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Evaluating meat production, growth performance, carcass traits, and blood parameters in the Fayoumi chicken breed by using L-Carnitine

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ABSTRACT

This study examined the impact of dietary L-carnitine supplementation on native Egyptian breed (Fayoumi chicken) growth parameters, carcass features, and serum biochemical markers. The present study was performed on 96 male Fayoumi chicks divided into four groups each one had 3 replicates each replicate contained 8 chicks, the first group was control, and the second, third, and fourth groups receive L-Carnitine (25, 50 and 100 mg/kg B.W, respectively) in drinking water. The experiment was expanded for 3 months. All birds were weighed at the end of each week. The results demonstrated an improvement in feed efficiency (FCR) and body-weight gain (BWG) After 90 days. The obtained results revealed that body weight after slaughtering (bled, de-feathered), semi-eviscerated carcass weight, dressed carcass weight, and breast weight, significantly increased in all treated groups (G_2, G_3, G_4). Each of the head, liver, heart, and lung weights were recorded and showed a non-significant difference at ($P<0.05$). The sera were obtained during slaughtering for biochemical tests which showed that the increasing the level of L-carnitine led to a significant decrease in cholesterol, and a significant increase in total protein, albumin, and total globulin. While the decrease in triglyceride and LDL is not significant. In conclusion, adding L-Carnitine to drinking water can improve meat production in Fayoumi chicken. Consequently, further studies are needed to explore the effects of higher dosages of supplementary carnitine to determine the optimum supply for improvement of meat production in male Fayoumi chickens.

1. INTRODUCTION

Due to its lower price compared to most other meats, poultry represents the second-highest meat consumption in the world (Valceschini, 2006). Breeders and nutritionists are under more pressure to raise the effectiveness of chicken growth and the quality of their meat due to the growing demand for poultry (Petracci and Cavani, 2011).

Carnitine can be biosynthesized endogenously from methionine and lysine (Cox et al., 1973). The endogenously synthesized amounts of l-carnitine are enough for proper growth and function under normal physiological conditions, but its needs are augmented under diet circumstances and during physiological and metabolically demanding times like growth and laying periods. In energy-demanding birds, L-carnitine boosts energy generation, fat metabolism, and immunological function (Neuman et al., 2002; Sarica et al., 2005; Rehman et al., 2017). The nutritional benefits of L-carnitine on chicken feed consumption and weight increase are controversial, according to the literature (Golzar Adabi et al., 2011).

L-Carnitine dietary supplements increase broilers' growth (Nouboukpo et al., 2010; Hrnčár et al., 2015; Abouzed et al., 2019). Murali *et al.* (2015) found that broilers' feed intake was unaffected by the administration of dietary L-carnitine at a dose of (900 mg/kg diet). Arslan et al. (2004) and Saricaet al. (2005) revealed that L-carnitine supplementation had no appreciable effect on the development and carcass characteristics of quails.

L-carnitine significantly increased breast muscle yield and crude fat content of the muscles, it also decreased abdomen fat content (Xu *et al.*, 2003). Other studies demonstrated that No difference in carcass yield was seen when L-carnitine was supplemented (Celik & Oztürkcan, 2003; Kidd et al., 2009). Lien and Horng(2001) discovered that L-carnitine had no discernible impact on the weights of the liver and heart.

Azizi-Chekosari and Bouyeh (2021) recorded that L-Carnitine supplementation resulted in a decrease in triglycerides, cholesterol, glucose, and VLDL levels and a rise in albumin, protein, HDL, and HDL/LDL levels. Also, Youssef found that L-Carnitine supplementation considerably decreased cholesterol levels. Zhang *et al.* (2010) discovered that L-Carnitine decreased blood triglycerides in broilers by enhancing fatty acid metabolism. Amin and Nagy (2009) reported that increasing exogenous L-carnitine reduces serum TG and T-cholesterol. Parsaeimehr et al. (2014) stated that the amount of total protein had no discernible impact.

