Egypt. Poult. Sci. Vol. (42) (II): (171-185) (2022) **(2204-1198)**

Egyptian Poultry Science Journal

http://www.epsj.journals.ekb.eg/

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

IMPACT OF SUPPLEMENTING L-CARNITINE ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF MAMOURA CHICKEN DURING THE WINTER SEASON

Y.S.Rizk, Beshara M.M, Hanan S.Mohamed and Hassan Abde-Lkarim

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

Corresponding author: Beshara M.M Email: malakman88@yahoo.com

Received: 14/03/2022 Accepted: 16 /05/2022

ABSTRACT: The purpose of this study was to see how supplementing with L-carnitine affected the productive and reproductive performance of Mamoura chickens from 36 to 48 weeks of age during the winter season. A total number of 132 Mamoura laying hens (120 hens + 12 cocks), 36 weeks (wk.)-old, was used in a completely randomized design and randomly assigned into four dietary treatments as follow: L-carnitine at 0, 150, 300 and 450 mg/kg, each group was included on three replications (10 hens +1 cock in each replicate) and was kept until 48 weeks of age. Results revealed that supplementing different levels of L-carnitine resulted insignificant improvement in feed intake, laying %, fertility, hatchability % of fertile egg and hatchability % of setting egg. Also, the results showed that egg weight, egg mass, Chick weight at hatch liver weight % and heart weight % were significantly increased by feeding diets supplemented with L-carnitine. In hens fed diets supplemented with L-carnitine, feed conversion, mortality percent, serum albumin, cholesterol, serum triglycerides, low density lipoprotein, and aspartate transaminase enzyme levels were all significantly lower. It could be concluded that dietary L-carnitine fortified with300 or 450 mg/kg for Mamoura laying hens in winter led to improvement in productive and reproductive traits.

Keywords: Mamoura breeders, hatchability, laying performance, L-carnitine,

INTRODUCTION

The world food consumption pattern has changed over the last decades, with consumers becoming more and more aware of food quality attributes. Nowadays, quality attributes include not only nutritional and sensory aspects, but also food safety and environmental and animal wellbeing during rearing (Castillo et al., 2007). Environmental conditions had direct effect on poultry production. Heat stress interferes and suppresses productive efficiency by reducing growth performance and immune response (Lara and Rostagno, 2013). L-carnitine adding in diets reduces the amount of long-chain fatty acids availability for esterification to triacylglycerols and storage in the adipose tissue, also, L-carnitine has antioxidant properties (Xu et al., 2003).

Because of its favorable effects on raising resistance to metabolic disorders, avoiding some diseases, strengthening the immune system, improving poultry performance, and playing a role in metabolic and physiological processes, carnitine is an alternative food supplement in poultry diets Carrol et al., 2001, Gropp et al., 1994, MAST et al., 1999 . Carnitine having nearly the same effects of vitamins takes part in many metabolic roles in organism, such as lipid catabolism and production the energy (Walter et al., 2000, Carrol et al., 2001). The diets of broilers and quail contain a high amount of cereal grains, which provide modest levels of L-carnitine Walter et al., 2001. Therefore, when metabolic demands increase, insufficient endogenous L-carnitine synthesis combined with a limited dietary L-carnitine supply could become limiting for metabolic requirements (Buyse et al., 2001) .

The metabolic function of L-primary carnitine appears to be the transport of long-chain fatty acids into the mitochondria for Beta oxidation and energy production. L-carnitine production in the cells, in combination with food intake, is thought to be sufficient for proper function. When energy needs are high (as in fasting-growth broilers and cold temperatures). L-carnitine availability could become a limiting factor in oxidative metabolism. According to Olkowski et al. (2007) the level of cardiac L-carnitine in broilers with heart failure was lower than in normal broilers. Adding L-carnitine supplementation from exogenous source may be useful in certain cases. Increasing metabolic oxygen demand as well as pulmonary hypertension, cold temperatures can enhance ascites susceptibility (Stolz et al., 1992). However, little is known regarding changes in broilers grown in a low temperature setting, physiological measures serum biochemical for example serum protein and triglyceride (Zhang et al., 2010; Kheiri et al., 2011), cardiac and oxidative capabilities, and liver enzymes activity (AST and ALT) were raised (Yersin et al., 1992; Biswas et al., 1995; Diaz-Cruz et al., 1996). Therefore, the purpose of this study was to discover how L-carnitine supplementation affected the productive and reproductive traits of Mamoura chickens over the winter season.

