The Effect of Adding A Mix of L.Carnitine With Herbal Methionine And Sunflower Seed oil on The Production Characteristics of Broilers

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Abstract
The study was conducted in the poultry field of the animal production department, college of agriculture, Kirkuk university from 1/12/2021 to 12/1/2022. The objective of the study was to evaluate the addition of L.carnitine with methionine and sunflower seeds oil to the broiler's diet and its effect on their productivity. At age a day, 350 asexual broilers type Ross with an average weight of 42 gm were brought from (Kirkuk hatcher) in Kirkuk province. They were raised on a sawdust floor in a closed chamber with the use of 35 cages (dimension 190 x 90 cm), each chamber was equipped with two air pullers. Chicks were randomly assigned to 5 treatments with 5 replicates for each treatment (10 chicks per replicate). The result of statistical analysis showed that at week six of age (1-42 days) the body weight and the average weight gain of treatments 3, 4, and 5 differed significantly (P≤0.05) compared to treatments 1 and 2. The feed consumption rate was significantly lower in treatments 4 and 5 compared to treatments 1, 2, and 3, while the rate of feed conversion factor was significantly improved in treatments 3, 4, and 5 compared to treatments 1 and 2. The abdominal fat was significantly lower in all treatments compared to treatments 1 and 2, whereas the relative weight ratio of heart, liver, and gizzard did not differ between the treatments. There was no significant effect on the relative weight ratio of breast, leg, wing, neck, back, and drumstick between the treatments as well as the carcass composition.
Keywords: L.carnitine, herbal methionine, broilers

1. Introduction

The amino acids, especially the essential of it, are considered the basic building unit of protein (Abd Ali, 2016) in poultry nutrition. Methionine has been considered an essential amino acid because of its limitation in plant protein sources, and birds required methionine more than other amino acids which involve in feather growth. Recently, and because of the increase in the prices of fish powder and the prohibition of using animal protein sources (lean and bone) which causes some diseases such as mad cow disease and some poisoning, the requirement of using plant protein sources increased (Chadd et al, 2002). In addition, methionine has the ability to remove the anti-nutrient factor (Tannin) as well as the phatic acid, and reduce its negative effects (Wareham et al, 1990; Ramachandra and Roy, 2006). L.carnitine has an important metabolism role for energy via directing the triglycerides, cholesterol, and long-chain fatty acids into the powerhouse (mitochondria through the oxidation process and produce energy ATP; adenosine triphosphate). Based on that, the growth and production improve the quality of the carcass by decreasing the fat ratio (Shahzad, 2009; Saima et al, 2011; Makinde, 2017; Alhashimi, 2020). There are two types of carnitines; D and L, and the body make them in the liver from methionine and lysine and play an important role in energy metabolism and improve growth since it decreases the opportunity for fat oxidation (Murali et al, 2015; Taklimi et al, 2015). Methionine is considered an essential amino acid for poultry since they cannot make its carbon body, or they make it in a little amount that is not enough for their body requirement (Burley et al, 2016). Furthermore, methionine is considered an important sulfur amino acid as well as the first determinant in poultry that depends on plant protein in their nutrition for its important role in making the protein, growth increase, improving the food conversion factor, and decreasing death rate (Makinde et al, 2017; Bhutyal et al, 2019). In addition, methionine is the most nutrient that plays a role in a number of important biological processes in the body (Ahmed and Abbas, 2015). Also, methionine deficiency in the body has increased continually depending on a diet that contains corn and soybean (Igbasan and Olugosi, 2013). Therefore, this study aimed to determine the effect of replacing the artificial methionine in a broiler diet with herbal methionine, and the effect of the addition of L.carnitine on some productive characteristics of broiler.

2. Materials and Methods

The study was conducted in the poultry field of the animal production department, college of agriculture, Kirkuk university from (1/12/2021 to 12/1/2022). In the study, 350 asexual chicks type Rose were used and were randomly distributed to 5 treatments with 5 replicates (10 chicks per replicate) from age one day to 42 days of age. The aim of the study was to determine the effect of a diet that contains herbal methionine and the addition of

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L.carnitine in the production performance of a broiler. The experiment consisted of 5 nutritional treatments as follows:

T1: Standard diet (Control)

T2: Contains 5% of sunflower oil

T3: Contains 5% sunflower oil + 250 mg/kg of L.carnitine

T4: Contains 5% sunflower oil + 100% of the herbal methionine requirements

T5: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine

Table 1: Chemical composition and percentage of starter diet from 1 to 10 days of age.