There hasn't been much investigation on the effects of dietary L-carnitine supplementation on the carcass composition, performance, and meat output of Fayoumi chicken, which is popular because it has a nice taste and is more resistant to bacterial and viral infection, but it has low

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body weight. Therefore, our study explores how to improve meat production through the use of L-Carnitine in Fayoumi chicken.

2. MATERIAL AND METHODS

This study was carried out in the Faculty of Veterinary Medicine, Benha University, for three months.

2.1. Birds, housing and management

One-day-old male pure Fayoumi breed chicks, average body weight of 33 gm, were acquired from the EL-Tkamoly poultry project from EL-Fayoum. Research ethics approval (BUFVTM 10-01-23). They were kept in a tidy, well-ventilated space that had previously been formalin- and potassium permanganate-fumigated.

2.1.1. Ration:

Birds had unlimited access to food and clean water. Diet was formulated according to breed requirements (Table 1).

2.1.2. Lighting:

24-hour-a-day illumination, both natural and artificial, was given during the whole trial (90 days).

2.1.3. Heating:

Brooding temperatures began at 32°C for the first week, dropped to 29°C for the second week, 26°C for the third week, 23°C for the fourth week, and stayed at 21°C until the experiment's end (90 days) (Azab et al., 2017).

2.1.4. Ventilation:

Ventilation was adequate to remove moisture allowing litter to dry and removing ammonia & carbon dioxide.

2.2. Experimental design:

Four groups of 96 chicks were created at random. Each group was divided into three duplicates, with eight birds in each replicate. They received a beginning diet (0–28 days), grower (29–49 days), and finisher (50 to 90 days). Adding L-Carnitine (syrup- ampoule, produced by Arab company for pharmaceuticals and medicinal plants (MEPACO-MEDIFOOD) in drinking water. Doses according to Xu *et al.* (2003).

1) First Group: control group.
2) Second Group: with dose 25 mg/kg B.W/day.
3) Third Group: with dose 50 mg/kg B.W/day.
4) Forth Group: with dose 100 mg/kg B.W/day.

Individual chick weights were taken at the beginning of the experiment, and subsequent weekly measurements of live body weights, feed consumption, and weight gain were taken (differences between every two successive weights).

2.3. Growth performance, feed intake and feed efficiency evaluations

2.3.1. Body mass index and weight gain:

At the beginning of the experiment and after each week, the chicks were precisely weighed individually, and the changes in live body weight were recorded as a measure of growth. The difference between the beginning weight and the final weight at the end of each week was used to compute the body weight growth (given in grams) of the hens.

2.3.2. Relative growth rate (RGR):

Relative growth rate (%) was calculated according to Crampton and Lioyd (1959).

RGR=100 (W2- W1)/½ (W2 + W1)

Where: W1= Body weight at the beginning of the week.
W2= Body weight at the end of the week.

2.3.3. Daily feed intake:

Regularly in the morning, the difference between the weight of the offered feed and the remaining part was determined, and the daily feed consumption was then divided by the number of birds in each group.

2.3.4. Feed conversion ratio (FCR)

It was calculated according to Wagner et al. (1983).

FCR= Feed intake (g)/bird/week divided by Body weight gain (g) /bird/week

2.3.5. Average daily gain:

It is the weight gain related to the number of days calculated.

Average daily gain (ADG) =W2-W1 divided by days (7)

Where: W1 = body weight at the beginning of the week.
W2 = body weight at the end of the same week.
Days= number of days between W1 and W2

Table 1 Composition (%) of the starter diets (1-28 days), grower diets (29-49 days), and finisher diets (after 49 days):

Items	Starter%	Grower%	Finisher%
yellow corn	57.80	65.44	64.90
Soya bean meal 46	36.20	27.90	24.80
Limestone	1.55	2.40	1.20
di-CA-Ph.	1.50	1.33	1.13
vegetable oil	1.29	1.20	2.80
DL-Methionine	0.37	0.40	0.32
Lysine hydro	0.30	0.36	0.35
Vitamin & mineral premix1	0.30	0.30	0.30
Sod. Bicarbonate	0.25	0.26	0.24
NaCl	0.25	0.22	0.24
Anti-Mycotoxin	0.05	0.05	0.05
Choline chloride	0.05	0.05	0.05
Anti-Coccidia	0.05	0.05	0.05
Emulsivet DS	-	-	0.03
Axtra XB (energy enzyme)	0.01	0.01	0.01
Axtra PHY (Phytase enzyme)	0.01	0.01	0.01
Lincomix	0.01	0.01	0.01
Axtra pro (Protease enzyme)	0.01	0.01	0.01
Wheat bran	-	-	3.50

