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PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF BROILER BREEDER LAYING HENS AS AFFECTED BY DIETARY LEVELS EITHER OF L-CARNITINE OR HERBAL MIXTURE.

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SUMMARY

A total number of four hundred and sixty two Ross 308 broiler breeder hens (40-wks of age) were used to evaluate the effect of dietary supplemented L-carnitine (LC) and herbal mixture (HM) on laying hens productive and reproductive performance , egg quality measurements, blood parameters and microbiological status . Hens were randomly distributed into 7 treatments each in 3 replicates (20 hens and 2 cocks per each replicate) and housed in floor pens. Feed was restricted according to the breed instruction ,while water was supplied *ad-libitum*. All hens were kept under the same managerial, hygienic and environmental conditions throughout the experimental period (12 weeks). Corn-soybean meal basal diet was formulated to cover the nutrients requirements recommended for the breed and served as the control diet (T_7) ; 3 supplemented levels of L-carnitine (LC) (10,20 and 30 mg /kg) for T_1,T_2 and T_3, *respectively* and 3 other supplemented levels of herbal mixture (HM) 5,10 and 15 g/kg for T_4,T_5 and T_6, *respectively*. Initial body weight, final body weight ,body weight change, egg production, egg weight, egg mass, feed conversion ratio, hatchability % , hatching of fertile eggs, hatching weight , egg quality and composition were also determined. Blood parameters, microbiological study were also determined and economical efficiency was calculated

The results indicated that:

1. Groups fed diet supplemented with 15 g/kg HM significantly ($P<0.05$)improved final live body weight, egg production rate ,total egg production , mean egg weight ,egg mass and daily egg mass more than groups either fed diet supplemented with L-carnitine or control group.
2. Addition HM to hen diets significantly improved feed conversion rate (FCR), fertility rate, hatchability rate and %hatchability of fertile eggs , while decreased embryonic early and late dead compared to L-carnitine supplemented diets.

3. Supplementation of dietary herb mixture for laying hen diets significantly improved the antioxidant capacity, Ca and P while decreased LDL,HDL, total cholesterol, triglycerides and total lipids in blood plasma.
4. Combination of 15 g/kg herbal mixture in laying hen diet showed significantly more improvements in external and internal egg quality than L-carnitine supplemented diet.
5. Total bacterial Count (TBC) of cloaca swabs from laying hens fed HM groups was significantly lower than those of LC groups, which led to improvements in fertility% and hatchability of these eggs.
6. Further studies must be carried out to study the possibility of using natural antioxidant in commercial broiler breeder diets for long time during laying period.

It may be concluded from this study and from economical point of view that supplementation of 15g/kg of herbal mixture (HM) as a natural antioxidant to broiler breeder laying hen diets during 40-52 weeks of age improved their productive and reproductive performance than artificial antioxidants.

Keywords: *L-carnitine, herbal mixture, fertility, hatchability, antioxidant capacity, egg quality, feed conversion*

INTRODUCTION

Breeder flocks have some problems in reproductive performance especially after the 40th week of age. Some of these problems referred to reduction of egg hatchability, fertility and egg quality (Rabie *et al.*, 1997).

In broiler breeder laying hens, egg hatchability ranged from 79 to 82% and loss of incubated eggs had a large economic impact on the industry (Schaal and Cherian, 2007 and Ali *et al.*, 2007). Chick embryo development is associated with an accumulation of polyunsaturated fatty acids in tissue lipids (Speak *et al.* 1998) making them susceptible to lipids peroxidation (Surai 1999a). Therefore, the integrated antioxidant systems in chicken tissues are responsible for protecting polyunsaturated fatty acids , protein and DNA from damaging effect of free radicals and toxic products of their metabolism (Surai *et al.* 2003). The antioxidant system of developing embryo and newly hatched chick includes fat-soluble antioxidant such as vitamin E (Surai, 1999b) and water-soluble antioxidants including ascorbic acid and L-carnitine (Zhai *et al.* 2008). L-carnitine (y-trimethylamino-B-hydroxybutyrate) is synthesized *in vivo* from methionine and lysine (Bremer, 1983) .

L-carnitine acts as an antioxidant that ultimately results in decrease in reactive oxygen species by removing excessive levels of intercellular Acetyl-COA that induces mitochondrial reactive oxygen species production (Vicari and Calogerro,2001;Agarwal and Said, 2004 and Agarwal *et al.*, 2005) . However, L-carnitine synthesis is limited in chicken embryos because gamma-butrobetaine intermediate required for L-carnitine biosynthesis is limited (Uni *et al.*, 2005).

Various dietary herbs, plant extracts, especially essential oils, have been studied for their antimicrobial and growth promoter abilities (Cross *et al.*, 2002). Nevertheless, it has been indicated that the optimal effects can be affected by factors such as the method used to extract the essential oil from herb and the chemical composition of the extract (Cross *et al.* 2007).

Miguel *et al.* (2004) and Botsoglou *et al.* (1997) found that hens fed thyme have a lower concentration of malonadldehyde in yolk compared to hens fed control diet and indicated that possible transfer of the antioxidant constituents of thyme into the hen through feeding might inhibit the chain reaction involved in oxidation of consumed lipids ,thus decreasing the oxidation products transferred into the yolk. Essential oils derived from oregano, clove and anise have been reported to posses antimicrobial (Dorman and Deans, 2000; Valero and Salmeron, 2003; and Singh *et al.* 2002), anticoccidial (Giannenas *et al.* 2003), antifungal (Pina- Vaz *et al.* 2004; Soliman and Badea, 2002, and Feng and Lipton, 1987) and additionally, clone have been used as an antiparasitic (Kim *et al.*, 2004 and Çabuk *et al.* 2003) and antipyretic agent (Feng and Lipton, 1987 and Afifi *et al.* 1994).