* Treatments					Diet %
Fifth	Fourth	Third	Second	First	
56.94	56.94	56.91	56.94	56.94	Wheat
3.00	3.00	3.00	3.00	3.00	Corn
30.71	30.71	30.71	30.71	30.71	Soybean (47% crude protein)
5	5	5	5	5	Plant oil
0.85	0.85	0.85	0.85	0.85	Calcic rock
2.66	2.66	2.66	2.66	2.66	Bicalcium phosphate
0.20	0.20	0.20	0.20	0.20	Salt
**Calculated chemical composition					
2955	2955	2955	2955	2955	Metabolisable energy) Kcal/Kg diet)
22.73	22.73	22.73	22.37	22.37	Crude protein %
130	130	130	130	130	C:P Ratio
1.32	1.32	1.32	1.32	1.32	Lysine %
0.59	0.59	0.59	0.59	0.59	Methionine %

* First: Standard diet (Control), Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 250 mg/kg of L.carnitine , Fourth: Contains 5% sunflower oil + 100% of the herbal methionine requirements , Fifth: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine.
** According to NRC, (1994).

Table 2: Chemical composition and percentage of growth diet from 11 to 24 days of age.

* Treatments					Diet %
Fifth	Fourth	Third	Second	First	
34	34	33.97	34	34	Wheat
27	27	27	27	27	Corn
30.07	30.07	30.07	30.07	30.07	Soybean (47% crude protein)
5.00	5.00	5.00	5.00	5.00	Plant oil
0.69	0.69	0.69	0.69	0.69	Calcic rock
2.19	2.19	2.19	2.19	2.19	Bicalcium phosphate
0.20	0.20	0.20	0.20	0.20	Salt
0.10	0.10	0.10	0.10	0.10	Mix of vitamins and minerals
0.025		0.025	-	-	L.carnitine
-		0.23	0.23	0.23	Artificial methionine
0.230	0.230	-	-	-	Herbal methionine
0.22	0.22	0.22	0.22	0.22	Lysine
100	100	100	100	100	Total
**Calculated chemical composition					
3072	3072	3072	3072	3072	Metabolisable energy)Kcal/Kg diet)
21.22	21.22	21.22	21.22	21.22	Crude protein %
14.76	14.76	14.76	14.76	14.76	C:P Ratio
1.28	1.28	1.28	1.28	1.28	Lysine %
0.53	0.53	0.53	0.53	0.53	Methionine %

* First: Standard diet (Control), Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 250 mg/kg of L.carnitine , Fourth: Contains 5% sunflower oil + 100% of the herbal methionine requirements , Fifth: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine.
** According to NRC, (1994).

Table 3: Chemical composition and percentage of final diet from 25 days of age till marketing.

* Treatments				Diet %	
Fifth	Fourth	Third	Second	First	
20.25	20.25	20.19	20.25	20.25	Wheat
44.08	44.08	44.08	44.08	44.08	Corn
27	27	27	27	27	Soybean (47% crude protein)
5.00	5.00	5.00	5.00	5.00	Plant oil
0.69	0.69	0.69	0.69	0.69	Calcic rock
2.19	2.19	2.19	2.19	2.19	Bicalcium phosphate
0.20	0.20	0.20	0.20	0.20	Salt
0.10	0.10	0.10	0.10	0.10	Mix of vitamins and minerals
-	-	0.025	-	0.025	L.carnitine
0.25	0.25	0.25	-	-	Artificial methionine
-	-	-	0.25	0.25	Herbal methionine
0.24	0.24	0.24	0.24	0.24	Lysine
100	100	100	100	100	Total
**Calculated chemical composition					
3162	3162	3162	3162	3162	Metabolisable energy)Kcal/Kg diet)
19.29	19.29	19.29	19.29	19.29	Crude protein %
164	164	164	164	164	C:P Ratio
1.28	1.28	1.28	1.28	1.28	Lysine %
0.54	0.54	0.54	0.54	0.54	Methionine %

* First: Standard diet (Control), Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 250 mg/kg of L.carnitine , Fourth: Contains 5% sunflower oil + 100% of the herbal methionine requirements , Fifth: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine.
** According to NRC, (1994).