MATERIALS AND METHODS

Birds and management:

This study was carried out at El – Serw poultry Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. It was carried out during December to February months (winter conditions). One hundred and thirty two Mamoura chickens (120 hens+12 cocks) 36 wks-old were used weighed and distributed into four experimental groups (30 females + 3 meals) each. According to the treatment groups, the chickens were arranged in a completely randomized design. Each treatment group was consisted of three replicates (10 hens+ 1 cock) each, and was kept until 48 weeks of age. Chickens were reared under similar hygienic, environmental and managerial conditions. Feed and fresh water were available all the time through the experimental period. Four dietary treatments were used as follow: L-carnitine at 0, 150, 300 and 450 mg/kg, each group was included on three replications (10 hens +1 cock in each replicate) and was kept until 48 weeks of age. The composition and calculated analysis of the basal diets are shown in Table 1.

Data collection and estimated parameters:

Productive and reproductive performance

Body weight of hens was recorded at the beginning and the end of the experimental periods. Body weight gain was calculated through the experimental period (36–48wks of age). Egg number (EN) and feed consumption (FC) were recorded while egg mass was calculated (EM; egg number × average egg weight) for each replicate then averaged and expressed per hen throughout the experimental period (36-48 weeks of age). Laying rate (LR; %) was also calculated (total EN produced/ total hen* 100) per each replicate. Feed conversion ratio (FCR; g feed/ g eggs) was calculated through the same period. Dead birds were recorded daily during the experimental period (36 - 48 weeks of age) and then hen's viability (%) was calculated through the experimental period. Body weight gain was calculated through the experimental period (36–48wks of age).

Hatching traits

A total of 600 suitable hatching eggs (150 eggs per each treatment) were collected and stored in a cold-humid area, then set in the incubator and incubated at 37.6 ºC and 56 % relative humidity. Eggs had been turned every 1 hour until they transferred to the hatching compartment at the 18st day of incubation. Eggs were examined by candling at day 18 of incubation and infertile eggs were removed. The hatching compartment was kept at 37.0 ºC and 65 % relative humidity until the end of hatching through incubation period. Fertility, hatchability and embryonic mortality percentages were calculated. And the hatched chicks were also weighed

Blood serum biochemical analysis: At the end of the 48th week of age, blood samples were collected in centrifugation tubes from three hens for per each treatment without anticoagulant and kept at room temperature for one hour to clot. The samples were centrifuged at 3500 rpm for 15 minutes to separate clear serum. After that, serum total protein,

triglycerides, cholesterol .High density lipoprotein, low density lipoprotein and liver enzymes activities (aspartate "AST, U/L:" and alanine amino transaminases "ALT, U/L) were calorimetrically determined using commercial Kits.

Slaughter traits: At the end of 48 week of age, three hens from each treatment group were randomly taken; slaughtering and individually weighed pre-slaughtering and post complete bleeding. Then, scalding, feather picking and evisceration were performed and different body parts, organs and abdominal fat were dissected and weighed. Relative weights of carcass traits were expressed to live weight.

5. Economic efficiency and net return

Economical efficiency and net return were calculated according to the prices of L-carnitine (450 LE / one kg), fertile one egg of Mamoura hen (2.00 LE) and one hatched chicks 3.0 LE) prevailing during experimental period:

Total cost LE = Total price of fertile eggs LE + Total price of L-carnitine LE

EEF = economic efficiency = (Net return LE / Total cost LE).

REEF = Net return % of control = net return of each group / net return of control

6. Statistical analysis: Data obtained were statistically analyzed using the general linear model of SAS (2004), as follows: $Yik = \mu + Ti + eik$

Where: Yik = an observation; μ= Overall mean; T= Effect of L-carnitine supplementation level; i= (1,2,.. and 4); and eik= random error. The significant differences among treatments means were tested by Duncan's multiple range test (Duncan 1955).

RESULTS AND DISCUSSION

Productive Performance Traits:

As shown in Table 2, the results of egg number in the current study showed that all dietary treatments did not actually differ from comparing with the control diet. The same manner was noticed in respect of feed intake where, no significant alternations were reported due to feeding on different levels of L-carnitine comparing with the hens fed the control diet. On the other hand, the diets supplemented with 300 and 450 mg L-carnitine /kg diet led to a significant increase ($P \leq 0.05$) in egg mass by 22.35 and 20.16% respectively compared to the control diet.

Some scientific publications illustrated that the considerable increase in egg laying (egg number or egg mass) as a results of adding l-carnitine in layer's diet could be attributable to increasing fatty acid - oxidation to adenosine triphosphate, resulting in enhanced energy yields by improving fatty acid and energy usage (Neuman et al. 2002). In addition, Agarwal and Said (2004) reported that L-carnitine improves fatty acid oxidation, which invigorates estrogen and progesterone biosynthesis by raising the production of the reducing equivalents required for the cholesterol side-chain cleavage reaction and these two factors partnership to promote ovarian small follicle growth and maturation, as well as speed up the ovulation process.