Active ingredient such as *thymol* and *carvacrol* in oregano oil, *eugenol* in clove have antioxidant effects (Lee and Shibamoto, 2002; Gülçin *et al.* 2004). Also, *thymol* , *carvacrol,* and *eugenol* have a digestive stimulating effects (Çabuk *et al.* 2003). Beside , *thymol , carvacrol,* and *eugenol* affected pathogen microorganism in the digestive system.

Rosemary has long been recognized as having antioxidant molecules and these have been identified as carnosic acid, carnasol, carsolic acid ,found in ethanol-soluble fraction (Svoboda and Deans, 1992) .

Ali *et al* .(2007) reported that addition of thyme to local strains of laying hens diet numerically increases antioxidant capacity in plasma, improved fertility and hatchability, while decreased LDL, HDL total cholesterol , triglyceride and total lipids in blood plasma .

Botsoglou *et al.* (2002) reported that oregano essential oil exerted antioxidant property in meats and abdominal fat, pointing at the incorporation of the productive antioxidant components of the essential oil into the membrane.

Ocak *et al.* (*2008*) reported that supplemented dry peppermint (*Mentha piperita* L.) or thyme (*Thymus vulgaris* L.) leaves, which are among the alternative growth promoters increased ($P< 0.05$) the abdominal fat pad at 42 days of age.

There is little information concerning effects of herbal mixtures or essential oils in broiler breeder laying hens studies have been conducted (Ertas *et al.* 2005).

Therefore, the objective of this investigation was to study the effects of L-carnitine as an artificial antioxidant and herbal mixture as a natural antioxidant on productive and reproductive performance as well as physiological parameters and economic efficiency of broiler breeder laying hens.

MATERIALS AND METHODS

The present study was conducted at the Poultry Research and Development Unit, El Wadi Company Farms and Poultry Nutrition Laboratory, Environmental Studies and Research Institute, Minufiya University, El Sadat Branch, during the period from 1/5 to 30/7/2004.

The aim of this investigation was to state the productive and reproductive (hatching) performance of broiler laying hens as affected by L-carnitine (LC) as an artificial antioxidant and Herbal mixture(HM)(as a natural antioxidant) supplementation during the period from 40 to 52 week of lying hen age.

Management and allocation of birds:

Four hundred and sixty two (462), 40 weeks old Ross 308 hens and cockerels, selected randomly from flock, were used in this experiment. Birds were distributed at

random into 7 treatment groups. Birds of each group were further subdivided into three replicates (20 + 2 cocks each) and housed in floor pens (250cm long and 210cm wide).

Feed was offered in a restricted system according to the breeder program. Water provided *ad libitum*. All hens were kept under the same managerial hygienic and environmental conditions throughout the entire experimental period that lasted for 12 weeks.

The Experimental diets:

The composition of the basal diet (treatment 7) is given in Table (1). It was formulated according to NRC (1994) and feed instructions of breed. Graded levels of L-carnitine (LC) being 10, 20 and 30mg/kg were added to the basal diet (treatments 1, 2 and 3) while, three other levels of herbs mixture (HM) being 5, 10 and 15g/kg were added to the basal diet to form the other experimental treatments (treatments 4, 5 and 6, respectively). Daily records were made of egg production and individual egg weights. Feed conversion determinations were based on measurements over three 28 d periods during the experimental period. The performance of laying hens was evaluated in terms of initial weight of hens, final weights, egg production rate, mean Egg weight, restricted daily feed intake ,daily egg mass and feed conversion ratio.

Table (1) Ingredient composition and calculated analysis of layer basal diet.

Ingredient	Kg/1000kg
Yellow corn	650.00
Soybean meal	252.00
Vegetable .Oil	10.00
Wadi Premix*	3.00
DL-Meth. 88%	1.40
Choline cloride50%	1.00
Di-calcium phosphate 18/23	14.10
$CaCo_3$	63.90
NaCl	3.10
Zinc Bacitracin	0.50
Na Bicarbonates	1.00
Calculated analysis %:	1000
ME (kcal/kg)	2750.00
CP%	16.00
Ca%	2.90
Av.p%	0.37
Lys%	0.79
Met%	0.36
Nic%	0.64
Try%	0.20
Arg%	1.04
Thr%	0.60
Na%	0.15
K%	0.16
Choline%	0.22
Cl%	0.69

*Each 3kg of Wadi Layer Premix contains: vit A 12 000 000, vit D_3 3000 000 IU, vit E 50000mg, vit K_3 3000mg, vit B_1 2000m g, vit B_2 7500mg, vit B6 3500 mg, vit B12 15mg, Pantothenic acid 12000mg, Niacin 30000mg, Biotin 150mg, Folic acid 1500mg, Choline 300gm, Selenium 300mg, Copper 10000mg, Iron 40000mg, Manganese 80000mg, Zinc 80000mg, Iodine 2000mg, Cobalt 250 mg and CaCO3 to 3000g,

Preparation of feed additives:

L-carnitine (LC) used in experiment (carnikingr®) 3- carboxy -2-hydroxypropal trimethyl ammonium-hydroxide manufactured by Lohman Animal ealth GMMH & Co. KG-Germany. Inner salt was obtained from International Free Trade Company (IFT). Whereas, Herbal Mixture (HM) composed of 6 different medicinal and aromatic plants were purchased commercially on dried form supplements and consists mainly of Thyme(*Foenicilum vulgar, Mill*); Oregano *(Origanum vulgare L.)*; Clove *(Syzygium arimaticum L.)*; Marjoram (*Origanum marjoranumL.)*; Rosmary (*Rosmarnus officinalis)* and Peppermint (*Mentha Piperita*) were mixed and ground to become fine powder then kept in clean ,dry and closed plastic bags. The mixture was supplemented during the preparation of the experimental diets.