Productive characteristics studied

1. Live Body Weight (gm)

Body weight was taken weekly during the experiment per replicate via a balance (made in China) that a sensitivity of 5 gm.

2. Average bird weight (gm/bird/week) = bird weight per replicate (gm) / total of birds in replicate.
3. Body weight gain (gm/bird/week) during the experiment.
Body weight gain was calculated weekly by subtracting the weight at the end of the week from the weight at the beginning of the week as the following equation:
Average body weight gain (gm/bird/week) = Live body weight at the end of the week – Live body weight at the beginning of the week.
4. Feed consumption (gm/bird/week).
Feed consumption was calculated based on the feed consumed during the week per replicate by collecting and weighing the remained feed at the end of the week and subtracting it from the total feed offered at the beginning of the week. Electronic balance type Dahongying with a sensitivity of 5 gm and depending on the following equation referred by Alzubaidi (1986).
Feed consumption per week = Total amount of feed offered at the beginning of the week – Remaining feed at the end of the week.
5. Feed conversion ratio (gm diet/ gm weight gain).
The feed conversion ratio was calculated weekly based on one replicate per week based on the equation referred to by Alzubaidi (1986).
Feed conversion ratio = Average feed consumption during a specific period of time (gm) / Average body weight gain during the same period of time.
6. Edible percentage (heart, liver, gizzard).
From all treatments, 70 birds were taken (10 birds per treatment, 2 birds per replicate) at the end of the experiment (age 42 days). Live body weight was recorded, and after slaughtering the carcass weight was taken without the edible parts (heart, liver, gizzard). Also, the internal edible parts were weight via a specific balance based on the following equation referred to by Alfayad et al. (2010).
Edible percentage = Organ weight (gm) / Average live body weight (gm) x 100
7. Carcass composition:
At the end of the experiment, four birds were selected randomly per treatment (1 bird per replicate) at the end of week 10. They were weight individually to get the live weight, then slaughtered and feathers, heads, and limbs were removed. The carcass was cleaned and washed and weight individually to get the carcass composition based on live body weight and depending on the following equation referred to by Alfayad et al. (2011).
Carcass composition = carcass weight (gm) / live body weight (gm).
8. Carcass cuts weight %
Carcass cuts were weight after slaughtering based on Alfayad et al. (2010)
Average carcass cuts weight % = cut weight (gm) / empty carcass weight (gm) x 100

3. Results

Table (4) showed no difference between the experiment treatments (P≤0.05) in the first week, whereas week two showed a significant difference in average body weight, treatment 5 was higher than treatments 1, 2, 3, and 4. Treatment 4 was higher compared to treatments 1, 2, and 3, while there was no difference between treatments 1, 2, and 3. In week three, all the experiment treatments showed a higher effect compared to the control diet. Furthermore, week four showed that treatment 5 was higher than treatments 1 and 2, while treatments 3 and 4 was higher than 1 and 2. In addition, weeks five and six showed that treatments 3, 4, and 5 was higher compared to treatments 1 and 2 as well as treatment 2 was higher than the control treatment.

Table 4: Effect of adding L.carnitine with herbal methionine and sunflower seeds oil in average live body weight (gm/bird/week) of broiler from day 1-42 (average ± standard error).

Sixth week	Fifth week	Fourth week	Third week	Second week	First week	Treatments**
25.00±2175.00 c	5.00±1695.00 c	3.22±1162.50 d	13.13±763.75 b	1.19±447.50nc	0.85±154.25na	T1
18.76±2611.25 b	21.60±1940.00 b	4.25±1211.50 c	4.60±812.75 a	0.47±445.75nc	0.85±154.25na	T2
52.01±2775.00 a	19.14±2131.75 a	5.12±1415.25 b	2.05±816.25 a	0.47±448.25nc	0.64±155.50na	T3
39.24±2740.50 a	31.45±2087.50 a	4.84±1414.00 b	1.32±817.50 a	1.10±457.75nb	0.47±156.25 a	T4
42.12±2774.75 a	38.81±2097.50 a	2.10±1445.50 a	1.55±818.50 a	0.85±467.75 a	0.62±156.25 a	T5
*	*	*	*	*	*	Significant level*

Different letters within the same column indicate the presence of significant differences at the probability level (P≤0.05). * T1: Standard diet (Control), T2: Contains 5% of sunflower oil, T3: Contains 5% sunflower oil + 250 mg/kg of L.carnitine , T4: Contains 5% sunflower oil + 100% of the herbal methionine requirements , T5: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine.