According to Al-Daraji and Tahir (2013) L-carnitine is an amino acid generator that improves the creation and secretion of albumin layers by boosting lipoprotein precursor synthesis in the liver, which is then deposited into the oviduct, resulting

in a rise in the proportion of laying rate and egg weight. Because albumen is formed from ovomucin, specifically - ovomucin, the increase in egg mass is likely related to an increase in metabolic level in magnum and/or increased activity of the shell gland, which may boost - ovomucin secretion when hens' diets are added with L-carnitine (USDA 2000). The results in the present study are agreement those of Al-Hayani (2012) and Awad *et al.* (2016), who found that addition of guinea fowl with 300 mg L-carnitine/kg diet increased egg quantity and egg weight. According to Kazemi-Fard et al. (2015), supplementing laying hens' diets with L-carnitine had a positive impact on egg production and egg mass. According to the current findings, laying hens fed a diet enriched with varied doses of L-carnitine consumed almost the same amount of feed. These results could be attributed to the fact that hens can adjust their feed intake based on their productivity and the calorie contents of the diet. Our findings in the line with those of Parizadian *et al.* (2011) and Kazemi-Fard *et al.* (2015), who discovered that addition of L-carnitine, had no effect on feed consumption.

Feed conversion ratio of hens fed diets with 150, 300, and 450 mg L-carnitine /kg improved by 17.04, 21.36, and 21.81 percent, respectively, and this finding could be resulting from an increase in egg laying and egg mass, also, an modification for the better in the coefficient of nutrients digestibility. The present results are consistent with those of Al-Hayani (2012), Kazemi-Fard *et al.* (2015), and Awad *et al.* (2016), who found that adding L-carnitine to the diet enhanced feed conversion ratio. L-carnitine protects cells from osmotic stress and acts as a second line of defense against reactive oxygen species and their derivatives by breaking free-radical chain reactions (peroxidation termination) and preventing unwanted oxidation reactions (Arenas *et al.* 1998). When compared to the other groups, the eggs from laying hens fed a diet containing 450 mg L-carnitine / kg were the highest. Supplementing the diet with L-carnitine had no effect on feed consumption (Table 2). In comparison to the other groups, laying hens fed diets containing three hundred and four hundred and fifty mg L-carnitine/kg had the best feed conversion ratio.

Hatching Traits

Dietary L-carnitine supplementation had no effect on fertility %, hatchability % of fertile eggs, or hatchability % of laying eggs; however it did have an effect on embryonic mortality percent and chick weight at hatch. The rate of embryonic death was reduced by 2.69 percent. Dietary L-carnitine supplementation (150, 300, and 450 mg/kg) increased weight loss by 7.51 percent and 10.28 percent, respectively. Dietary L-carnitine supplementation (300 and 450 mg/kg) increased chick weight by 3.62 and 3.17 percent, respectively, however chick weight produced from laying hens given 150 mg/kg fell by 4.24 percent as comparing with control group. The improvement in hatchability as well as decrease in embryonic mortality could be attributable to an increase in L-carnitine content in the egg yolk caused by food supplementation (Peebles *et al.,* 2007).

Furthermore, L-carnitine may enhancing growth stage of avian embryonic and hatched chicks by improving the

production of energy which incidence in mitochondria, which resulted in decrease the late dead of embryos, especially during the piping stage, because it work as an antioxidant to scavenge free radicals (Zhai et al., 2008). Fertility % from hens fed diets supplemented with one hundred and fifty, three hundred, and four hundred and fifty mg L-carnitine / kg were improved by 0.31, 1.89, and 2.52 percent, respectively, and this may be attributed to the fact that L-carnitine adding increases egg productivity, sperm concentration and semen quality. Sarica *et al.* (2007) obtained similar results in Japanese quail, reporting that supplemented dietary L-carnitine boosted fertility % without having any significant impacts. Dietary L-carnitine supplementation dramatically enhanced egg fertility in Domyati ducks, according to Awad *et al.* (2016). Hatchability % of fertile eggs was increased by 4.63 % in the current study for eggs produced by chickens fed a diet added with four hundred and fifty L-carnitine/kg. Furthermore, the hatchability % of setting eggs was raised by 5.66 % for the same groups.

Carcass traits:

Table 4 shows the effects of feeding on diets contained varying levels of L-carnitine on body weight and carcass parameters. The current results illustrated that different levels of L-carnitine had no effect on ultimate body weight when compared to a control diet. Addition LC by 300 mg/kg and 450 mg/kg, final body weight increased by 3.26 % and 3.48 % respectively, but adding 150 mg/kg L-carnitine, final body weight was lower than the other dietary treatments. The effects of adding of dietary LC on carcass characteristics are shown in Table 4 (expressed as percentages of LBW). By supplementing varied L-carnitine levels to the diets, carcass % was greatly improved, while abdominal fat % was significantly lowered as compared to the control. When hens fed diets supplemented with different levels of L-carnitine were compared to the control, carcass improvement % ranged from 1.12 percent to 6.73 %, while abdominal fat % dropped from 23.3 to 64.01 %.

