

The effect of adding L. Carnitine with herbal methionine and sunflower seed oil on 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 the 30th of Sep 2021 to the 1st of Nov 2021. The objective of the study was to evaluate the addition of L. Carnitine with Herbal methionine and sunflower seeds to the broiler's diet and its effect on their productivity. At age a day, 350 broilers (Ross308) with an average weight of 42 gm. They were raised on a sawdust floor in a closed chamber with the use of 35 pen (dimension 190 x 90 cm), each chamber was equipped with two air pullers. Chicks were randomly assigned to 8 treatments with 4 replicates for each treatment (10 chicks per replicate). The result of statistical analysis showed that at 42 day of age the body weight of T 3, 4, 5, 6, 7, and 8 differed significantly ($P \leq 0.05$) compared to T1 and T2. The average daily gain of treatment 6 was higher significantly ($P \leq 0.05$) compared to treatments 3, 4, 5, 7, and 8. Also, treatments 3, 4, 5, 7, and 8 were higher than the control and treatment 2. The feed consumption rate was significantly lower in all treatments compared to the control, while T8 was higher than the other experiment treatment. Also, it has been noticed that T4 was significantly lower in feed consumption rate compared to treatments 1, 2, 3, 5, 6, and 7. The rate of feed conversion was significantly improved in treatments 4 and 8 compared to the other treatment. 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. The carcass composition was significantly higher in treatments 6 and 8 compared to the other treatments. There was no significant effect on the relative weight ratio of breast, leg, wing, neck, back, and drumstick between the treatments.

Keywords: L. Carnitine, herbal methionine, broilers

دراسة تأثير إضافة L.carnitine مع الميثيونين العشبي وخليطهما وزيت بذور زهرة الشمس في الصفات الإنتاجية لدجاج فروج اللحم

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الخلاصة

أجريت هذه الدراسة في حقل الدواجن التابع لقسم الإنتاج الحيواني – كلية الزراعة - جامعة كركوك للفترة من 2021/12/1 الى 2022/1/12، وكان الهدف منها معرفة تأثير دراسة مقارنة إضافة L. Carnitine والميثيونين العشبي في أيض زيت زهرة الشمس المضاف للعليقة في الأداء الإنتاجي لفروج اللحم ، اذ تم توزيع وبشكل عشوائي 350 فرخ بعمر يوم واحد من فروج اللحم نوع Ross 308 غير مجنس بمعدل وزن ابتدائي 42 غرام، تم الحصول على الافراخ من (مفقس كركوك) في محافظة كركوك ، ربيت هذه الافراخ تربية أرضية في قاعة مغلقة باستخدام 25 قفص ذو أبعاد (190 × 90سم) على فرشاة من نشارة الخشب، وكانت كل قاعة مجهزة بساحبتان هواء، وزعت الافراخ عشوائياً على 5 معاملات بواقع 5 مكررات للمعاملة الواحدة (المكرر الواحد 10 افراخ) تم توزيع الافراخ عشوائياً من عمر واحد. بينت نتائج التحليل الإحصائي في الاسبوع السادس من العمر (1-42) يوم وجود فروق معنوية ($P \geq 0.05$) في وزن الجسم ومعدل الزيادة الوزنية، ف لوحظ تفوق المعاملات الثالثة والرابعة والخامسة على المعاملة الاولى والثانية معنوياً ($P \geq 0.05$)، وفي معدل استهلاك العلف وجد انخفاضاً معنوياً للمعاملة الرابعة والخامسة مقارنة بالمعاملة الاولى والثانية والثالثة، أما في معدل معامل التحويل الغذائي فنلاحظ تحسن معنوي للمعاملة الثالثة والرابعة والخامسة مقارنة للمعاملة الاولى والثانية، وفي صفة الوزن النسبي للأحشاء الداخلية المأكولة ودهن البطن يلاحظ انخفاض معنوي في نسبة دهن البطن لجميع معاملات التجربة مقارنة بالمعاملة الاولى والثانية ولوحظ معدل الوزن النسبي للقلب والقانصة والكبد عدم وجود فروق معنوية بين معاملات التجربة ، ولم يلاحظ وجود اي فروق معنوية في معدل الوزن النسبي للوصلة الفخذية بين المعاملات، أما بالنسبة للوزن النسبي للصدر، عصا الطبال، الظهر، الاجنحة، ووزن النسبي للرقبة ولوحظ عدم وجود فروق معنوية في نسبة التصافي بين معاملات التجربة .