Parameters measured and obtained:

Performance traits:

Individual body weights of hens were recorded on the first day of the experiment and biweekly. Daily egg production for each experimental group and individual egg weights were recorded. Both egg mass and egg production rate as well as feed conversion (g feed /g egg and kg feed per hen/12eggs produced) were calculated. Eggs were sent to hatchery every three days and placed in incubation machines under the same incubational and environmental conditions for 18 days, then transmitted into hatcheries for 3 days until hatch.

Fertility was calculated as follows:

Fertility%= (number of fertile eggs/number of total set eggs)*100.

Hatchability %=(number of hatched eggs/ number of fertile eggs)*100.

Dead embryonic eggs were measured as follows:

Embryonic early dead (EED) were measured as embryos died during the first quarter of incubation .Some of these could be detected and removed during candling.

Embryonic middle dead (EMD); embryos died after the early period but before transfer. Embryonic late dead (ELD) means that embryos died during the hatch phase of incubation. Means of egg weight as well as egg mass of each group were determined during the three experimental periods.

External and internal egg quality traits:

At the end of 4^{th}, 8^{th} and 12^{th} week of experimental period, a total number of 210 eggs (10 eggs from each pen) were taken to determine egg quality as follows: egg albumin weight(g) ,egg yolk weight (g), egg length (mm) were measured and calculated by using a digital caliper . Egg shape index was calculated according to Romanoff and Romanoff (1949). Egg yolk index was calculated as follows:

Yolk and shape index %=egg width (cm)/egg length (cm)*100.

Hough unit (%) was calculated according to Eisen *et al.* (1962). Egg shell thickness (mm) was measured by micrometer and egg shell weight (g) was measured to the nearest 0.1g. Egg albumin index (%) was calculated according to Funk *et al.* (1958) as yolk and albumen height divided by yolk and albumen diameter, respectively. Yolk color was measured using Laroche Fan. Shell pressure force was measured according to Paganel *et al.* (1974) and Nordstrom and Qusterhant (1982).

Blood constituents:

At the end of each experimental period , 3 hens from each dietary treatment were randomly selected to obtain blood samples from wing vein into dry clean centrifuge tubes containing drops of heparin , centrifuged at 4000 rpm for 5 minutes. The clear plasma was separated and stored in a deep freezer at 20C. Blood constituents determined by colorimetric methods were low density lipoprotein (LDL) according to Assmann (1984), High density lipoprotein (HDL) according to Warnick *et al.*,(1983); Total cholesterol (CH) according to Pisani *et al.*, (1995); Triglycerides (TG) according to Soloni (1971). Total lipids (TL) were determined according to Frings *et al.* (1972), Antioxidant capacity, Ca and P using available commercial kits (Spectrum diagnostics which was manufactured at 2006 by MDSS GmbH, Schiffgraben 41,30175 Hannover , Germany). Moreover ,another blood samples were collected from laying hens every week to determine immunization and the serum antibody titre according to hemagglutination Inhibition (HI) test (Hitchner *et al.*,1980).

Microbiological study:

Swaps samples from layer hens cloaca were collected weekly and examined to count the aerobic and anaerobic microflora as Total Bacterial Count (cfu of TBC) using Nutrient agar, MacConky agar (Difco) and Sabouraud agar .

Economic efficiency:

The economic efficiency of the study was calculated from output and input analysis based upon the total revenue/hen/period and the total cost /hen /period according to the price of 1 Kg of diet in the market at the experimental period,1 kg of L-carnitine = 500 LE, 1kg of herbs mixture =5 LE and price of one day old chick=2.5 LE at the experimental time.

Statistical analysis:

Analysis of variance had been done to estimate the effect of different levels of either L-carnitine or herbs mixture on productive and reproductive performance of broiler laying hens. Data were statistically analyzed according to SAS (1999) version 6.12. Tests of significances for the difference among treatments were done according to Duncan (1955) statistical model range T test.

RESULTS AND DISCUSSION

Performance of laying hens:

Experimental data of laying performance as well as productive traits as affected by different dietary levels of L-carnitine (LC) or Herbal mixture (HM) are presented in Table 2. No mortalities occurred during the study. Significant differences among final live body weight (LBW) and body weight change as affected by dietary L-carnitine (LC) or herbal mixture (HM) were observed. The groups fed dietary 20 mg LC and those having 15 g/kg HM recorded significantly ($P<0.05$) the best values of LBW and LBWG that may be due to the improvements in digestive tract ecosystem with herbal mixture (Ertas *et al.* 2005).

Table (2): Performance of broiler breeder hens as affected by dietary levels of L-carnitine or herbal mixture[1].