In general, increasing L-carnitine to the diet may improve the ultimate live body weight and decrease un-edible components, resulting in a higher carcass percentage. The results of this study accord with those of Oladele *et al.* (2011), who observed that increasing the amount of L-carnitine in broiler diets enhanced dressing carcass percentage considerably (P0.05). In addition, Abdel-Fattah et al. (2014) found that supplementing diet of quails with L-carnitine (400 mg/kg food) raised their dressing percentage considerably. Daskiran and Teeter (2001) found no significant change in broiler dressing % in response to dietary L-carnitine. Sarica *et al.* (2005) discovered that carcass weights and yields were insignificantly improved not Japanese quail on a diet containing 200 mg LC/kg. L-carnitine may play a role in facilitating the removal of short and medium-chain fatty acids from the mitochondria that accumulate as a result of normal and abnormal metabolism, as well as promoting the -oxidation of these fatty acids to generate adenosine triphosphate energy and improve energy utilisation (Xu *et al.*, 2003). These present findings are comparable to those of Parsaeimehr *et al.* (2014), who discovered that feeding

broiler chickens with L-carnitine (300 mg/kg) dramatically reduced belly fat percentage. In Japanese quail, dietary L-carnitine boosted fertility (percent) without having any significant side effects. Supplementing with dietary L-carnitine had no influence on gizzard percent. Supplementation of L-carnitine to the experimental diet reduced gizzard percent, which agrees with Rabie and Szilagyi (1998), who reported that gizzard weight was reduced.

Blood Serum Constituents

Due to dietary L-carnitine supplementation, all examined serum components were significantly ($P \leq 0.05$) modified (Table 5). The highest levels of total protein were found in groups of hens fed diets containing 150 and 300 mg L-carnitine / kg (8.2 and 8.53 mg/dl, respectively), whereas the lowest total protein values were showed in the control hens which fed diet contained 6.8 and 7.76 mg LC/kg diet. Adding of three hundred and four hundred and fifty mg L-carnitine /kg resulted in increased levels of blood serum albumin. In comparison with the other groups, hens fed diets with three hundred and four hundred and fifty mg L-carnitine/kg diet had the lowest cholesterol levels (131 and 79.3 mg/dl). In comparison to other treatments, hens fed a diet supplemented with 450 mg L-carnitine/ kg and those fed a diet containing 300 mg L-carnitine/ kg had the lowest average triglyceride levels. The addition of L-carnitine to the laying diet reduced LDL values in all treatment groups as comparing with the control group. HDL values, on the other hand, were considerably higher in all treatment groups as compeer with control diet. When compared to other treatments, 300 mg L-carnitine/kg have the highest levels of HDL (18 mg/dl), while the lowest levels of LDL (26.33 and 28.3 mg/dl) were achieved with groups of hens fed diets containing three hundred and four hundred and fifty mg L-carnitine/kg, respectively.

By addition of different levels of L-carnitine than the control group, liver AST and AST enzymes were reduced. The metabolic condition of Mamoura laying hens and their health as modified by food L-carnitine supplementation throughout the winter season were evaluated using blood serum components. In hens fed a diet with LC, blood serum cholesterol levels were reduced by 0.68, 30.79, and 58.1 percent, respectively. In comparison to those feeding the control group, they were supplemented with one hundred and fifty, three hundred, and four hundred and fifty mg L-carnitine/kg, respectively.

Addition of L-carnitine reduced serum total cholesterol mostly through a drop in cholesteryl esters. Furthermore, it could be linked to a rise in biliary sterol excretion or a rise in cholesterol to bile acid conversion (Augustyniak and Skrzydlewska 2009). In hens fed diets containing three hundred and four hundred and fifty mg L-carnitine/kg, serum triglycerides were reduced by 30.2 and 39.63 percent, respectively. These could be as a result of boosting fatty acid oxidation by enhancing fatty acid transit capacity to the inner mitochondrial membrane. Furthermore, L- carnitine boosts lipase activity while decreasing lipoprotein lipase activity, resulting in an increase in fatty acid concentration in serum by speeding up the breakdown of TG to glycerol and fatty acids (Maritza *et*

al., 2006). Several studies have confirmed the benefits of L-carnitine in the regulation of blood lipids, which include total cholesterol and triglycerides Mirzaei (2016), who discovered that dietary fortified with L-carnitine resulted in a significant decrease in blood total cholesterol and AST and ALT when comparing with the control diet.