الكلمات المفتاحية : L-carantine، الميثيونين العشبي، ، فروج اللحم

Introduction

The amino acids, especially the essential of it, are considered the basic building unit of protein (Yusuf et al, 2014) in poultry nutrition. Researchers started to replace artificial sources of feed addition with plant sources. The two amino acids (methionine and lysine) have a major role in metabolism and increase growth and production quantitatively and qualitatively. Also, their artificial sources of them have a role as an antioxidant factor. Therefore, the herbal source of these amino acids was used to replace and avoid the harmful side effects of using artificial sources. In the body, the extra amount of methionine and lysine convert in the liver into L. Carnitine (Hu et al, 2000; Arslan, 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).

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.

Materials and Methods

The study was conducted in the poultry field of the animal production department, college of agriculture, Kirkuk university from (30/9/2021 to 10/11/2021). In the study, 320 chicks ROSE 308 and were randomly distributed to 8 treatments with 4 replicates (10 chicks per replicate) from 1 – 42 day. The aim of the study was to determine the effect of a diet that contains herbal methionine and the addition of L. Carnitine in the production performance of a broiler. The experiment consisted of 8 nutritional treatments as follows:

T1: Standard diet (Control)

T2: Contains 5% of sunflower oil

T3: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine

T4: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine

T5: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine

T6: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 1/3 of Artificial methionine.

T7: Contains 5% sunflower oil + 1/2 of the herbal methionine requirements and 1/2 of Artificial methionine.

T8: Contains 5% sunflower oil + 100% of the herbal methionine requirements. Table 1:

Chemical composition and percentage of starter diet from age one day to 10.

Diet %	* Treatments							
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
Wheat	56.94	56.94	56.92	56.91	56.91	56.85	56.94	56.94
Corn	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Soybean (47% crude protein)	30.71	30.71	30.71	30.71	30.71	30.71	30.71	30.71
Plant oil	5	5	5	5	5	5	5	5
Limestone	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Bicalcium phosphate	2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66
Salt	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mix of vitamins and minerals***	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
L. Carnitine	-	-	0.020	0.025	0.030	-	-	-
Artificial methionine	0.30	0.30	0.30	0.30	0.30	0.198	0.150	-
Herbal methionine	-	-	-	-	-	0.198	0.150	0.30
Lysine	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Total	100	100	100	100	100	100	100	100
**Calculated chemical composition								
Metabolisable energy (Kcal/Kg diet)	2955	2955	2955	2955	2955	2955	2955	2955
Crude protein %	22.37	22.37	22.73	22.73	22.73	22.37	22.37	22.37
C:P Ratio	130	130	130	130	130	130	130	130
Lysine %	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
Methionine %	0.59	0.59	0.59	0.59	0.59	0.49	0.45	0.59
Available Calcium	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Available phosphate	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47

* First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + ½ of the herbal methionine requirements and ½ of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