=================== Chemical composition ===================

Nutrients	Unite	Starter	Grower	Finisher
Metabolizable energy	Kcal/kg	2987.70	3162.30	3207.05
Crude protein	%	22.18	19.02	18.01
Crude fat	%	4.00	5.07	5.54
Crude fiber	%	2.32	2.20	2.41
Linoleic acid	%	1.89	2.33	2.52
Lysine	%	1.34	1.20	1.10
Available lysine	%	1.22	1.11	1.01
Methionine	%	0.67	0.62	0.57
Available Methionine	%	0.64	0.60	0.55
Methionine + cysteine	%	1.00	0.91	0.85
Available Methionine + cystine	%	0.91	0.84	0.78
Total calcium	%	0.95	0.85	0.80
Available phosphorus	%	0.48	0.43	0.40
Chloride	%	0.24	0.24	0.24
Potassium	%	0.90	0.76	-
Sodium	%	0.17	0.16	0.16

2.4. Identifying carcass characteristics:

Three birds from each group were randomly selected after the experiment, fastened for 12 hours, and then the carcass qualities were evaluated as: the bird live body weight, post-slaughter body weight, semi-eviscerated carcass weight (includes head, thoracic viscera, liver, and kidneys), dressed carcass weight (no head or viscera) and breast weight, head weight (g), heart weight (g), lung weight (g). To calculate the dressing percentage, the dressed carcass weight was expressed as a percentage of the live body weight and as a percentage of each internal organ (Ferket et al., 1993).

2.5. Biochemical analysis of blood:

Blood samples were taken from birds fasted the previous night through their wing veins. To separate the serum, blood was allowed to clot for 30 minutes at room temperature and centrifuged at 3000 rpm for 15 minutes Eppendorf's tubes were then kept at -20 until use (Stott and Fellah, 1983). Determination of total protein according to (Oshige et al., 1999)Using the commercial kit supplied by DIAMOND DIAGNOSTICS, Cairo, Egypt. Albumin was determined according to (Doumas et al., 1971) Using the commercial kit supplied by DIAMOND DIAGNOSTICS, Cairo, Egypt. However, globulin was obtained by subtraction of plasma albumin from total protein. Determination of Serum total cholesterol according to Alagwu et al. (2011)Using a commercial kit supplied by

SPINREACT, Santa Coloma, Spain. Triacylglycerol was determined according to Fossati and Prencipe (1982) Serum high-density lipoprotein cholesterol was determined according to Gordon et al. (1977) LDL-c was calculated according to the equation of Friedewald et al. (1972).

2.6. Statistical analysis:

The mean ± SEM was used to express all values. With the use of One-Way ANOVA and the following Duncan's multiple range test, mean values across treatment groups were compared (Duncan, SPSS Student Version 10.0.7, June). The threshold of ($P<0.05$) was used to determine the statistical significance of mean differences.

3. RESULTS

3.1. Impact of L-carnitine dosages on growth performance, feed intake and feed efficiency evaluations

3.1.1. Birds body weight:

The bird's weights at the end of each week are shown in Table (2). From the 3rd week till the 12th week, there was a significant ($P<0.05$) difference among the control and treated groups. Final body weight revealed a substantial difference ($P<0.05$), the highest value (1221.67 g) was recorded in the fourth treated group (100 mg/kg), and the lowest value (1100 g) was in the control group.

3.1.2. Birds body weight gain:

Results in Table (3) showed that body weight gain (g) differed significantly ($P<0.05$) among different weeks and treated groups. The final body weight gain significantly ($P<0.05$) differed, and all treated groups were higher than the control group. The highest value (1206.67 g) was recorded in the fourth treated group, and the lowest value (1068.33 g) was in the control group.