Item	Control	L-carnitine levels, mg/kg			Herbal mixture level ,g/kg			SEM	Sig.
		10	20	30	5	10	15		
Number of hens /treatment	60	60	60	60	60	60	60		
Initial LBW (Kg)	3.21	3.21	3.21	3.21	3.21	3.21	3.21	0.001	NS
Final LBW (kg)	3.53^{f}	3.54^{e}	3.60^{d}	3.54^{e}	3.58^{c}	3.56^{b}	3.60^{a}	0.003	*
LBW changes (kg)	0.32	0.33	0.39^{a}	0.33	0.37	0.35	0.39	0.01	*
Egg Production rate ,%	61.69^{e}	65.67^{e}	73.12^{b}	77.38^{ab}	62.54^{e}	76.92^{ab}	83.27^{a}	1.00	*
Total egg production/period	345.44^{e}	367.87^{e}	409.44^{b}	433.33^{ab}	350.22^{e}	430.78^{ab}	466.33^{a}	5.57	*
Egg production /hen /period	17.27^{e}	18.39^{e}	20.47^{b}	21.67^{ab}	17.51^{e}	21.54^{ab}	23.32^{a}	0.28	*
Mean egg weight (g)	59.22^{e}	60.58^{bc}	60.46^{bc}	60.48^{bc}	61.06^{ab}	62.24^{a}	61.1^{ab}	0.48	*
Total egg mass(g / hen / period)	1022.73^{e}	1113.34^{e}	1238.0^{abc}	1310.48^{ab}	1069.01^{e}	1343.9^{ab}	1424.37^{a}	17.08	*
Daily egg mass(g / hen / period)	36.52^{e}	39.76^{bc}	44.21^{abc}	46.8^{ab}	38.18^{e}	48^{ab}	50.87^{a}	0.16	*
Daily feed intake (g/hen)	158	160^{a}	160^{a}	159.67^{a}	159^{b}	159^{b}	158^{c}	0.13	*
Feed conversion (g / feed /g egg)	4.4	4.06^{abc}	3.64^{abcd}	3.44^{bcd}	4.24^{ab}	3.38^{cd}	3.12^{d}	0.05	*
Total feed intake (kg feed/ hen/period)	4.43	4.48^{a}	4.48^{a}	4.47^{a}	4.45^{b}	4.45^{b}	4.43^{c}	0.003	*
Twelve eggs(prod./hen/period)	1.44	1.53^{bc}	1.71^{abc}	1.8^{ab}	1.46^{c}	1.8^{ab}	1.94^{a}	0.015	*
Feed conversion(kg feed/12 egg)	3.12	2.95^{ab}	2.64^{abc}	2.49^{bc}	3.11^{a}	2.51^{bc}	2.29^{c}	0.03	*

[1] *a, b, c* and *d* Means followed by different superscripts in the same row are significantly different (P<0.05).

NS : not significant.

SEM: Standard error mean .

Results of egg production rate%; total egg production; egg production /hen /period; total egg mass (g/hen/period) and daily egg mass (g/hen/day)as affected by supplementation of dietary levels of LC or HM indicated that group of laying hens fed 15 g/kg HM diet significantly ($P<0.05$) recorded the best values compared to control and other experimental groups. Significant differences were detected among daily feed intake (g/hen/day).However, these differences could be due to changes in restricted feed for laying hen during the three periods of the study.

Data of feed conversion (g feed /g egg)or (kg feed /12 eggs) revealed that groups fed 15 g/kg HM and those fed 20,30 mg LC/kg diet converted their feed into eggs significantly ($P<0.05$) better than control and other experimental groups .These results are in harmony with findings of Mahmoud and El-Sahn (2005) who indicated that laying hens fed fenugreek, anise and pollen mixture (FAP) converted their feed into egg more efficiently than control group through all the experimental period. Rashwan (1998) reported that feed efficiency values were improved with Fenugreek. The results obtained herein agree with those obtained by Bolukbasi and Erhan (2007) who found that feed conversion and egg production of laying hens were improved by thyme supplementation at levels of 0.1 and 0.5%. However, egg weight did not change during the experimental period from birds receiving the control diet and the others supplemented with thyme. Findings of Rabie *et al.* (1997) who studied the effect of dietary L-carnitine on performance and egg quality of laying hens from 65-73 weeks of age and reported that dietary L-carnitine did not influence laying performance (egg production, mean egg weight, daily feed intake, daily egg mass and feed conversion). However, the antioxidative effects has considerable significance at times of stress ,whether on body or cell level which plays an important role in poultry production since poultry is very sensitive to stress situations (Peris and Asensia 2002).

Reproductive performance of broiler breeder hens:

Results in Table 3 show the effect of dietary levels of L-carnitine and herbal mixture as feed supplementations on reproductive performance of broiler breeder laying hens. Data indicated that group fed diet supplemented with 30 mg LC/kg and that fed diet supplemented with 15g HM/kg diet recorded significantly ($p<0.05$) higher fertility percentage than other tested groups and control one. Meanwhile, group fed 15g HM/kg diet was significantly ($p<0.05$) the best in hatchability percentage compared to control and other experimental groups (Table 3).Similarly, hatchability of fertile eggs% showed that group fed diet supplemented with 15g HM/kg diet(T_6) showed the best value but no significant differences were observed among experimental groups .Also, weight of hatched chicks recorded insignificant differences between tested groups.

Best values of embryonic early dead % and embryonic late dead % were significantly($P<0.05$) recorded with group fed 15g HM/Kg diet in comparison with other experimental groups, while control group significantly ($p<0.05$) recorded the worst value of embryonic medium dead (1.07%)and embryonic late dead (6.07%).

These results are in agreement with those obtained by Blesbois *et al.* (1993), Castellini *et al.* (2000) and Mahmoud and El-Sahn (2005).

Table (3): Reproductive performance of broiler breeders as affected by dietary level of L-carnitine or herbal Mixture[1].