**According to NRC, (1994).

*** MIAVIT company contains Vit A, D3, E, K₃, biotin, folic acid, Vit B1, B2, B6, B12, nicotinic acid, antioxidant.

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

Diet %	* Treatments							
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
Wheat	34	34	33.98	33.97	33.97	34	34	34
Corn	27	27	27	27	27	27	27	27
Soybean (47% crude protein)	30.07	30.07	30.07	30.07	30.07	30.07	30.07	30.07
Plant oil	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Limestone	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Bicalcium phosphate	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42
Salt	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mix of vitamins and minerals	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
L. Carnitine	-	-	0.020	0.025	0.030	-	-	-
Artificial methionine	0.23	0.23	0.23	0.23	0.23	0.152	0.125	-
Herbal methionine	-	-	-	-	-	0.076	0.125	0.230
Lysine	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Total	100	100	100	100	100	100	100	100
**Calculated chemical composition								
Metabolisable energy (Kcal/Kg diet)	3072	3072	3072	3072	3072	3072	3072	3072
Crude protein %	21.22	21.22	21.22	21.22	21.22	21.22	21.22	21.22
C:P Ratio	14.76	14.76	14.76	14.76	14.76	14.76	14.76	14.76
Lysine %	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Methionine %	0.53	0.42	0.45	0.53	0.53	0.53	0.53	0.53
Available Calcium	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Available phosphate	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43

* First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + ½ of the herbal methionine requirements and ½ of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

** According to NRC, (1994).

*** MIAVIT company contains Vit A, D3, E, K₃, biotin, folic acid, Vit B1, B2, B6, B12, nicotinic acid, antioxidant.

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

Diet %	* Treatments							
	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
Wheat	20.25	20.25	20.21	20.19	20.19	20.25	20.25	20.25
Corn	44.08	44.08	44.08	44.08	44.08	44.08	44.08	44.08
Soybean (47% crude protein)	27	27	27	27	27	27	27	27
Plant oil	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Limestone	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Bicalcium phosphate	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19
Salt	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mix of vitamins and minerals	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
L. Carnitine	-	-	0.020	0.025	0.030	-	-	-
Artificial methionine	0.25	0.25	0.25	0.25	0.25	0.165	0.125	-
Herbal methionine	-	-	-	-	-	0.082	0.125	0.25
Lysine	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Total	100	100	100	100	100	100	100	100
**Calculated chemical composition								
Metabolisable energy (Kcal/Kg diet)	3162	3162	3162	3162	3162	3162	3162	3162
Crude protein %	19.29	19.29	19.29	19.29	19.29	19.29	19.29	19.29
C:P Ratio	164	164	164	164	164	164	164	164
Lysine %	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
Methionine %	0.54	0.41	0.45	0.54	0.54	0.54	0.54	0.54
Available Calcium	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Available phosphate	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39

* First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + ½ of the herbal methionine requirements and ½ of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

** According to NRC, (1994).

*** MIAVIT company contains Vit A, D3, E, K₃, biotin, folic acid, Vit B1, B2, B6, B12, nicotinic acid, antioxidant.

Productive characteristics studied: Live Body Weight (gm), Body weight gain, Feed consumption (gm/bird/week): estimated by Al-zubaidi (1986), Feed conversion ratio (gm diet/ gm weight gain): estimated by Al-zubaidi (1986), Edible percentage (heart, liver, gizzard), Carcass composition and Carcass cuts weight % based on Al-Fayyad et al. (2010)

Results

Table (4) showed a significant difference between the experiment treatments ($P \leq 0.05$) in the first week. Treatment 8 was significantly higher compared to treatments 1, 2, 3, 4, 5, and 6, also treatment 3 was higher than treatment 2 and the last one was higher than treatment 1 and 6. In the second week, treatment 8 was significantly higher than all other treatments ($P \leq 0.05$). In addition, treatments 3, 4, 5, and 7 showed a higher effect compared to treatments 1, 2, and 6, while there were no differences between treatments 1 and 2. Furthermore, treatment 8 showed a higher difference in the third week compared to the other treatments, whereas treatments 3, 4, 5, 6, and 7 showed a higher effect compared to treatments 1 and 2. Also, there were no differences between treatments 3, 4, 5, 6, and 7, while treatment 2 was higher than treatment 1. Week four showed higher differences between treatments 5, 7, and 8 compared to treatments 1, 2, 3, 4, and 6, while treatments 5, 7, and 8 didn't show any differences. Treatments 3, 4, and 6 were higher than treatments 1 and 2, whereas treatments 3, 4, and 6 didn't show any differences, also treatment 2 was higher than treatment 1. In week five, treatment 8 was significantly ($P \leq 0.05$) higher compared to the other treatments, and treatment 3, 5, and 7 was higher than treatment 4 and 6, while the last two treatments were higher than treatment 2, and treatment 2 was higher than treatment 1. Week six showed a higher difference in treatments 3, 4, 5, 6, 7, and 8 compared to treatment 1 and 2, while treatment 2 was higher than treatment 1. Also, there were no differences between treatments 3, 4, 5, 6, 7, and 8.