3.1.3. Relative growth rate (%)

Results in Table (4) showed that RGR differed among different weeks and treated groups.

3.1.4. Birds feed conversion rate

Results in Table (5) showed that FCR was significantly improved by 3.13, 3.20 and 3.25 for growing Fayoumi chicken supplemented with L-carnitine 100, 50 and 25 mg/kg than the control group.

3.1.5. Birds daily feed intake (g)

Results in Table **(6)** showed a non-significant difference in DFI among different weeks and treated groups.

3.2. Impact of L-carnitine dosages on carcass characteristics:

Carcass weight semi-eviscerated carcass weight, dressed carcass weight, head weight, liver weight, heart weight, lung weight, and their relative percent (%) among different experimental groups treated with L-carnitine for 3 months are represented in Table (**7**). The post-slaughter body weight, semi-eviscerated carcass weight, dressed carcass weight, and breast weight showed significant differences ($P<0.05$), all treated groups were higher than the control group.

The percentage of carcass weight varied greatly ($P<0.05$), with the highest value recorded in the second (25 mg/kg) and third (50 mg/kg) groups, and the lowest value for the control group. Semi-eviscerated carcass weight and breast weight were significantly ($P<0.05$) higher in all treated groups than the control group. The dressed carcass weight was significant ($P<0.05$) difference greater in the 2nd (25 mg/kg) and 4th (100 mg/kg) groups.

Table 2 Effect of different doses of L-carnitine on body weight (g) at different weeks.

Parameter (BW)	Control group	25 mg/kg B. W	50 mg/kg B. W	100 mg/kg B. W
Initial weight	31.67 ± 1.67	30.8.3 ± 0.83	33.33 ± 1.67	31.67 ± 0.83
1st week	67.08 ± 1.50	67.71 ± 1.46	65.00 ± 2.89	68.33 ± 1.67
2nd week	112.92± 3.07	110.21 ± 1.63	112.71 ±1.63	113.54 ± 1.45
3rd week	198.96 ± 7.29ab	194.17 ± 2.11b	202.92 ± 4.90ab	212.71 ± 2.40a
4th week	278.33± 7.43b	300.63 ± 3.66a	279.17±12.26ab	304.58 ± 5.59a
5th week	375.33 ± 10.17b	403.96 ± 7.61a	398.54 ± 5.18ab	413.33 ± 12.1ab
6th week	462.29 ± 17.86b	507.92 ± 10.27ab	527.08 ± 18.03a	519.17 ± 15.57ab
7th week	547.92 ± 16.58b	584.38 ± 7.02ab	598.33 ± 4.41a	584.58 ± 17.33ab
8th week	772.92 ± 29.97b	868.54 ± 6.75a	866.67 ± 10.98a	845.83 ± 26.78a
9th week	872.29 ± 34.19b	953.33 ± 36.78ab	973.33 ± 12.02a	965.00 ± 12.58a
10th week	917.500±14.79c	1016.67±26.03b	1060.00±20.82ab	1118.33 ±39.19a
11th week	1058.75±35.69b	1155.00±24.66ab	1173.33±28.48ab	1226.67 ±14.53a
12th week	1100.00±33.92b	1196.67±32.45ab	1213.33 ±18.56a	1221.67 ±35.81a

Values are mean ± standard error. Means with different superscript letters at the same row differ significantly at P≤0.05.

