and egg production (%) were calculated during the same period.

At 48 and 52 wks of age, three birds from each group were taken randomly for slaughter test, weights of liver, ovary, oviduct and abdominal fat were recorded to the nearest gram and their weights as a percentages of live body weight were calculated. Length of oviduct (cm). and gall bladder volume (ml) were also recorded. Samples of liver were frozen at -20°C until the determination of lipids and cholesterol in liver extract according to Washburn and Nix (1974). At 48 and 52 wks of age hens were artificially inseminated using 50 µL of pooled semen for each experimental group to calculate fertility and hatchability percentages, also chicks at hatching, day were weighed per experimental group.

Statistical analysis of data were subjected to the ANOVA using SAS software (SAS, 1990), when significant differences were found, means were compared using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Physiological Traits

1. Serum Constituents

As expected, administration of 300 mg EPL/kg BW caused a significant ($P \leq 0.01$) decreased by 26.4, 21.8 and 18.8% in serum total lipids at 40, 44 and 48 wks of age, respectively. Injection of EPL was significantly ($P \leq 0.01$) decreased serum cholesterol and triglyceride at 40, 44 and 48 wks of age (Table 1). When injection high level of EPL, the reduction of cholesterol was about 31.7, 32.6 and 33.9%, while the reduction was about 24.6, 25.5 and 29.5% in triglyceride at 40, 44 and 48 wks of age, respectively. These reductions were greater than these observed by El-Sheikh (2005) who found that addition of EPL to the laying diet caused a significant decrease by 9.8, 7.7 and 11.7 in total lipids, cholesterol and triglyceride, respectively at 52 weeks of age.

On the other hand, the injection of EPL was significantly ($P \leq 0.01$) increased serum HDL allover treatment period. Henriksen *et al.*, (1979) showed that HDL suppress LDL-binding to smooth muscle cells and inhibit the proliferation of smooth muscle cells into the media of arterial vessels thus weakening the damaging effect of LDL cholesterol on the endothelium. Consequently, any drug therapy is aimed at enlarging the HDL capacity for cholesterol uptake from LDL and the vascular wall, so that serum LDL cholesterol as well as total cholesterol are reduced and an accumulation of cholesterol in the vascular wall is prevented. This increase in serum HDL was in agreement with EL-Sheikh (2005).

Administration of 300 mg EPL/Kg BW significantly ($P \leq 0.01$) decreased serum calcium (at 44 wks of age), while GOT was significantly ($P \leq 0.01$) decreased due to EPL injection (at 44 and 48 wks of age). Sloan *et al.*, (1994) reported that a high positive correlation between plasma Ca and plasma cholesterol.

No significant differences were obtained in GPT throughout the experimental period. This result agree with El-Sheikh (2005) who indicated that no significant differences were found in serum GPT when hens fed diet with 300 mg and 1500 mg EPL/kg diet.

2. Egg Yolk Lipids

Egg yolk lipids and cholesterol significantly decreased ($P \leq 0.01$) in response to EPL injection especially high dose of EPL allover treatment period but this effect was disappeared in recoverey period (Table 3). At 48 wks of age the highest reduction in egg yolk lipids and cholesterol was observed with 300 mg EPL (19.5 and 30.9% respectively). These results are in agreement with Naber *et al.*, (1982) who found that egg yolk cholesterol content is reduced by 5% with the 10% dietary level of Probucol. Similar results were observed by Waldroup *et al.*, (1986) who showed that dietary concentration of 1% Probucol significantly reduced yolk cholesterol within 2 weeks by 7% after feeding. El-Sheikh (2005) showed that addition of essential phospholipids (EPL) to the laying diet caused a significant decrease in egg yolk cholesterol and lipids by 18.4 and 5.3% respectively.

3. Liver Lipids

A significant decrease in liver lipids and cholesterol ($P \leq 0.01$) was observed in hens administration with EPL at 48 wks of age where, administration 300 mg of EPL was achieved the highest reduction in liver lipids and cholesterol by about 13.6 and 38.9%, respectively. There were no significant differences among treatments in liver lipids and cholesterol at recovery period (Table 4). These results are in agreement with Naber *et al.*, (1982) who found that Propucol reduced total liver lipogenesis as measured by incorporation of ^{14}C-acetate by surviving liver slices. An *et al.*, (1997) demonstrated that liver cholesterol and triglyceride contents were significantly decreased as affected by dietary safflower phospholipids.