The result in table (5) showed no significant difference (P≤0.05) in weight gain between all treatments in the first week of the experiment. In the second week, treatment 5 was higher compared to treatments 1, 2, 3, and 4, while the last one was higher than treatments 1, 2, and 3, and there was no difference between treatments 1, 2, and 3. Week three showed that all treatments were higher than the control treatments. Whereas week four showed that treatment 5 was higher than other treatments, and treatments 3 and 4 were higher than treatments 1 and 2. Furthermore, weeks 5 and 6 showed that all treatments were higher than the control treatment, while treatments 2, 3, 4, and 5 showed no difference between each other.

Table 5: Effect of adding L.carnitine with herbal methionine and sunflower seeds oil in average gain weight (%) of broiler from day 1-42 (average ± standard error).

Total weight gain	Sixth week	Fifth week	Fourth week	Third week	Second week	First week	Treatments**
25.00±2133.00 c	27.08±480.00 b	5.20±532.5 b	15.18±398.75 c	13.96±316.25 b	1.70±293.25 c	0.85±122.25 a	T1
18.76±2569.25 b	31.01±671.25 a	25.52±728.5 a	3.59±398.75 c	4.26±367.00 a	0.95±291.50 c	0.85±112.25 a	T2
52.04±2733.00 a	35.52±643.25 a	16.57±716.5 a	5.09±599.00 b	1.77±368.00 a	0.62±292.75 c	0.64±113.5 a	T3
39.24±2698.50 a	36.86±653.00 a	26.85±673.5 a	4.41±596.50 b	2.39±359.75 a	1.32±301.50 b	0.47±114.25 a	T4
42.12±2732.75 a	59.91±677.25 a	36.76±652.0 a	2.38±627.00 a	1.25±350.75 a	1.32±311.50 a	0.62±114.25 a	T5
*	*	*	*	*	*	*	Significant level*

*Different letters within the same column indicate the presence of significant differences at the probability level (P≤0.05). * * T1: Standard diet (Control), T2: Contains 5% of sunflower oil, T3: Contains 5% sunflower oil + 250 mg/kg of L.carnitine , T4: Contains 5% sunflower oil + 100% of the herbal methionine requirements , T5: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine.

The result in table (6) showed an improvement in feed consumption in all treatments compared to the control treatment in the first week. In week two, the feed consumption was increased in the control treatment compared to treatment 5, while treatments 3 and 4 were lower compared to treatment 2, and treatments 3 and 4 were no different from each other. The last 4 weeks showed lower feed consumption in treatments 4 and 5 compared to treatments 1, 2, and 3, also treatments 2 and 3 were lower in feed consumption than the control diet. There was a difference in the total feed consumption, treatments 4 and 5 were lower than other treatments.

Table 6: Effect of adding L.carnitine with methionine and sunflower seeds oil in average feed consumption (gm/bird/day) of broiler at age 42 day (average ± standard error).

Total feed consumption rate	Sixth week	Fifth week	Fourth week	Third week	Second week	First week	Treatments**
18.23±3280.75 a	3.20±1605.50 a	13.14±1087.50 a	4.26±791.25 a	2.98±691.25 a	1.10±532.25 a	0.64±178.50 a	T1
8.19±2880.75 b	1.68±1461.75 1b	3.22±947.50 b	2.04±750.00 b	3.11±588.25 b	0.47±419.25 b	0.47±175.75 + 0.47 b	T2
±4.83±2870.50 b	3.94±1456.50 b	3.50±947.50 b	1.37±746.75 b	4.14±588.00 b	1.08±412.00 c	0.85±176.25 + 0.85 b	T3
3.96±2772.25 c	1.60±1422 c	1.35±924.00 c	2.19±705.00 c	1.54±554.25 c	1.54±414.25 c	0.62±174.75 + 0.62 b	T4
5.80±2761.00 c	1.03±1417.75 c	0.64±916.50 c	4.36±711.75 c	5.26±554.25 c	1.43±403.25 d	0.62±175.25 + 0.62 b	T5
*	*	*	*	*	*	*	Significant level*

Different letters within the same column indicate the presence of significant differences at the probability level (P≤0.05). * T1: Standard diet (Control), T2: Contains 5% of sunflower oil, T3: Contains 5% sunflower oil + 250 mg/kg of L.carnitine , T4: Contains 5% sunflower oil + 100% of the herbal methionine requirements , T5: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine.