Economic efficiency:

Calculations were made using the prices of L-carnitine and fertile Mamoura hen's eggs and chicks as given in Table for the year 2021. (6). Dietary L- carnitine supplementation (300 and 450 mg/kg) increased net return by 8.85 and 57.32 percent, respectively. For the control, 150 mg/kg, 300 mg/kg, and 450 mg/kg treatments, the economic efficiency was 9.83, 7.82, 10.65, and 15.63, respectively. In comparison to other treatments, (Ardekani *et al.,* 2012). The current findings are consistent with those of (Elgazzar *et al.,* 2012), Fallah and

450mg/kg had the best net return and economic efficiency. An increase in hatchability and a decrease in embryonic mortality could reflect the improvement in EE.

CONCLUSION

According to the current resulting, dietary L-carnitine fortified with three hundred or four hundred and four hundred and fifty mg/kg diet might be used to maximize and increase net return and economic efficiency, as well as productive and reproductive performance of mamoura hens during the winter season; as a result, taking L-carnitine supplements is strongly suggested.

Table (1): Composition and calculated analysis of the basal diet

Ingredients %	**Layer**
Yellow Corn	64.00
Soybean meal (44%)	22.50
Corn gluten (60%)	1.58
Wheat bran	1.68
Di-calcium phosphate	1.40
Limestone	8.14
Vit.&Min. Premix[1]	0.30
NaCl	0.30
DL.Methionine	0. 10
Total	100
Calculated Analysis[2]	
Crude protein %	16.10
ME (Kcal / kg)	2730
Crude fat %	2.87
Crude fiber %	3.30
Calcium %	3.43
Av.phosphorus %	0.39
Lysine %	1.10
Methionine %	0.40
Methi+ Cyst %	0.68

1- Each 3 kg of the Vit and Min. premix manufactured by Agri-Vit Company, Egypt contains: Vitamin A 10 MIU, Vit. D 2 MIU, Vit E 10 g, Vit. K 2 g, Thiamin 1 g, Riboflavin 5 g, Pyridoxine 1.5 g, Niacin 30 g, Vit. B12 10 mg, Pantothenic acid 10 g, Folic acid 1.5 g, Biotin 50 mg, Choline chloride 250 g, Manganese 60 g, Zinc 50 g, Iron 30 g, Copper 10 g, Iodine 1g, Selenium 0. 10 g, Cobalt 0.10 g. and carrier CaCO3 to 3000 g.

2- According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001)

Table (2): Effect of different levels of L-carnitine supplementation on laying performance of Mamoura hens

Parameters	L-carnitine levels (mg/kg)(				Pooled SEM	Sig
	control	150	300	450		
Egg number / day	13.69	15.9	16.75	16.45	0.56	N.S
Laying rate %	45.63	53.01	55.83	54.84	1.87	N.S
Egg weight (g)	52.84^{b}	54.72^{ab}	55.04^{a}	55.53^{a}	0.40	*
Egg mass (kg / hen)	24.11^{b}	28.97^{a}	30.72^{a}	30.84^{a}	0.86	*
Feed intake (g/hen/d	105.9	105.7	106.4	104.7	0.73	N.S
Feed conversion ratio (g feed/g egg)	4.4^{a}	3.65^{b}	3.46^{b}	3.44^{b}	0.12	*

a,b,c,d :means in the same row bearing different superscript are significantly different ($P \leq 0.05$; NS= Non significant

Table (3): Effect of different levels of L-carnitine supplementation on reproductive performance of laying hens

Parameters	L-carnitine levels (mg/kg)				Pooled SEM	Sig
	control	150	300	450		
Fertility %	83.60	83.86	85.18	85.71	0.91	N.S
Hatchability of fertile egg %	86.27	85.89	86.95	90.27	1.22	N.S
Hatchability of setting egg %	73.22	72.03	74.07	77.37	1.06	N.S
Mortality %	14.1^{a}	13.72^{a}	13.04^{a}	9.72^{b}	0.55	*
Chick weight at hatch (g)	37.5^{a}	35.91^{b}	38.86^{a}	38.69^{a}	0.39	*

a,b,c,d :means in the same row bearing different superscript are significantly different ($P \leq 0.05$)

Table (4): Effect of different levels of L-carnitine supplementation on live body weight and carcass traits of laying hens

Parameters	L-carnitine levels (mg/kg)(				Pooled SEM	Sig
	control	150	300	450		
Initial body weight (g)	1795	1810	1915	1960	0.031	N.S
Final body weight (g)	1836	1801	1896	1900	0.023	N.S
Carcass %	64.44	65.77	65.22	68.78	0.78	N.S
Abdominal fat %	3.39^{a}	2.6^{b}	1.9^{c}	1.22^{d}	0.25	*
Liver %	2.2^{b}	2.57^{ab}	2.74^{a}	2.53^{ab}	0.08	*
Heart %	0.44^{c}	0.56^{ab}	0.50^{bc}	0.6^{a}	0.02	*
Gizzard %	1.76	1.72	1.55	1.67	0.07	N.S

a,b,c,d :means in the same row bearing different superscript are significantly different ($P \leq 0.05$