4. Fertility and Hatchability

Regarding fertility, hatchability and hatched chick weight, it was observed that the injection of EPL did not impair fertility and hatched chick weight but significantly ($P \leq 0.05$) reduced hatchability percentage about 12.4 and 12.9% due to the injection of 150 and 300 mg EPL/kg BW, respectively at 48 wks of age. (Table 5). On the other hand, EPL had no effect on hatchability during recovery period. Likewise, El-Sheikh (2005) indicated that dietary EPL significantly reduced hatchability but did not affect fertility and hatched chick weight.

5. Internal Organs

EPL injection had no effect on relative weights of liver, ovary, oviduct and oviduct length although was significantly decreased ($P \leq 0.01$) abdominal fat percentage but significantly increased gall bladder volume at 48 wks of age (Table 6). No effects were observed in recoverey period as a

result of EPL injection. These observations are in accordance with those of El-Sheikh (2005) who showed that addition of EPL to the diet of Gimmizah and Bandarah hen had no significant effects on relative weights of liver, ovary, oviduct and oviduct length. Although this hypocholesterolemic agent decreased significantly abdominal fat percentage and increased bile content of gall bladder.

Sim and Bragg (1977) reported that the anti-cholesterogenic function of plant sterols in laying hens is due to an influence on cholesterol catabolism rather than cholesterol absorption. This factor appears to increase the degradation followed by excretion of degraded cholesterol in feces as bile acid a neutral sterol metabolites.

Productive Traits

1. Body Weight and Feed Intake

Body weight was significantly increased ($P \leq 0.01$) as influenced by EPL injection at 44 and 48 wks of age (Table 7). This finding disagree with Waldroup *et al.*, (1986) and El-Sheikh (2005) were they found that the hypocholesterolemic agent had no effect on hens body weight. Whereas, Vargas and Naber (1984) reported that body weight and feed intake were negatively correlated with egg cholesterol concentration when the hens consumed less than 110 g of feed/day.

Feed intake was not affected by EPL injections. This supports the findings of Zhao and Scheidele, (1999) and Szymezyk and Pisulewski (2003) they concluded that dietary linolenic acid had no significant effect on feed consumption

2. Egg Production

Egg weight was significantly increased ($P \leq 0.01$) throughout treatment period as response to the injection of 300 mg EPL/kg BW (Table 7). These results agree with those of Scragg *et al.*, (1987) who observed an increase in mean of egg weight with linoleic acid concentrations up to 2.33% in the diet. Also, some authors (Sell *et al.*, 1987; Keshavarz and Nakajima, 1995) have observed that the addition of fat to diets containing a concentration of linoleic acid above NRC (1994) requirements (1.0%) increased egg weight.

Injection of EPL had no significant effects on egg number and egg production % except at 40 wks of age. Where egg number and egg production % increased significantly ($P \leq 0.01$) as a result of EPL administration. This increment may be because of egg yolk cholesterol

concentration was inversely correlated with rate of egg production as suggested with Vargas and Naber, (1984). Also, anther study has indicated that a minimal level of cholesterol was required for maintenance of maximal egg production (Sutton et al., 1984). However, Zhao and Scheidele (1999) stated that dietary linolenic acid had no significant effect on egg production.

3. Egg Quality

EPL had no significant effect on egg quality except in albumen weight percentage and yolk index at 40 and 48 wks of age, respectively. Although EPL caused significant increase ($P \leq 0.05$) in albumen weight percentage but 300 mg EPL/kg BW significantly reduced ($P \leq 0.05$) yolk index (Table 8 and 9). Whitehead *et al.*, (1993) observed that egg albumen was increased in young (<30 wk) and old (>46 wk) hens and that the improvement in egg weight in the old hens was primarily due to an increase in albumen. Also, they added that, dietary fatty acids may increase egg weight by stimulating the synthesis of oviducal proteins, a mechanism that is different from that causing the age-related increase in weight. Furthermore, Zhao and Scheidele (1999) found that eggs from dietary linolenic acid had significantly higher albumen percentage weight than egg from control diets.

The reduction in yolk index may be due to the increase of yolk size. Nichols *et al.*, (1963), indicated that egg yolk size have been observed to be inversely related to cholesterol concentration. Increase dietary linoleic acid levels were paralled with the greater yolk size of the egg yolks (March, 1989).