Table 3 Effect of different doses of L-carnitine on body weight gain (g./bird/week) at different weeks

Parameter (BWG)	Control group	25 mg/kg B. W	50 mg/kg B. W	100 mg/kg B. W
1st Gain	35.42 ± 0.42^{ab}	36.88 ± 1.57^{a}	31.67 ± 1.67^{b}	36.67 ± 0.83^{a}
2nd Gain	45.84 ± 4.57	42.50 ± 3.08	47.71 ± 1.26	45.21 ± 2.71
3rd Gain	86.04 ± 4.30^{b}	83.96 ± 0.91^{b}	90.21 ± 4.06^{ab}	99.17 ± 1.98^{a}
4th Gain	79.38 ± 1.44^{b}	104.46 ± 2.80^{a}	76.25 ± 7.83^{b}	91.88 ± 3.82^{ab}
5th Gain	96.10 ± 5.77	103.33 ± 4.48	119.37 ± 10.10	108.75 ± 7.46
6th Gain	86.96 ± 8.51^{b}	103.96 ± 3.11^{ab}	128.54 ± 12.93^{a}	105.83 ± 3.63^{ab}
7th Gain	85.63 ± 21.49	76.46 ± 8.39	71.25 ± 14.05	65.42 ± 19.29
8th Gain	224.10 ± 20.45	284.17 ± 0.42	268.34 ± 11.94	261.25 ± 33.87
9th Gain	99.38 ± 13.82	84.79 ± 32.48	106.66 ± 1.37	119.17 ± 17.46
10th Gain	45.21 ± 19.10^{b}	63.33 ± 15.90^{b}	86.67 ± 12.01^{b}	153.33 ± 26.67^{a}
11th Gain	141.25 ± 24.73	138.33 ±4.41	113.33 ± 12.02	91.66 ± 10.14
12th Gain	41.25 ± 20.12	41.66 ± 11.67	40.00 ± 10.00	28.33 ± 11.67
Final gain	1068.33±35.37^{b}	1165.83 ± 32.29^{a}	1180.00 ±17.56^{a}	1206.67 ± 18.39^{a}

Values are mean ± standard error. Means with different superscript letters at the same row differ significantly at P≤0.05.

Table 4 Effect of different doses of L-carnitine on relative growth rate (%) at different weeks:

Parameter (RGR)	Control group	25 mg/kg B. W	50 mg/kg B. W	100 mg/kg B. W
1st RGR%	71.89 ± 2.66	72.55 ± .89	69.21 ± 2.54	73.34 ± .17
2nd RGR%	50.84 ±4.67	47.77 ± 3.42	53.83 ± 2.79	49.73 ± 3.10
3rd RGR%	55.12 ± 1.04^{b}	55.18 ± .60^{b}	57.12 ± 1.73^{ab}	60.79 ± 1.03^{a}
4th RGR%	33.32 ± 1.16^{b}	43.03 ± .92^{a}	33.27 ± .55^{b}	35.50 ± 1.07^{b}
5th RGR%	28.08 ± 1.61^{b}	29.31 ± .90^{ab}	33.63 ± 1.98^{a}	30.24 ± 1.44^{ab}
6th RGR%	22.30 ± .14^{b}	22.80 ± .38^{b}	26.26 ± 1.01^{a}	22.69 ± .25^{b}
7th RGR%	16.99 ± 4.41	14.02 ± 1.64	14.20 ± 1.36	11.84 ± 3.48
8th RGR%	34.01 ± 2.43	36.28 ± 2.56	36.62 ± 1.44	36.48 ± 4.56
9th RGR%	12.07 ± 1.66	12.09 ± .58	11.60 ± .10	13.24 ± 2.16
10th RGR%	5.90 ± 1.62^{b}	5.54 ± 1.03^{b}	8.50 ± 1.07^{ab}	11.97 ± 1.06^{a}
11th RGR%	13.49 ± 1.57^{a}	9.07 ± 2.06^{ab}	7.9681 ± .93^{b}	8.36 ± .18^{b}
12th RGR%	3.84 ± 1.91	7.60 ± 2.21	5.55 ± 1.81	3.15 ± .79
Final RGR%	188.76 ± .90	189.60 ± .55	189.84 ± .57	189.89 ± .03

Values are mean ± standard error. Means with different superscript letters at the same row differ significantly at P≤0.05.