Table (7) showed a significant effect in the average feed conversion ratio factor in the first week in treatments 4 and 5 compared to treatments 1, 2, and 3. Treatment 3 was higher than treatments 1 and 2 as well as treatment 2 compared to the control treatment. Week two showed that treatment 5 was higher than all other treatments, while treatment 4 was higher than treatment 3. Treatment 3 was higher than treatment 2 and the last one was higher than the control treatment. The result in week three showed that all treatments were higher than the control treatments, while there was no difference between the other treatments. Week four showed that treatments 3, 4, and 5 were higher than treatments 1 and 2, and treatment 2 was not different from treatment one. In weeks 5 and 6, all treatments showed a higher effect compared to the control treatments.

Table 7: Effect of adding L.carnitine with methionine and sunflower seeds oil in Average feed conversion factor (gm feed/gm weight gain) of broiler at age 42 day (average ± standard error).

Total feed consumption rate	Sixth week	Fifth week	Fourth week	Third week	Second week	First week	Treatments**
0.01 ± 1.92 a	0.21±3.38 a	0.03±2.04 a	0.08±1.99 a	0.09±2.19 a	0.01±1.81 a	0.01±1.59 a	T1
0.00 ± 1.55 a	0.10±2.19 b	0.04±1.30 b	0.01±1.88 a	0.02±1.60 b	0.00±1.43 b	0.00±1.56 ab	T2
0.00 ± 1.42 a	0.13±2.28 b	0.03±1.32 b	0.01±1.24 b	0.00±1.59 b	0.00±1.40 c	0.00±1.55 cb	T3
0.01 ± 1.40 a	0.13±2.20 b	0.05±1.37 b	0.00±1.18 b	±0.011.54 b	0.00±1.37 d	0.00±1.52 c	T4
0.01 ± 1.39 a	0.18±2.14 b	0.08±1.41 b	0.00±1.13 b	0.02±1.58 b	0.00±1.29 e	0.00±1.53 c	T5
*	*	*	*	*	*	*	Significant level*

Different letters within the same column indicate the presence of significant differences at the probability level (P≤0.05). * T1: Standard diet (Control), T2: Contains 5% of sunflower oil, T3: Contains 5% sunflower oil + 250 mg/kg of L.carnitine , T4: Contains 5% sunflower oil + 100% of the herbal methionine requirements , T5: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine.

Table 8 showed that there was no significant effect in all the experimental treatments on the edible components (liver, heart, gizzard). The abdominal fat ratio was higher in all treatments compared to the control treatment.

The result in table 9 showed that there was no significant effect between the experimental treatments in the percentage of carcass cuts as well as the carcass composition.

Table 8: Effect of adding L.carnitine with herbal methionine and sunflower seeds oil in edible components and abdominal fat of broiler at age 42 days (average ± standard error).				
Treatments	Abdominal fat	Gizzard%	Liver%	Heart%
T1	0.04±2.06a	0.10 ± 2.63 a	0.00 ± 2.33 a	0.01 ± 0.50 a
T2	0.12±1.54b	0.18 ± 2.41 a	0.00 ± 2.33 a	0.02 ± 0.50 a
T3	0.03±1.16b	0.01 ± 2.39 a	0.00 ± 2.33 a	0.01 ± 0.48 a
T4	0.03±1.15b	0.05 ± 2.43 a	0.00 ± 2.34 a	0.01 ± 0.47 a
T5	0.09±1.17b	0.03 ± 2.40 a	0.00 ± 2.34 a	0.00 ± 0.47 a
Significant level	*	*	*	*
Different letters within the same column indicate the presence of significant differences at the probability level (P≤0.05). * T1: Standard diet (Control), T2: Contains 5% of sunflower oil, T3: Contains 5% sunflower oil + 250 mg/kg of L.carnitine , T4: Contains 5% sunflower oil + 100% of the herbal methionine requirements , T5: Contains 5% sunflower oil + 250 mg/kg of L.carnitine + 100% herbal methionine.				