Table (1): Effect of essential phospholipids (EPL) administration on serum total lipids, cholesterol, triglyceride and HDL at different periods.

Age (weeks)	Treatments	Total lipids (g/dl)	Cholesterol (mg/dl)	Triglyceride (mg/dl)	HDL (mg/dL)
40	Control	6.70±0.32^{a}	190.33±18.05^{a}	325.43±7.65^{a}	26.50±0.93^{b}
	150 mg EPL/kg BW	5.43±0.58^{ab}	135.00±8.66^{b}	299.43±7.49^{b}	32.13±0.90^{a}
	300 mg EPL/kg BW	4.93±0.12^{b}	130.00±7.64^{b}	245.23±5.15^{c}	33.13±0.35^{a}
44	Control	7.03±0.12^{a}	188.55±5.78^{a}	326.00±3.80^{a}	26.83±0.32^{b}
	150 mg EPL/kg BW	6.03±0.19^{b}	139.00±12.34^{b}	292.73±6.47^{b}	32.51±0.36^{a}
	300 mg EPL/kg BW	5.50±0.32^{c}	127.00±23.01^{b}	242.93±6.54^{c}	32.60±0.55^{a}
48	Control	7.11±0.30^{a}	192.67±9.49^{a}	329.67±4.88^{a}	27.73±0.46^{b}
	150 mg EPL/kg BW	6.13±0.25^{ab}	131.33±15.38^{b}	292.60±6.67^{b}	32.87±0.43^{a}
	300 mg EPL/kg BW	5.77±0.43^{b}	127.33±15.88^{b}	232.37±8.32^{c}	32.83±0.58^{a}
52 (Recovery period)	Control	7.20±0.21	199.33±30.02	331.80±4.71	27.67±0.41
	150 mg EPL/kg BW	7.16±0.28	190.30±12.17	333.50±2.68	28.57±0.54
	300 mg EPL/kg BW	7.13±0.49	203.01±30.09	334.97±4.61	28.43±0.39

a,b,c = Means having different letters within each column are significantly different ($P \leq 0.05$).

Table (2): Effect of essential phospholipids (EPL) administration on serum calcium, GOT and GPT at different periods.

Age (weeks)	Treatments	Calcium (mg/dL)	GOT (U/mL)	GPT (U/mL)
40	Control	14.60±0.80	46.67±0.88	12.33±0.15
	150 mg EPL/kg BW	15.87±1.62	51.00±3.06	12.27±0.44
	300 mg EPL/kg BW	16.97±0.52	50.33±4.37	12.23±0.39
44	Control	18.93±1.09^{a}	53.67±3.77^{a}	12.40±0.40
	150 mg EPL/kg BW	18.07±0.87^{a}	48.33±0.33^{b}	13.33±0.75
	300 mg EPL/kg BW	12.27±1.38^{b}	45.00±0.58^{b}	12.10±0.23
48	Control	16.87±1.72	54.67±3.28^{a}	11.70±0.29
	150 mg EPL/kg BW	14.67±1.28	48.00±0.58^{b}	12.23±0.55
	300 mg EPL/kg BW	13.13±0.94	45.33±1.45^{b}	11.43±0.34
52 (Recovery period)	Control	18.77±1.34	50.67±5.17	11.83±0.30
	150 mg EPL/kg BW	18.30±2.09	52.33±4.63	12.33±0.55
	300 mg EPL/kg BW	18.10±1.80	50.67±4.18	12.80±0.26

a,b = Means having different letters within each column are significantly different (P≤0.05).

Table (3): Effect of essential phospholipids (EPL) administration on egg yolk total lipids and cholesterol at different periods.