Item	Control	L-carnitine levels, mg/kg			Herbal mixture level ,g/kg				Sig.
	0	10	20	30	5	10	15	SEM	
Fertility%	88.12^{c}	90.52^{b}	90.97^{b}	93.08^{a}	89.65^{bc}	90.40^{b}	93.69^{a}	0.62	*
Hatchability	77.55^{d}	80.50^{bc}	80.52^{bc}	81.14^{b}	78.68^{cd}	79.96^{bc}	84.32^{a}	0.69	*
Hatchability of fertile egg	87.95	89.13	88.49	87.26	88.02	88.46	90.02	0.97	NS
Hatched chicks weight (g)	41.58	41.79	41.71	41.75	41.96	41.96	41.83	0.18	NS
Early died	4.99^{ab}	5.41^{a}	5.61^{a}	4.41^{ab}	5.00^{ab}	5.21^{ab}	3.63^{b}	0.52	*
Medium Died	1.07^{a}	0.67^{b}	0.53^{b}	0.54^{b}	0.31^{b}	0.43^{b}	0.52^{b}	0.13	*
Late dead	6.07^{a}	5.10^{a}	4.68^{ab}	4.56^{ab}	5.31^{a}	4.96^{ab}	3.41^{b}	0.53	*

[1] a, b, c and d means followed by different superscripts in the same row are significantly different ($p<0.05$).

NS : not significant.

SEM: Standard error mean .

Moreover, Adabi *et al.*, (2006) reported that supplemented diet of broiler breeder hens with 30 mg L-carnitine had increased hatchability ($P<0.05$)and fertility ($p<0.01$). The possible effect of L-carnitine not only on hatchability, but also with regard to chick viability and possible reduction in mortality in the first few days of life which are the subject of going investigations (Leibetseder,1995). Recently, Sarica *et al.*, (2007) concluded that dietary L-carnitine supplementation at 250 or 500 mg/kg didn't significantly affect fertility rate and hatchability rate of set and fertile eggs. Zhai *et al* .(2008) injected L-carnitine *in ovo* and reported that no beneficial effect of injecting L-carnitine at dosages that ranged from 0.05 to 10 mmol on hatchability or hatchling body weight. On the other hand, the improvements in fertility %, hatchability % , set eggs and embryonic mortality within group supplemented with 15g/kg herbal mixture indicated that mixture of herbs was better than L-carnitine .In this concern, Botsoglou *et al* (1997) suggested that thymol, the main antioxidant constituent of thyme, passes into egg yolk with antioxidant activity to provide antioxidative properties. Extracts of rosemary and sage have also played an important role in oxidation activity (Economou *et al.* 1991 and Schwartz *et al.* 1996).

External and internal egg quality traits:

Experimental results of external and internal egg quality as affected by dietary levels of L-carnitine or herbal mixture are presented in Table 4. Results showed that supplementation level up to 10 g/kg diet (T_5) of HM had a significantly increase in mean egg weight and shell pressure force compared to L- carnitine or control groups .While, group fed 15g/kg diet of HM (T_6) recorded significantly ($P<0.05$) best values with respect to shape index (81.97%), albumen height (8.41mm), albumen weight (39.28 g) and Haugh unit score (88.85) than groups either fed LC levels or control group. However, no significant differences were observed among groups with regard to shell weight, yolk color and and yolk index values (Table 4). It is worthy to note that the group of layers fed 5g/kg HM achieved significantly ($P<0.05$) the best shell thickness compared to other experimental groups.

Mahmoud and El-Sahn (2005) found that supplementation levels up to 5% of fennel ,anise and pollen mixture resulted in significant increases in shell weight ,shell thickness and egg shape index. Roland *et al.* (1993) suggested that such increment in egg shell could be attributed to that about 7% of dietary zeolite passed through the digestive system in its original form which suggested possible ion-exchange mechanism of zeolite for improvement the egg shell quality. Bolukbasi and Erhan (2007) detected that hen receiving diets containing 1% thyme had a significantly lower yolk rate compared to those fed the control and diets containing 0.1 and 0.5% thyme. They also reported that there were no differences ($p>0.05$)in albumin, shell and Haugh unit between the treatments, that could be attributed to the increased production of digestive enzymes and improved utilization of digestive products through enhanced liver functions (Langhout, 2000 and Williams and Losa, 2001). Hertrampf (2001) reported that essential oils derived from species and herbs could be successfully used as growth promoters. Adabi *et al.*, (2006) found that no significant differences were observed in external and internal egg quality for broiler breeder hen fed diets supplemented with 0 and 60 ppm L-carnitine. The present results indicated that dietary herbal mixture (HM) supplementation resulted in improvements in albumen quality (albumen height and Haugh unit score), which were significantly ($p<0.05$) better than dietary L-carnitine supplemented. Egg weight was significantly ($p<0.05$)increased in HM groups compared to control group. egg white% increased and that of egg yolk decreased with HM and LC supplemented groups compared to the control. The higher values for relative albumen weight of eggs laid by HM supplemented group may be due to the higher metabolic rate in magnum and/or higher activity of the shell gland of treated birds compared to LC supplemented groups and control (Rabie *et al.* 1997).

Table (4): Internal and external egg quality parameters as affected by dietary levels of L- carnitine or Herbal Mixture[1].