Table 9: Effect of adding L.carnitine with herbal methionine and sunflower seeds oil in carcass composition and carcass cuts of broiler at age 42 days (average ± standard error).							
Percentage of carcass cuts							
Net Weight%	Chest%	Joint Thigh %	drumstick %	Back%	wings	Neck %	Treatments
0.15 ± 73.58 a	0.17 ± 24.51 a	0.08 ± 16.18 a	0.09±12.68	0.08 ± 20.46 a	0.33 ± 17.03 a	0.04 ± 5.17 a	T1
0.18 ± 74.77 a	0.19 ± 24.58 a	0.10 ± 16.38 a	0.04±12.71a	0.28 ± 20.91 a	0.15 ± 17.49 a	0.02 ± 5.13 a	T2
0.21 ± 75.56 a	0.28 ± 24.38 a	0.06 ± 16.31 a	0.17±12.48a	0.26 ± 20.32 a	0.39 ± 16.76 a	0.04 ± 5.10 a	T3
0.61 ± 75.99 a	0.14 ± 24.38 a	0.16 ± 16.31 a	0.17±12.61a	0.30 ± 20.58 a	0.34 ± 16.66 a	0.05 ± 5.08 a	T4
0.09 ± 75.23 a	0.11 ± 24.65 a	0.07 ± 16.45 a	0.09±12.61a	0.18 ± 20.38 a	0.28 ± 16.94 a	0.04 ± 5.13 a	T5
*	*	*	*	*	*	*	Significant level

4. Discussion

The addition of L.carnitine and herbal methionine to the experiment treatments showed significant improvement compared to the control treatments. The average body weight was higher in treatments 2, 3, 4, and 5 compared to the control at 42 days of age. The reason is related to the role of herbal methionine in improving body weight as the positive effect of the amino acids in making proteins and producing energy. The result agreed with a study conducted by (Esteve and Mack, 2000) where they found an increase in body weight between treatments compared to the control and an improvement in feed conversion ratio factor when methionine was added to the broiler diet as mentioned by (Helder and Roy, 2007; Kalbande et al, 2009). The addition of 250 mg of L.carnitine/kg of diet to the broiler diet, or the replacement of the artificial methionine with 100% herbal one resulted in improvement in these treatments compared to the control diet. That could be related to the role of L.carnitine and herbal methionine as an antioxidant factor in the body of the birds which is involved in producing important enzymes such as glutathione. These enzymes provide protection to the tissues by removing the effect of the peroxides which brake down the body proteins, also prevent fatty cirrhosis (Dorman and Deans, 2000). In addition, these molecules not only prevent the breaking of proteins but increase their concentration in blood serum (Dragested et al, 2001; Surai et al, 2003). Methionine improves the internal environment of the intestine in a bird's body which leads to an increase in the benefit from the absorption of nutrients, thus increasing the live body weight (Alhashimi, 2020). The result showed a decrease in feed consumption when herbal methionine was added to the diet compared to the control diet. These results agreed with (Igbasan and Olugosi, 2013). There was an improvement in the food conversion factor in all treatments compared to the control in all six weeks of the experiment, and this was agreed with (Helder and Roy, 2007; Barbosa, 1995). L.carnitine could be the reason for improving the food conversion factor in treatments 4 and 5, by preventing the accumulation of collagen fibers which leads to cirrhosis, also absorbs the toxic materials and excreted out of the body (Kaur et al, 2013; Ebrahimi et al, 2015). In addition, methionine increases the efficiency of the birds by increasing the absorption of nutrients via increasing the length of the villi in the intestine which increase the absorption of proteins, fats, and minerals (Lesson, Summers, 2008). Furthermore, methionine increases weight gain by providing sulfuric amino acids which are very important for proteins in the body (Wang et al, 2004; Eklund et al, 2006). The reduction in the abdominal fat in the experiment treatments compared to the control was because of the addition of the sunflower seed oil with L.carnitine which affects metabolism and decrease the fat accumulation in the abdominal region in the broiler. The role of L.carnitine in b-oxidation is the key to fat reduction in carcasses (Shahzad, 2009; Samia et al, 2011; Makinde, 2017; Alhashimi, 2020; Pesti et al, 2000; Sanz et al, 2002). In addition, methionine is the reason why there was no difference in the weight of heart, liver, gizzard, and carcass cuts weight because it did not have any negative effect on the birds as mentioned by Aldaraji et al (2008).

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