Table 5 Effect of different doses of L-carnitine on the feed conversion rate at Different weeks:

Items	Control group	25 mg/kg B. W	50 mg/kg B. W	100 mg/kg B. W
FCR (1)	1.77 ± .02^{b}	1.71 ± .09^{b}	2.03 ± .09^{a}	1.71 ± .08^{b}
FCR (2)	1.96 ± .27^{a}	2.11 ± .12^{a}	1.83 ± .01^{a}	1.99 ± .18^{a}
FCR (3)	1.69 ± .10^{a}	1.72 ± .03^{a}	1.60 ± .05^{ab}	1.46 ± .05^{b}
FCR (4)	2.50 ± .054^{a}	1.81 ± .09^{b}	2.67 ± .33^{a}	2.18 ± .09^{ab}
FCR (5)	2.57 ± .14^{a}	2.41 ± .09^{ab}	2.05 ± .15^{b}	2.27 ± .14^{ab}
FCR (6)	3.48 ± .38^{a}	2.85 ± .073^{ab}	2.33 ± .23^{b}	2.79 ± .08^{ab}
FCR (7)	4.74 ± 1.08^{a}	4.90 ± .67^{a}	5.56 ± 1.28^{a}	6.35 ± 1.47^{a}
FCR (8)	1.83 ± .18^{a}	1.42 ± .01^{a}	1.50 ± .06^{a}	1.60 ± .25^{a}
FCR (9)	4.70 ± .71^{b}	9.99 ± 6.16^{a}	4.21 ± .05^{b}	3.95 ± .66^{b}
FCR (10)	32.59 ± 3.67^{a}	8.63 ± 2.50^{b}	5.63 ± 0.70^{b}	3.30 ± .69^{b}
FCR (11)	3.82 ± 0.62^{b}	3.69 ± 0.14^{b}	4.61 ± 0.58^{ab}	5.69 ± 0.62^{a}
FCR (12)	21.78 ± 9.33^{a}	16.52 ± 5.70^{a}	16.73 ± 5.53^{a}	19.85 ± 1.19^{a}
FINAL FCR	3.55±0.12^{a}	3.25±0.08^{b}	3.20 ± 0.05^{b}	3.13±0.05^{b}

Values mean ± standard error. Means with different superscript letters at the same row differ significantly at P≤0.05.

Table 6 Effect of different doses of L-carnitine on daily feed intake (gm):

Items	Control group	25 mg/kg B. W	50 mg/kg B. W	100 mg/kg B. W
DFI (1)	8.99 ± .21	8.96 ± .21	9.17 ± .21	8.96 ± .21
DFI (2)	12.50 ± .36	12.71 ± .21	12.50 ± .36	12.71 ± .42
DFI (3)	20.62 ± .36	20.63 ± .36	20.63 ± .36	20.63 ± .36
DFI (4)	28.33 ± .55	27.50 ± .95	28.33 ± .42	28.54 ± .42
DFI (5)	35.42 ± .21	35.42 ± .21	34.58 ± .21	35.00 ± .36
DFI (6)	42.29 ± .21	42.29 ± .21	41.88 ± .00	42.08 ± .21
DFI (7)	51.46 ± .91	51.88 ± .95	51.46 ± .55	51.25 ± .72
DFI (8)	57.71 ± .42	57.50 ± .36	57.29 ± .21	57.29 ± .42
DFI (9)	63.96 ± .21	63.96 ± .21	64.17 ± .21	63.96 ± .21
DFI (10)	67.08 ± .21	67.08 ± .21	67.29 ± .21	67.08 ± .21
DFI (11)	72.71 ± .75	72.71 ± .75	72.71 ± .75	72.71 ± .75
DFI (12)	79.79 ± .21	79.79 ± .21	79.79 ± .21	79.79 ± .21

Values are mean ± standard error. Means with different superscript letters at the same row differ significantly at P≤ 0.05.