Item	Control	L-carnitine levels, mg/kg			Herbal mixture level ,g/kg			SEM	Sig.
		10	20	30	5	10	15		
Mean egg weight,g	59.2^{c}	60.58^{bc}	60.46^{bc}	60.48^{bc}	61.06^{ab}	62.24^{a}	61.10^{ab}	0.48	*
Egg-shape index,%	75.84^{c}	77.73^{bc}	77.54^{bc}	79.08^{b}	77.68^{bc}	79.16^{b}	81.97^{a}	0.45	*
Shell pressure force,	32.22^{c}	33.56^{b}	34.44^{ba}	35.11^{a}	32.00^{c}	35.11^{a}	34.22^{ab}	0.71	*
Albumen height,	6.18^{f}	6.74^{e}	7.10^{d}	7.99^{b}	7.54^{c}	7.63^{c}	8.41^{a}	0.10	*
Yolk weight	15.63^{a}	13.10^{b}	12.94^{b}	13.04^{b}	13.03^{b}	13.08^{b}	13.17^{b}	0.11	*
Albumen weight	35.90^{d}	37.29^{c}	37.38^{bc}	38.40^{ab}	36.91^{cd}	37.19^{c}	39.28^{a}	0.24	*
Shell weight	6.36	6.35	6.36	6.36	6.37	6.36	6.37	0.04	NS
Shell thickness	0.37^{b}	0.38^{b}	0.40^{ab}	0.38^{b}	0.43^{a}	0.40^{ab}	0.40^{ab}	0.02	*
Yolk color	7.89	8.22	7.78	7.56	8.00	8.33	8.22	0.28	NS
Yolk index,%	53.71	54.83	54.73	54.98	53.83	53.94	55.08	0.65	NS
Haugh unit score	75.31^{d}	83.98^{bc}	85.16^{b}	86.19^{b}	81.72^{b}	85.23^{b}	88.85^{b}	0.46	*

[1] *a, b, c* and *d* Means followed by different superscripts in the same row are significantly different ($p<0.05$).
NS : not significant.
SEM: Standard error mean .

The decrease in yolk weight for eggs of supplemented with LC and HM groups compared with control group, may be due to reduction in the hepatic biosynthesis rate of yolk precursors and /or an alteration in the mode of their transport from the liver into the ovarian follicle and the oocyte, probably caused by antioxidants such as L-carnitine and herbal mixture (Rabie *et al.*, 1997).

Peebles and Brake (1987) found that egg shell weight and thickness were negatively correlated to the relative rate of water loss from eggs of strain hens between 30 and 64 weeks of age .Also, Benntt (1992) showed that breeder eggs are incubated those with thin shell did not hatch. since the herbal mixture used in this study consists of a number of medicinal plants such as thyme ,oregano, clove ,rosmary, Peppermint and marjoram which are known as antioxidants, therefore, they may improve uterus environment (site of calcium deposition)and consequently increase shell weight and shell thickness.

Blood Constituents:

Data in Table (5) indicated that there were significant differences between dietary levels of LC and HM in plasma antioxidant capacity, Ca, P, LDL, HDL, total cholesterol, triglycerides and total lipids. However, such significant ($p<0.05$) effects for herbal mixture (HM)levels used in this study was more evidenced than L-carnitine and control groups where the hens fed control and L-carnitine supplemented diets recorded lower values of plasma antioxidant capacity than HM groups. These results agree with Coa *et al.*, (1998) who found with human that increasing serum antioxidant capacity after the treatment of strawberry and spinach indicated the possible absorption of phenolic compounds in these diets. Moreover, Ali *et al.* (2007) reported with local laying hen strains that addition of thyme or anise increased antioxidant capacity in plasma of groups fed diets supplemented with herbal mixture (HM) significantly ($p<0.05$) achieved lower values of plasma LDL,HDL, total cholesterol and triglycerides compared with L-carnitine supplemented groups and the control one . Most of essential oils are known to be alter lipid metabolism. Previous research studies have shown that hyperlipidemia increases the plasma level of oxygen free radicals (Prasad and Kalra, 1993) and produce oxidized compounds such as malondialehyde. In this connection, Case *et al.*, (1995) reported that feeding thymol at levels of 150 ppm to Leghorn chicken cholesterol by 9 %. Lee *et al.* (2003) found that dietary carvacrol significantly reduced plasma triglycerides and phospholipids by 12 and 7%, respectively.

Recently, Ali *et al.* (2007) reported that addition of thyme or anise to laying hens decreased LDL, HDL, total cholesterol, triglyceride and total lipids of blood plasma, liver and yolk extract. Therefore, it may be concluded that decreasing of plasma lipids by herbal mixture (as antioxidants) may be the main factor to increase plasma antioxidative capacity of hens fed HM in their diets.

Microbiological Studies and Immune Response:

Results in Table (6) show the effect of dietary supplementation of LC and HM on hemagglutination Inhibition (HI) test for New Castle Disease Virus (NDV) and some measurements of total bacteria counts (TBC) growing on different nutrient cultures. Data indicated no significant differences in HI test for NDV as affected by different dietary levels of LC or HM. Meanwhile, hens fed diet supplemented with 15 kg/ton HM recorded significantly ($P<0.05$) the lowest values (as cfu) of total bacterial count compared to LC groups and control one. These results agree with those obtained by Bolukbasi and Erhan (2007) who reported that the usage of 0.1 and 0.5%thyme in laying hens diets significantly ($p<0.05$) reduced *E.coli* concentration in feces. In this concern, Botsoglou and Spais (2003) and Cross *et al.* (2007) reported that volatile oils of many herbs are known to have antimicrobial activity. Also, studies has focused nowadays on various herbs that possess immune simulating properties that may be useful to reduce the risk and to their antimicrobial activity (Singh *et al.* 2002 and Elgayyar *et al.* 2001 and Valero and Salmeron 2003).

Table: (5): Blood plasma parameters of broiler breeders as affected by dietary levels of L-carnitine or herbal Mixture[1].