Age (weeks)	Treatments	Total lipids (g/g. yolk)	Cholesterol (mg/g. yolk)
40	Control	2.63±0.06^{a}	12.67±0.80^{a}
	150 mg EPL/kg BW	2.39±0.07^{b}	10.20±0.55^{b}
	300 mg EPL/kg BW	2.23±0.09^{b}	8.87±0.74^{b}
44	Control	2.64±0.03^{a}	12.77±0.70^{a}
	150 mg EPL/kg B.W.	2.40±0.05^{b}	11.23±0.35^{ab}
	300 mg EPL/kg BW	2.15±0.03^{c}	9.07±0.86^{b}
48	Control	2.66±0.04^{a}	12.73±0.67^{a}
	150 mg EPL/kg BW	2.42±0.06^{b}	10.93±0.84^{ab}
	300 mg EPL/kg BW	2.14±0.03^{c}	8.80±0.35^{b}
52 (Recovery period)	Control	2.67±0.03	13.43±0.86
	150 mg EPL/kg BW	2.68±0.05	12.17±0.82
	300 mg EPL/kg BW	2.68±0.04	12.33±0.76

a,b,c = Means having different letters within each column are significantly different (P≤0.05).

Table (4): Effect of essential phospholipids (EPL) administration on liver total lipids and cholesterol.

Age (weeks)	Treatments	Total lipids (g/g. liver)	Cholesterol (mg/g. liver)
48	Control	4.72±0.05[a]	3.93±0.19[a]
	150 mg EPL/kg BW	4.38±0.03[b]	2.60±0.32[b]
	300 mg EPL/kg BW	4.08±0.05[c]	2.40±0.17[b]
52 (Recovery period)	Control	3.67±0.24	3.33±0.34
	150 mg EPL/kg BW	3.10±0.15	2.97±0.43
	300 mg EPL/kg BW	3.00±0.21	2.70±0.25

a,b,c = Means having different letters within each column are significantly different (P≤0.05).

Table (5): Effect of essential phospholipids (EPL) administration on fertility, hatchability and chick hatching weight.

Age (weeks)	Treatments	Fertility (%)	Hatchability (%)	Chick hatching weight (g)
48	Control	89.0±2.52	91.0±3.06[a]	39.4±0.50
	150 mg EPL/kg BW	89.7±1.20	79.7±2.91[b]	38.5±0.53
	300 mg EPL/kg BW	89.3±2.33	79.3±2.33[b]	39.0±0.42
52 (Recovery period)	Control	89.7±2.40	90.7±3.93	40.0±0.42
	150 mg EPL/kg BW	89.3±2.33	91.0±3.06	39.4±0.47
	300 mg EPL/kg BW	90.0±1.15	91.3±1.86	39.9±0.44

a,b = Means having different letters within each column are significantly different (P≤0.05).

Table (6): Effect of essential phospholipids (EPL) administration on some internal organs measurements.

Age (weeks)	Treatments	Liver weight (%)	Ovary weight (%)	Oviduct weight (%)	Oviduct length (Cm)	Abdominal fat weight (%)	Gall bladder volume (mL)
48	Control	2.33±0.13	0.20±0.01	1.84±0.14	63.30±2.91	3.65±0.42^{a}	0.61±0.04^{c}
	150 mg EPL/kg BW	2.27±0.24	0.40±0.09	2.40±0.17	27.30±3.30	2.15±0.24^{b}	0.78±0.02^{b}
	300 mg EPL/kg BW	2.13±0.07	0.29±0.01	2.35±0.30	62.80±0.60	1.54±0.18^{b}	0.99±0.02^{a}
52 (Recovery period)	Control	2.37±0.45	0.34±0.06	2.73±0.21	54.33±5.24	2.34±0.20	0.73±0.04
	150 mg EPL/kg BW	2.30±0.38	0.35±0.07	2.74±0.26	56.00±3.61	2.30±0.24	0.75±0.06
	300 mg EPL/kg BW	2.23±0.43	0.25±0.03	2.44±0.17	56.67±3.53	2.80±0.69	0.70±0.03

a,b,c = Means having different letters within each column are significantly different (P≤0.05).

Table (7): Effect of essential phospholipids (EPL) administration on body weight (g), feed intake (g/hen/day), egg weight (g), egg number (egg/hen/4weeks) and egg production % at different periods.