Table (5): Effect of different levels of L-carnitine supplementation on some biochemical traits of blood serum of laying hens

Parameters	L-carnitine levels (mg/kg)(				Pooled SEM	Sig
	control	150	300	450		
Total protein	6.8^{b}	8.2^{ab}	8.53^{a}	7.76^{ab}	0.28	*
Albumin	2.0^{b}	2.2^{ab}	2.63^{a}	2.26^{ab}	0.08	*
Cholesterol	189.3^{a}	188^{a}	131^{ab}	79.3^{b}	18.0	*
Triglyceride	824.3^{a}	733.3^{ab}	575.3^{bc}	497.6^{c}	44.9	*
HDL	12^{c}	14.67^{b}	18^{a}	15.67^{b}	0.67	*
LDL(mg/dl)	32^{a}	30^{b}	26.33^{d}	28.3^{c}	0.66	*
AST	298.3^{a}	266.0b	213^{c}	259.3^{b}	9.98	*
ALT	32^{a}	30^{ab}	28^{ab}	23^{b}	1.35	*

a,b,c,d :means in the same row bearing different superscript are significantly different ($P \leq 0.05$); HDL= high density lipoprotein; LDL= Low density lipoprotein; AST= Aspartate transaminase; ALT= Alanine transaminase

Table (6): Effect of dietary L-carnitine supplementation on economical efficiency (EE) for Mamoura chickens at the end of experimental period.

Items	L-carnitine			
	Control (0)	150 mg/kg	300 mg/kg	450 mg/kg
No. of fertile eggs	150	150	150	150
Cost of fertile eggs (LE)*	300	300	300	300
L-caritine cost / hen (LE)	0	0.6	1.2	1.78
Total cost (LE)	300	300.6	301.2	301.78
No.of hatched chicks	109.83	108.04	111.1	116.05
Total price of hatched chick(LE)	329.49	324.12	333.3	348.15
Net return (LE)	29.49	23.52	32.1	46.37
EEF	9.83	7.82	10.65	15.63
REEF	100	79.75	108.85	157.23

*L.E = Egyptian pound; EEF= Economic efficiency; REEF= Relative economic efficieny

REFERENCES

Abdel-Fattah, S.A.; E. F. El-Daly and N. G.M. Ali 2014. Growth performance, immune response, serum metabolites and digestive enzyme activities of Japanese quail fed supplemental L-Carnitine. Global Vet., 12: 277-286.

Agarwa, l.A. and T.M. Said 2004. Carnitines and male infertility. Reprod BioMed Online 8: 376-384

AL-Daraji, H.J. and A.O. Tahir 2013. Effect of dietary supplementation with L-canitine on productive performance of local ducks. Inter J Agric Sci 3: 101-110.

AL-Hayani W.K.H. 2012. The uses of different levels of L-carnitine for improve productive performance of Guinea Fowl. Ph.D. Thesis, College of Agriculture, Baghdad University, Iraq

Arenas. J. R. Ubioc, J.C. and M.A. Martin 1998. Biological roles of L-carnitine in perinatal metabolism. Early Hum Dev 53: 43-50.

Augustyniak, A. and E. Skrzydlewska 2009. L-Carnitine in the lipid and protein protection against ethanol-induced oxidative stress. Alcohol 43: 217-223.

Awad, A.L, Fahim, H.N. and M.M. Beshara 2016. Effect of season and dietary L-carnitine supplementation on

Biswas, N. K., M. R. Dalapati and M. K. Bhowmik. 1995. Ascites syndrome in broiler chickens: Observations on certain biochemical and pathological changes. Indian J. Anim. Sci. 65:1068-1072.

Buyse, J., Janssens G.P. and E. Decuypere 2001. The effects of dietary L-carnitine supplementation on the performance, organ weights and circulating hormone and metabolite concentrations of broiler chickens reared under a normal or low temperature schedule. Br. Poult. Sci., 42, 230-241

Carrol M.C. and E. CORE (2001). Carnitine: a review. Comp. Cont. Edu.Pract. Vet., **23**, 45-52.

Castillo, C.C., A. A. Pinto., G. L. Souza., N. J. Beraquet., A.P. Aguiar., K. M. V. A. B. Cipolli., C. M. I. Mendes and E. M. Ortega 2007. Effects of feed withdrawal periods on carcass yield and breast meat quality of chickens reared using an alternative system. J. Appl. Poult. Res. 16:613–622.