Item	Control	L-carnitine levels, mg/kg			Herbal mixture level ,g/kg			SEM	Sig.
	0	10	20	30	5	10	15		
Antioxidant capacity (mml/l)	0.38^{e}	0.44^{d}	0.45^{d}	0.49^{bc}	0.51^{bc}	0.53^{b}	0.56^{a}	0.09	*
Ca (mg/dl)	12.0^{e}	11.77^{f}	12.01^{e}	12.23^{d}	12.52^{c}	13.50^{b}	14.30^{a}	0.06	*
P (mg/dl)	3.60^{f}	4.04^{e}	4.22^{e}	4.52^{d}	5.09^{c}	5.57^{b}	6.02^{a}	0.07	*
LDL (mg/dl)	72.01^{a}	68.51^{c}	70.81^{b}	70.57^{b}	64.19^{d}	60.32^{e}	55.64^{f}	0.39	*
HDL (mg/dl	35.33^{c}	45.65^{a}	38.14^{b}	25.39^{e}	24.43^{f}	25.18^{e}	27.86^{d}	0.29	*
Total cholesterol (mg/dl)	107.34^{c}	114.16^{a}	108.95^{b}	95.97^{d}	88.62^{e}	85.05^{f}	83.50^{g}	0.49	*
Triglycerides (mg/dl)	538.12^{a}	448.94^{c}	459.89^{c}	508.28^{b}	537.15^{a}	315.79^{d}	296.34^{d}	10.08	*
Total lipids (g/dl	16.68^{a}	17.05^{f}	17.82^{a}	18.35^{d}	10.36^{e}	8.53^{b}	7.53^{a}	0.17	*

[1] *a, b, c* and *f* Means followed by different superscripts in the same row are significantly different ($p<0.05$).
NS : not significant.
SEM: Standard error mean .

Table (6): Microbiological studies and H1 test for NDV for broiler breeders as affected by supplementation with different levels of LC or HM[1] .

Item	Control	L-carnitine levels, mg/kg			Herbal mixture level ,g/kg			SEM	Sig.
	0	10	20)	30	5	10	15		
(TBC)H1 test for NDV	7.22	7.39	7.52	7.30	7.51	7.51	7.35	0.13	NS
(TBC)Nutrient agar	83.93^{b}	76.80^{b}	28.20^{d}	30^{d}	117.46^{a}	80.93^{b}	48.13^{c}	2.72	*
Maconky agar	59.13^{a}	60.73^{a}	12^{d}	10.93^{d}	58.40^{ab}	54^{b}	21.60^{c}	1.59	*
(TBC)Sabouraud agar	57.60^{c}	65^{b}	31.60^{d}	21.53^{e}	84.20^{a}	82.86^{a}	36.06^{d}	1.97	*

[1] *a,b,c* and *d* Means followed by different superscripts in the same row are significantly different ($p<0.05$).
SEM: Standard error mean .
TBC: Total bacterial counts.

Table (7) : Economical efficiency of broiler breeder laying hens as affected by dietary different levels of L-carnitine or herbal mixture.

Item	(1)	L-carnitine levels, mg/kg			Herbal mixture level ,g/kg		
	Control	10	20	30	5	10	15
Av feed intake (kg/hen/period) a	4.43	4.48	4.48	4.47	4.45	4.45	4.43
Price /kg feed (PT)* b	250.00	255.00	260.00	265.00	252.50	255.00	257.50
Total feed cost (LE) axb=c	11.08	11.42	11.65	11.85	11.24	11.35	11.41
Total egg production/hen/period d	17.27	18.39	20.47	21.67	17.51	21.53	23.32
Hatchability% e	77.55	80.50	80.51	81.14	78.68	79.96	84.32
Chick /hen/period (dxe=f)	13.39	14.80	16.48	17.58	13.78	17.22	19.66
Chick price (LE)**	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Total revenuer /hen/period c	33.48	37.00	41.20	43.95	34.45	43.05	49.15
Net revenuer (LE) (f-c=g)	22.40	25.58	29.55	32.10	23.21	31.70	37.74
Economic efficiency*** (g/c)	0.67	0.69	0.72	0.73	0.67	0.74	0.77
Relative economic efficiency ****	100	102.99	107.05	109.01	100	109.90	114.61

* According to the price of different ingredients available in the market at the experimental time.

** According to the local market price at the experimental period.

*** Net revenue per unit cost.

**** Group fed control diet (1)=100%.

Economic efficiency:

Data on economical evaluation (Table 7) indicated that the use of supplemental herbal mixture in breeder laying hens at 15 /Kg diet increased the total revenue per hen per period. This may be attributed to increasing the number of chick per hen ,this treatment group has achieved the best net revenue (LE) compared to groups supplemented with 30mg LC/kg. (37.74 *vs* 32.10) for net revenue). The same trend was noticed among relative economic efficiency.

CONCLUSION

From the performance parameters and economical point of view it may be concluded that:

1. 1. Addition of herbal mixture (as a natural antioxidant) to laying hens diets numerically increased egg number and improved feed conversion more than L-carnitine ,as an artificial antioxidant.
2. Addition of herbal mixture tended to improve fertility ,hatchability and hatchability of fertile eggs , while decreased both Embryonic early and late dead compared to L-carnitine supplemented groups.
3. Inclusion of dietary levels of herbal mixture (HM) in broiler breeder laying hens diets up to 15g/kg significantly improved internal and external egg quality parameters.
4. Addition of herbal mixture increased antioxidant capacity in blood plasma while decreased LDL, HDL, total cholesterol, triglycerides and total lipids in blood plasma.
5. The combination of 15g/kg herbal mixture is the most successful additive for improving hatchability under the condition of this study.
6. Further studies must be carried out to study the possibility of using natural antioxidants in commercial broiler breeders diets for a long period of time during laying periods.