Age (weeks)	Treatments	Body weight (g)	Feed intake (g/hen/day)	Egg weight (g)	Egg number (egg/hen/4weeks)	Egg production (%)
40	Control	1901.5±33.0	113.1±1.6	54.68±0.06^{b}	17.28±0.45^{b}	57.30±0.15^{b}
	150 mg EPL/kg BW	1960.3±39.8	114.5±2.1	54.43±0.07^{c}	19.73±0.39^{a}	65.30±1.20^{a}
	300 mg EPL/kg BW	1979.5±34.1	113.7±3.5	55.03±0.11^{a}	19.75±0.44^{a}	65.27±1.30^{a}
44	Control	1920.5±30.1^{c}	112.0±2.2	54.80±0.14^{b}	17.90±0.52	60.36±1.70
	150 mg EPL/kg BW	1968.8±32.4^{b}	109.5±3.4	54.40±0.19^{b}	19.01±0.51	62.38±1.80
	300 mg EPL/kg BW	2098.8±32.3^{a}	108.7±2.9	56.00±0.32^{a}	19.10±0.37	63.39±1.20
48	Control	1794.6±33.5^{b}	110.6±2.8	54.62±0.49^{b}	17.50±0.47	58.30±1.50
	150 mg EPL/kg BW	1935.1±31.4^{a}	108.8±3.0	54.10±0.39^{b}	18.40±0.58	61.26±1.80
	300 mg EPL/kg BW	1970.3±33.4^{a}	108.0±3.3	55.60±0.49^{a}	18.80±0.36	62.60±1.20
52 (Recovery period)	Control	1805.7±33.4	111.1±3.1	54.45±0.55	18.13±0.46	60.21±1.50
	150 mg EPL/kg BW	1873.2±28.1	112.2±4.3	53.87±0.41	17.93±0.44	59.63±1.41
	300 mg EPL/kg BW	1884.6±32.6	111.0±3.5	54.40±0.24	17.70±0.52	58.98±1.71

a,b,c = Means having different letters within each column are significantly different (P≤0.05).

Table (8): Effect of essential phospholipids (EPL) administration on relative weight of albumin, yolk and shell and shell thickness (mm).

Age (weeks)	Treatments	Albumin weight (%)	Yolk weight (%)	Shell weight (%)	Shell thickness (mm)
40	Control	51.42±0.46^{b}	34.64±0.49	13.94±0.56	0.350±0.013
	150 mg EPL/kg BW	54.16±0.69^{a}	32.64±0.64	13.20±0.64	0.350±0.011
	300 mg EPL/kg BW	54.68±0.59^{a}	33.08±0.85	12.24±0.22	0.378±0.006
44	Control	53.86±2.21	32.52±0.55	13.90±0.50	0.380±0.017
	150 mg EPL/kg BW	53.32±0.76	32.78±0.55	13.62±0.58	0.360±0.012
	300 mg EPL/kg BW	53.42±1.03	33.36±0.61	13.22±0.65	0.360±0.025
48	Control	53.18±0.33	32.74±0.63	14.08±0.36	0.38±0.016
	150 mg EPL/kg BW	52.22±1.54	33.24±0.81	14.54±0.79	0.37±0.023
	300 mg EPL/kg BW	51.66±1.72	34.48±0.90	13.86±0.70	0.34±0.002
52 (Recovery period)	Control	54.93±1.36	31.80±1.00	13.27±0.66	0.37±0.086
	150 mg EPL/kg BW	53.60±1.23	32.73±0.38	13.77±1.07	0.34±0.078
	300 mg EPL/kg BW	53.47±0.62	33.07±0.69	13.46±0.38	0.37±0.088

a,b = Means having different letters within each column are significantly different (P≤0.05).

Table (9): Effect of essential phospholipids (EPL) administration on egg shape index, yolk index and haugh unit percentage.

Age (weeks)	Treatments	Egg shape index (%)	Yolk index (%)	Haugh unit (%)
40	Control	75.74±1.58	45.0±1.5	90.86±1.43
	150 mg EPL/kg BW	75.62±1.27	44.0±1.0	91.74±0.33
	300 mg EPL/kg BW	74.14±1.85	44.6±1.1	90.82±1.29
44	Control	75.34±1.22	45.2±0.5	90.72±1.27
	150 mg EPL/kg BW	75.64±1.38	46.0±0.7	87.82±2.71
	300 mg EPL/kg BW	76.60±0.49	43.8±0.6	86.78±1.27
48	Control	77.56±0.95	43.8±0.7^{a}	89.12±1.08
	150 mg EPL/kg BW	74.18±0.73	42.6±0.5^{ab}	85.20±3.98
	300 mg EPL/kg BW	76.70±1.50	41.4±0.2^{b}	90.74±1.21
52 (Recovery period)	Control	74.03±0.97	41.8±0.4	88.73±1.63
	150 mg EPL/kg BW	76.70±1.28	41.6±0.6	88.10±0.40
	300 mg EPL/kg BW	75.53±1.73	42.4±0.8	87.67±1.39

a,b = Means having different letters within each column are significantly different (P≤0.05).