Daskiran, M. and R.G. Teeter 2001. Effects of dietary L-carnitine supplementation on overall performance and carcass characteristics of seven-week-old broiler chickens. Animal Science Research Report.

Diaz-Cruz, A., C. Nava, R. Villanueva, M. Serret, R. Guinzberg and E. Pina. 1996. Hepatic and cardiac oxidative stress and other metabolic changes in broilers with the ascites syndrome. Poult. Sci. 75:900-903.

Duncan, D.B. 1955. Multiple ranges and multiple F tests.Biometrics 11: 1-42.

ELgazzar U.B., I. Isamaen, A. Ghanema and Z.M. kalaba 2012. Effect of dietary L-carnitine supplementation on the concentration of circulating serum metabolites in growing New Zealand Rabbits. Austral J Basic Appl Sci 6: 80-84.

Fallah R., and Mirzaei E. 2016. Effect of adding L-carnitine and Protexin® probiotic on performance and some

blood parameters of ostrich chickens. Bras J Biol Sci 3: 153-164.

Feed Composition Tables for Animals and Poultry Feedstuffs Used in Egypt 2001. Technical Bulletin No., 1, Central Lab. For Food and Feeds (CLFF) Ministry of Agric. Res. Cent. Egypt.

Gropp J.M., A. Schumacher and F.J. Schweigert 1994. Recent research in vitamin nutrition with special emphasis to vitamin A, B- carotene and L-carnitine. In: Proceedings of the Meeting of the Arkansas Nutrition Conference, Fayetteville, AR: Arkansas Poultry Federation, 124-134.

Kazemi-Fard M., S. Yousefi, E. Dirandeh and M. Rezaei 2015. Effect of different levels of L-carnitine on the productive performance, egg quality, blood parameters and egg yolk cholesterol in laying hens. Poultry Sci J 3: 105-111.

Kheiri, F. J. Pourreza, Y. Ebrahimnezhad, K. Nazeradl and S. M. A. J. Haji-abadi. 2011. Effects of supplemental ractopamine and L-carnitine on growth performance, blood biochemical parameters and carcass traits of male broiler chicks. Afr. J. Biotechnol. 10:15450-15455.

Lara, L.J. and Rostagno, M.H., 2013. Impact of heat stress on poultry production. Anim. J., 3:356-369.

Maritza, F.D., U.A. Julio, L. Flor and H.R. Frank 2006. L-carnitine induced modulation of plasma fatty acids metabolism in hyper-lipidemic rabbits. Rev Electron Biomed/Electron J Biomed 1: 33-41.

Mast J., J. buyse and B.M. Goddeeris B.M.199. Dietary L-carnitine supplementation increases antigen-specific immunoglobulin G production in broiler chickens. Br. J. Nutr., **83**, 161-166.

Oladele, O.A., F. Adeboye, S. Richard and H. Zainob, H. 2011. Growth response, carcass yield and serum biochemistry of broiler chicken feds with supplemental L-carnitine in feed or drinking water. J. Poult. Sci., 48: 223-228.

Olkowski, A. A., S. Nain, C. Wojnarowicz, B. Laarveld, J. Alcorn and B. B. Ling. 2007. Comparative study of myocardial high energy phosphate substrate content in slow and fast growing chicken and in chickens with heart failure and ascites. Comp. Biochem. Physiol. A Mol. Integr. Physiol. 148:230-238.

Parizadian, B., Y.J. Ahangari, S.M. Shargh and A. Sardarzadeh 2011. Effects of different levels of L-carnitine supplementation on egg quality and blood parameters of laying Japanese quail. Int J Poultry Sci 10: 621-625.

Parsaeimehr, K., M. Afrouziyeh and S. Hoseinzadeh 2014. The effects of L-carnitine and different levels of animal fat on performance, carcass characteristics, some blood parameters and immune response in broiler chicks. Iranian J. of Appl. Anim. Sci., 4: 561-566.

Peebles, E. D., M. T. Kidd, C. D. McDaniel, J. P. Tanksley, H. M. Parker, A. Corzo, and J. C. Woodworth 2007. Effects of breeder hen age and dietary L-carnitine on progeny embryogenesis. Br. Poult. Sci., 48:299–307

productive and reproductive performance of local duck breeds. Egypt Poultry Sci J 36: 29-51.

Rabie, M. H. and M. Szilagyi 1998. Effects of L-carnitine supplementation of diets differing in energy levels on performance, abdominal fat content, and yield and composition of edible meat of broilers. In British Journal of Nutrition, vol. 80, pp. 391–400

Sarica. S., M. Corduk, M. Suicmez, F. Cedden, M. Yildirim K. AND Kilinc 2007. The effects of dietary L-carnitine supplementation on semen traits, reproductive parameters, and testicular histology of Japanese quail breeders. J Appl Poultry Res 16: 178-186.