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تأثير إضافة مستويات مختلفة من الكارنتين و مخلوط الأعشاب الطبيه على الاداء الانتاجى و التناسلى لأمهات دجاج اللحم

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تم إجراء هذه الدراسه فى محطة بحوث و تطوير الدواجن بشركة دواجن الوادى بالنوباريه و تم اجراء التحليلات و القياسات المعمليه بمعامل قسم التنميه المتواصله بمعهد الدراسات و البحوث البيئيه جامعة المنوفيه بمدينة السادات حيث تم استخدام حوالى ٤٦٢ دجاجه أمهات لاحم من سلاله Ross المنتجه للدجاج اللاحم عمر ٤٠ أسبوع، و ذلك بهدف دراسة تأثير اضافة مستويات مختلفة من الكارنتين أو مخلوط النباتات والأعشاب الطبية للعلائق على الاداء الانتاجى و التناسلى و مقاييس جودة بيض التفريخ الناتج و مقاييس الدم و المحتوى الميكروبي لزرق الأمهات ، و الكفاءة الاقتصادية لاستخدام هذه المضافات .

تم توزيع الدجاج عشوائيا إلى سبع مجموعات، كل مجموعه في ٣ مكررات (٢٠ دجاجه + ٢ ديك لكل مكرر) ليصبح كل مجموعه بها ستون دجاجه+ ستة ديوك. و كانت التغذيه محددة طبقا للمقررات الغذائيه و توصيات الشركه المنتجه للسلاله.

تم توفير الماء في كل الأوقات لكل المجموعات و تم رعاية و إدارة قطيع التجربه التى استمرت ١٢ أسبوع .تم تغذية المجموعات على عليقه قاعديه مكونه من الذره و فول الصويا لتغطى الاحتياجات الغذائيه لهذه السلاله و هذا العمر و الحاله الانتاجيه كما تم اضافة الكارنتين بمستويات ثلاث هى : ٣٠،٢٠،١٠ مجم/كجم عليقه للمجموعات ٣،٢،١ على التوالى وكذا ثلاث مستويات من مخلوط النباتات و الاعشاب الطبيه هى ١٥،١٠،٥ جم/كجم عليقه للمجموعات ٦،٥،٤ على التوالى بينما تم تغذيه المجموعه السابعه على العليقه القاعديه بدون أى إضافات كعليقه ضابطه و تم اخذ القياسات التاليه.

وزن الدجاج عند بداية و نهاية التجربه و حساب معدل التغير فى الوزن و حساب إنتاج البيض و معدل إنتاج البيض ووزن البيض و كتلة البيض و معامل التحويل الغذائى و الخصوبه و الفقس و

معدلات الفقس من البيض المخصب .و كذلك تم تقدير بعض مكونات الدم و المحتوى الميكروبى لزرق الدجاج .

أوضحت النتائج ما يلى :

١. أوضحت نتائج المجموعه التى غذيت على عليقه تحتوى على ١٥ جم لكل كجم مخلوط بنباتات طبيه زياده معنويه فى كل من معدل إنتاج البيض و إنتاج البيض الكلى و متوسط وزن البيض وكتلة البيض الكليه وكذلك كتلة البيض اليومية عن المجموعات سواء المغذاة على مستويات مختلفه من الكارنتين أو الكنترول.

٢. إضافة مخلوط النباتات الطبيه الى علائق أمهات دجاج اللحم حسن معنويات كلاً من: - معامل التحويل الغذائى -نسبة الخصوبه و الفقس ، بينما انخفضت نسبة النفوق الجينى فى المرحله المبكره و المتأخره لفترة التحضين مقارنة بالمجموعات المحتويه على الكارنتين او الكنترول.

٣. ادى اضافة مخلوط النباتات الطبيه لعلائق دجاج الامهات الى زياده معنويه فى محتوى بلازما الدم لكل من:

٤. مضادات الاكسده و الكالسيوم و الفسفور بينما انخفض المحتوى من البروتينات الدهنيه المنخفضة الكثافه و عالية الكثافة والكوليستيرول الكلى و الجلسريدات الثلاثيه و كذلك الدهون الكلية في بلازما الدم.

٥. إحتواء علائق أمهات اللحم على ١٥ جم مخلوط نباتات طبيه/ كجم عليقه حسن معنوياً المقاييس الداخليه و الخارجيه لبيض التفريخ الناتج بدرجه اكبر من العلائق المحتويه على الكارنتين او الكنترول.

٦. اظهر المحتوى البكتيرى للمسحات المأخوذة من زرق الدجاج للمجموعات المغذاة على مستويات مختلفه من مخلوط النباتات الطبيه أعداد أقل بدرجه معنويه عنها فى زرق الدجاج المغذى على العلائق المحتوية على مستويات مختلفة من الكارنتين او الكنترول .

٧. سجلت دراسة الكفاءة الاقتصادية أن المجموعه المغذاه على ١٥ جم مخلوط نباتات طبيه /كجم عليقه أحسن كفاءه إقتصاديه تحت الظروف البيئيه التي أجريت فيها الدراسة.

وتوصى الدراسة باستخدام مضادات الاكسده الطبيعيه لتحسين الاداء الأنتاجى و صفات التفريخ فى أمهات دجاج اللحم بمستوى ١٥ جم/كجم مخلوط النباتات الطبيه المذكوره بديلاً عن استخدام مضادات الاكسده الصناعيه.