REFERENCES

An, B.K.; Nishiyama, H.; Tanaka, K.; Ohtami, S.; Iwata, T.; Tsutsumi, K. and Kasai, M. (1997). *Dietary safflower phospholipid reduces liver lipids in laying hens. Poult. Sci. 76: 689-695.*

American Heart Association. (1986). *Dietary guidelines for healthy American adults. Circulation 74: 1465A-1468A.*

Dam, R.; LaBate, M.E.; Tam, S.W. and Cuervotorres, C. (1979). *Effects of diazacholesterol, triparamol, and B-sitosterol on egg cholesterol deposition in coturnix quail. Poultry Sci. 58: 985-987.*

Duncan, D.B. (1955). *Multiple range and multiple F test biometrics, 11: 1-24.*

Elkin, R.G. and Rogler, J.C. (1990). *Reduction of the cholesterol content of eggs by the oral administration of lovastation to laying hens. J. Agric. Food. Chem. 38: 1635-1641.*

El-Sheikh, A. M.H. (2005). *Reducing the cholesterol content in local chickens. Egypt Poult. Sci. 25 (1): 29-59.*

Gundermann, J. and Schneider, E. (1990). *Essential phosopholipds. Rhone-Poulenc Rorer Publishing Co., W. Germany.*

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

Lekim, D. und Betzing, H. (1974). *Der eimbau von EPL-substanz in organe von gesunden und durch galaktosamin geschädigten ratten. Arzneim. Forch. (Drug Research) 24: 1217-1221.*

Leuschner, F.; Wagener, H.H. und Neumann, B. (1976). *Die antihyperlipämische und antiatherogene wirksamkeit der "essentiellen" phospholipide (EPL) in pharmakologischen versuch. Arzneim. Forch. (Drug Research). 26: 1743-1772.*

March, B.E. (1989). *Linoleic acid as a limiting factor in hepatic synthesis of egg lipoproteins. Poult. Sci. 68: 89.*

Henriksen, T. et al. (1979) *Scand. J. Clin. Lab. Invest. 39: 369 Cited by Gundermann and Schneider. 1990.*

Naber, E.C.; Elliot, J.f. and Smith, T.L. (1982). *Effect of probucol on reproductive performance, egg yolk cholesterol content, and lipid metabolism in the laying hen. Poult. Sci. 61: 1118-1124.*

National Research Council. (1994). *Nutrient Requirements of Poultry 9th rev. ed. National Academy Press, Washington, DC.*

Nichols, E.L.; Marion, W.W. and Balloun, S.L. (1963). *Effect of egg yolk size on yolk cholesterol concentration. Proc. Soc.Exp. Biol. Med. 112: 378-380.*

Nimpf, J. and Schneider, W.J. (1991). *Receptor-mediated lipoprotein transport in laying hens. J. Nutr. 121: 1471-1474.*

Pekkanen, A.N.; Punsar, S. and Karvonen, M.J. (1992). *Short and long term association of serum cholesterol with mortality. Am. J. Edpidemiol. 135: 1252-1258.*

SAS (1990). *SAS STAT, Users Guide, Release 6.03 Edition. SAS Institute, Inc. Cary, NC, USA.*

Scragg, R.H.; Logan, N.B. and Geddes, N. (1987). *Response of egg weight to the inclusion of various fat in layer diets. Br. Poult. Sci. 28: 15-21.*

Sell, J.L.; Angel, R. and Escribano, F. (1987). *Influence of supplemental fat on weights of eggs and yolks during early egg production. Poult. Sci. 66: 1807-1812.*

Sim, J.S. and Bragg, D.B. (1977). *Effect of dietary factors on serum and egg yolk cholesterol levels of laying hens. Poult. Sci. 56: 1616-1621.*

Sloan, D.R.; Harms, R.H.; Russell, G.B. and Smith, W.G. (1994). *The relationship of egg cholesterol to serum cholesterol, serum calcium, feed consumption and dietary cholecalciferol. Poult. Sci. 73: 472-475.*