Sarica, S., M. Corduk and K. Kilinc 2005. The effect of dietary L–carnitine supplementation on growth performance, carcass traits and composition of edible meat in Japanese quail. J. Appl. Poult. Res., 14: 709-715.

SAS. 2004. SAS User's Guide: Statistics. Edition 9.1. SAS Institute Inc., Cary, NC.

Stolz, J. L., L. M. Rosenbaum, D. Jeong and T. W. Odom. 1992. Ascites syndrome, mortality and cardiological responses of broiler chickens subjected to cold exposure. Poult. Sci. 71(Suppl 1): 4(Abstr.).

USDA- UNITED STATES DEPARTMENT OF AGRICULTURE. 2000. Egg-Grading Manual. Agricultural Handbook. No: 75. Washnigton, DC, 50 p.

Walter, P. 2000. L-carnitine a 'vitamin-like substance for functional food. Ann. Nutr. Metab., 44, 75-96

Xu, Z.R., M.Q. Wang, H.X. Mao, X.A. Zhan and C.H. Hu 2003. Effects of L-carnitine on growth performance, carcass composition and metabolism of lipids in male broilers. Poult. Sci., 82: 408-413.

Yersin, A. G., W. E. Huff, L. F. Kubena, M. A. Elissalde, R. B. Harvey, D. A. Witzel and L. E. Giroir. 1992. Changes in hematological, blood gas and serum biochemical variables in broilers during exposure to stimulated high altitude. Avian Dis. 36:189-197.

Zhai, W., S.L. Neuman, M.A. Latour and P.Y. Hester 2008. The effect of male and female supplementation of L-carnitine on reproductive traits of white Leghorns. Poult. Sci., 87:1171-1181.

Zhang, Y, Q. G. Ma, X. M. Bai, L. H. Zhao, Q. Wang, C. Ji, L. T. Liu and H. C Yin. 2010. Effects of dietary acetyl-L-carnitine on meat quality and lipid metabolism in arbor acres broilers. Asian-Aust. J. Anim. Sci. 23:1639-1644.

الملخص العربى
تأثير إضافة ال-كارنيتين علي الأداء الإنتاجي والتناسلي لدجاج المعمورة خلال فصل الشتاء

ياسر صديق رزق ، ملاك منصور بشاره ، حنان محمد ،حسن عبد الكريم
معهد بحوث الإنتاج الحيواني مركز البحوث الزراعية – وزارة الزراعة – الدقي – الجيزة

الهدف من اجراء هذا البحث هو دراسة تأثير اضافة الـ ال-كارنيتين للعليقة علي الأداء الإنتاجي والتناسلي لدجاج المعمورة خلال فصل الشتاء وذلك في الفترة ٣٦من الي ٤٨ اسبوع من عمر الدجاج. تم استخدام ما جملته ١٣٢ دجاجة بياض معمورة (١٢٠ فرخة + ١٢ ديك) عمر ٣٦ أسبوع ، استخدمت في تصميم تام العشوائية وتم توزيعها علي أربعة معاملات تجريبية (٣٠ فرجة + ٣ ديوك / معاملة) وثلاثة مكررات لكل معاملة تجريبية (١٠ فرخات + ١ ديك / مكررة). وقد تم توزيع البحث في أربعة معاملات تخريبية كما يلي، العليقة المقارنة بدون اضافة ا ال-كارنيتين ، ١٥٠ ملجم من ال-كارنيتين / كجم عليقة، بينما المعاملة الثالثة والرابعة تشمل التغذية علي العليقة الأساسية مضافا اليها ٣٠٠ و ٤٥٠ مجم ال-كارنيتين/ كجم عليقة. أوضحت النتائج أن المستويات المختلفة المضافة من ال-كارنيتين أدت الي تحسن غير معنوي في واستهلاك العلف ومعدل انتاج البيض والخصوبة والفقس من البيض المخصب والكلي. من ناحية أخري فقد وجد تحسن معنوي في وزن البيض وكتلة البيض ووزن الكتكوت عند الفقس ووزن الكبد والقلب % بالتغذية علي علائق مضاف اليها ال-كارنيتين. وقد وجد انخفاض معنوي في كل من معدل التحويل الغذائي والنفوق% وألبيومين السيرم والكوليستيرول ومستوي الجلسريدات الثلاثية واللبيوبروتين منخفض الكثافة و AST في الدجاجات المغذاه علي عليقة مضاف اليها ال-كارنيتين.
الخلاصة أن نتائج البحث الحالي اوضحت أن اضافة ال-كارنيتين بمستوي ٣٠٠ أو ٤٥٠ مجم لكل كجم عليقة لدجاج المعمورة في فصل الشتاء يحسن من الأداء الانتاجي والتناسلي.