Table 7 Effect of different doses of L-carnitine on carcass traits:

Items	Control group	25 mg/kg B. W	50 mg/kg B. W	100 mg/kg B. W
Carcass weight (g)	875.00 ± 42.52^{b}	1131.67 ± 29.49^{a}	1125.00 ±37.53^{a}	1110.00 ± 84.01^{a}
Semi-eviscerated (g)	783.33 ± 43.43^{b}	1043.33 ± 44.94^{a}	1050.00±32.53^{a}	1043.33 ±76.07^{a}
Dressed carcass weight (g)	750.00 ± 45.09^{b}	975±34.64a	933.30 ± 40.55^{a}	996.67 ± 69.67^{a}
head weight (g)	75.00 ± 0.00	80.00 ± 5.77	83.33 ± 1.67	75.00 ± 7.64
heart weight (g)	13.33 ± 1.67	16.67 ± 6.01	11.67 ± 3.33	11.67 ± 4.41
lung weight (g)	13.33 ± 3.33	26.67 ± 10.14	8.33 ± 3.33	13.33 ± 6.01
liver weight (g)	26.67 ± 4.41	43.33 ± 7.27	28.33 ± 4.41	33.33 ± 8.82
Breast weight (g)	303.33 ± 24.04^{b}	455.00 ± 14.43^{a}	453.33 ± 19.65^{a}	455.00 ± 22.91^{a}
Carcass weight (%)	79.073 ± 2.18^{b}	94.70 ± 3.3^{a}	92.67 ± 1.67^{a}	89.55 ± 6.02^{ab}
Semi-eviscerated (%)	71.37 ± 2.55^{b}	87.19 ± 2.97^{a}	86.50 ± 1.35^{a}	84.17 ± 5.35^{a}
Dressed carcass (%)	68.32 ± 2.72^{b}	81.49 ± 2.13^{a}	76.87 ± 2.35^{ab}	80.40 ± 4.85^{a}
Head weight (%)	6.20 ± 1.33	7.09 ± 0.80	6.87 ± 0.14	6.05 ± 0.56
Heart weight (%)	1.23 ± 0.34	2.24 ± .84	0.68 ± .26	1.07 ± 0.47
Lung weight (%)	1.23 ± 0.18	1.68 ± .72	0.96 ± .27	0.93 ± 0.35
Liver weight (%)	2.30 ± 0.58	3.64 ± 0.64	2.34 ± .37	2.68± .69
Breast weight (%)	27.59 ± 1.43^{b}	38.10 ± 1.78^{a}	37.36 ± 1.48^{a}	36.7 ± 1.56^{a}

Values are mean ± standard error. Means with different superscript letters at the same row differ significantly at P≤0.05.

3.3. Impact of L-carnitine dosages on blood parameters:

Data of Cholesterol, TG, HDL, LDL, total protein, albumin, and total globulin levels in different experimental groups treated with L-carnitine for 3 months are represented in Table (8). The value of cholesterol significantly decreased by increasing the dose of L-carnitine, the lowest value was in the 4th group receive 100mg/kg, while the highest value was in the control group. HDL was significantly (P<0.05) maximal in the group that received 25 mg/kg. The total protein, albumin, and globulin significantly differed (P<0.05) between groups with the highest total protein and globulin values were found in the 4th group receive 100 mg/kg, and the lowest values were recorded in the control group. The 2nd and 4th groups which receive 25mg/kg, and 100mg/kg, respectively showed the highest albumin value.

Table 8 Effect of different doses of L-carnitine on lipid profile, Total protein, Albumin, T. globulin:

Items	Control group	25 mg/kg B. W	50 mg/kg B. W	100 mg/kg B. W
Cholesterol	70.33 ± 5.46^{a}	61.32 ± 3.96^{ab}	55.49 ± 2.86^{b}	53.66 ± 4.56^{b}
TG	75.75 ± 1.63	67.74 ± 10.55	58.94 ± 1.32	59.33 ± 4.88
VLDL	15.15 ± .33	13.55 ± 2.11	11.78 ± .26	12.25 ± .79
HDL	22.26 ± .42^{ab}	25.93 ± 2.34^{a}	22.44 ± .99^{ab}	18.23 ± 1.22^{b}
LDL	32.91 ± 5.67	21.84 ±6.07	21.26 ± 3.22	23.18 ± 4.07
T. Protein	7.28 ± .44^{b}	8.18 ± .45^{ab}	7.54 ± .34^{ab}	8.95 ± .48^{a}
Albumin	3.23 ± .07^{ab}	3.69 ± .26^{a}	3.09 ± .05^{b}	3.73 ± .21^{a}
Globulin	4.05 ± .37^{b}	4.50 ± .31^{ab}	4.24 ± .21^{ab}	5.22 ± .27^{a}

Values are means ± standard error. Means with different superscript letters at the same row differ significantly at P≤0.05. [Cholesterol, TG (Triglyceride), HDL (High-Density Lipoprotein), LDL (low-density lipoprotein), total protein, albumin, total globulin].