Sutton, C.D.; Muir, W.M. and Jr, G.E.M. (1984). *Cholesterol metabolism in the laying hen as influenced by dietary cholesterol, caloric intake, and genotype. Poult. Sci. 63: 972-980.*

S ymezyk, B. and Pisulewski, P.W. (2003). *Effects of dietary conjugated linoleic acid on fatty acid composition and cholesterol content of hen egg yolk. Br. J. Nutr: 90(1): 93-99.*

Vargas, R.E. and Naber, E.C. (1984). *Relationship between dietary fiber and nutrient density and its effect on energy balance, egg yolk cholesterol and hen performance. J. Nutr. 114: 645-652.*

Waldroup, P.W.; Ndife. L.I. and Hellwing H.M. (1986). *Influence of probucol [(4,4'-isopropylidinedithio)-bis (2,6-di-t-butyl-phenol)] on egg yolk cholesterol content and performance of laying hens. Poult. Sci. 65: 1949-1954.*

Washburn, K.W. and Nix, D.F. (1974). *A rapid technique for extraction of yolk cholesterol. Poult. Sci. 53: 1118-1122.*

Whitehead, C.C.; Bowman, A.S. and Griffin, H.D. (1993). *Regulation of plasma oestrogen by dietary fats in the laying hen: Relationship with egg weight. Br. Poult. Sci. 34: 999-1010.*

Zhao, F. and Scheidele, S.E. (1999). *Functional properties and oxidative stability on n-3 fatty acid-enriched eggs. Poult.Sci. 78:80.*

الملخص العربي

تأثير الحقن بالدهون الفوسفورية الاساسية على محتوي الدهون والكوليسترول الكلي لأناث الجميزة البياضة

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الهدف من هذه الدراسة هو تقدير تأثير الحقن بالدهون الفوسفورية الأساسية على محتوي البيضة من الدهون والكوليسترول الكلي. حيث تم توزيع ١٢٠ دجاجة بياضه من سلاله الجميزة عمر ٣٦ أسبوع الي ٣ مجاميع كل مجموعة بها ٤٠ دجاجة تم وضعهم في أقفاص فردية لمدة ١٦ أسبوع. حيث تم حقن الدجاجات تحت الجلد بجرعات من الدهون الفوسفورية الأساسية بمستويات صفر، ١٥٠، ٣٠٠ ملجم EPL لكل كجم من وزن الجسم لمدة١٢ أسبوع. وكانت **أهم النتائج:**

١. الحقن بالمستوى ٣٠٠ ملجم EPL سبب انخفاض معنوى فى الدهون الكلية فى السيرم خلال فترة المعاملة.

٢. الحقن بالدهون الفوسفورية أدي الي انخفاض معنوي في الكوليستيرول والجلسريدات الثلاثية في السيرم بينما أدى الى ارتفاع معنوى فى HDL .

٣. الحقن بمستوى ٣٠٠ ملجم EPL ادى الى انخفاض معنوى فى سيرم الكالسيوم عند عمر ٤٤ أسبوع بينما انخفض GOT معنوياً نتيجة للحقن بـ EPL عند عمر ٤٤و ٤٨ أسبوع.

٤. الجرعة العالية من EPL كانت اكثر تأثيراً على خفض الدهون والكوليسترول في كل من الصفار والكبد.

٥. النسبة المئوية للفقس والنسبة المئوية للدهن الحشوي انخفض معنوياً نتيجة تأثرهم بالحقن بـ EPL بينما كان هناك زيادة معنوية في حجم محتوي العصارة الصفراوية.

٦. وزن البيضه زاد معنوياً خلال فترة المعاملة نتيجة للحقن بجرعة ٣٠٠ ملجم EPL بينما وزن الجسم زاد فقط عند عمر ٤٤ و ٤٨ أسبوع.

٧. عند عمر ٤٠ أسبوع وجد أن الحقن بـ EPL ادى الى زيادة معنوية فـي عـدد البـيض ونسبة انتاج البيض والنسبة المئوية للالبيومين وهذا التأثير اختفى بعد هذه الفترة.

وبذلك يمكن التوصية بإن الحقن بـEPL للدجاجات البياضه يقلل تركيزات الدهون الكلية والكوليستيرول فى الدم وصفار البيضه والكبد خاصة الجرعة العالية من EPL وانه ليس له أي تأثر سلبي على أداء الدجاجات ماعدا نسبة الفقس.