4. DISCUSSION

The present study showed that final body weight and ultimate body weight gain in grams were considerably higher across the treatment groups compared to the control group. This finding comes in agreement with Hoppel (2003), Nouboukpo *et al.* (2010), Hrnčár *et al.* (2015), and Abouzed *et al.* (2019).This finding disagrees with Lien and Horng (2001), Çelik et al. (2003), and Xu et al. (2003).

Growing Fayoumi Chicken supplemented with 100, 25, and 50 mg LC/kg had significantly better FCR than the control group By 3.18, 3.20 and 3.25 and this result is supported by Abdel-Fattah et al. (2014) and Mahmoud et al. (2019) and disagreed with Buyse et al. (2001), Rezaei et al. (2007) and Xu et al. (2003). It was recognized that the rise in BWG and decrease in FI of broiler chicks were related to the improvement of FCR (Elnaggar, 2017). The results may be due to enough L-carnitine allowing birds to utilize protein and energy from their food more effectively (Hossininezhad et al., 2011). In young animals whose synthesis is insufficient to fulfill endogenous requirements, dietary L-carnitine supplementation promotes the oxidation of fatty acids to create (ATP) energy and boosts energy use, improving body weight gain and feed efficiency (Neuman et al., 2002). Also, L-carnitine is thought to benefit growth because it causes the release of growth-promoting insulin-like growth factors (Beccavin et al., 2001; Kita et al., 2002).

In our study, the post-slaughter body weight, semi-eviscerated carcass weight, dressed carcass weight, and breast weight showed significant differences (P<0.05) and all treated groups were higher than the control group. These results are supported by Xu *et al.* (2003), Wang and McPherron (2012), and Parsaeimehr et al. (2014). These results disagree with Celikand Oztürkcan (2003) and Kidd et al. (2009), who noted that L-carnitine administration had no impact on carcass production.

Examination of the main effects of dietary L-carnitine supplementation on male Fayoumi chicken showed that increasing the level of L-Carnitine decreased the number of triglycerides, cholesterol, VLDL, and increased the amount of albumin, protein, total globulin, and HDL. Increasing the level of L-carnitine leads to a significant decrease in cholesterol, and a significant increase in total protein, albumin, and total globulin. While the decrease in triglyceride, VLDL, and LDL is not significant. These results agree with Lien and Horng (2001), Wang *et al.* (2003), Rezaei *et al.* (2007), Amin and Nagy (2009), Zhang et al. (2010), Youssef et al. (2011), Parsaeimehr et al. (2014), and Azizi-Chekosari and Bouyeh (2021). L-carnitine supplementation has long been known to help people with type IV hyperlipoproteinemia's lipid metabolism (Maebashi et al., 1978). Our results are not supported by the study of Parsaeimehr et al. (2014). L-carnitine is essential for the transport of FFA into mitochondria for its oxidation, which is an important step in the metabolism of fat which makes them less available during esterification to triacylglycerols so supplementation of chickens with it results in a reduction in triacylglycerol content of sera, as well as the percentage of liver and abdominal fat (Lien and Horng, 2001; Wang et al., 2003).

5. CONCLUSION

In conclusion, dietary L-carnitine supplementation in male Fayoumi chickens at the doses of 25, 50, and 100 mg/kg resulted in significant improvement in growth performance, FCR, carcass traits, lipid profile, and total protein. Consequently, further studies are needed to explore the effects of higher dosages of supplementary carnitine to determine the optimum supply for improvement of meat production in male Fayoumi chickens.

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