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 \pm standard error).

Treatments	First week	Second week	Third week	Fourth week	Fifth week
T1	148.50 \pm 1.500 c	726 \pm 14.7 c	1146024 \pm 14.7 c	1510.25 \pm 0.03 d	1815.75 \pm 7.69d
T2	152.75 \pm 1.314 b	788.25 \pm 2.83 b	1168.25 \pm 2.83 b	1201.50 \pm 4.78 c	1908.5 \pm 4.75c
T3	154.00 \pm 0.40 ab	799.25 \pm 2.39 ab	1179.25 \pm 2.39 ab	1400.50 \pm 5.17b	2117.5 \pm 3.12ab
T4	154.25 \pm 0.47 ab	801.25 \pm 1.37 ab	1201.25 \pm 1.37 ab	1402.50 \pm 4.17b	2115.5 \pm 14.36b
T5	154.25 \pm 0.62 ab	802.75 \pm 1.03 ab	1212.75 \pm 1.03 ab	1435 \pm 2.12 a	2150.5 \pm 13.8ab
T6	150.00 \pm 0.00 c	800.75 \pm 1.10 ab	1207.75 \pm 1.10 ab	1402.50 \pm 4.17 b	2115.7 \pm 14.6b
T7	154.00 \pm 0.70 ab	801.50 \pm 1.19 ab	1211.50 \pm 1.19 ab	1438 \pm 1.87 a	2150.7 \pm 13.8ab
T8	156.75 \pm 0.75a	815.50 \pm 1.65 a	1221.50 \pm 1.65 a	1435.25 \pm 2.17 a	2153.7 \pm 13.9a
Significant level	*	*	*	*	*

*Different letters within the same column indicate the presence of significant differences at the probability level ($P \leq 0.05$). ** First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + 1/2 of the herbal methionine requirements and 1/2 of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

The result in table (5) showed a significant difference ($P \leq 0.05$) in the first week of the experiment. Treatment 8 was significantly higher than the other treatments, while treatment 3, 5, and 7 were higher compared to treatments 2, 6, and 1. Also, treatment 2 was higher than treatment 1. In the second week, the results indicated that treatment 8 was also higher compared to all other treatments, whereas treatments 4, and 5 were higher than

treatments 1, 3, 6, and 7. In addition, treatment 1, 3, 6, and 7 was higher compared to treatment 2, while there were no differences between treatment 1, 3, 6, and 7. There was a significant difference in week three between treatment six and other treatments. Also, treatment 8 was higher than treatments 2, 3, 4, 5, and 7, while there were no differences between treatments 2, 3, 4, 5, and 7. In week four, the result showed that treatment 5, and six was higher than other treatments significantly ($P \leq 0.05$). Treatment 8 was higher compared to treatments 3, 4, and 6, while treatments 3, 4, and 6 were higher than treatments 1 and 2. In weeks 5 and 6 there were significant differences between all treatments and treatment 1, whereas there were no differences between treatments 2, 3, 4, 5, 6, 7, and 8.

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 \pm standard error).

Treatments	First week	Second week	Third week	Fourth week	Fifth week	Average weight gain
T1	106.5 \pm 1.5 c	276.7 \pm 2.59 bc	300.7 \pm 16.38 c	425.2 \pm 16.93 c	664.5 \pm 5.63 b	1775.75 \pm 12.54d
T2	110.7 \pm 1.3 b	276 \pm 1.08 c	359.5 \pm 2.72 ab	413.2 \pm 2.52 c	707 \pm 5.74 a	1908.5 \pm 12.46c
T3	112 \pm 0.4 ab	285 \pm 3.18 bc	360.2 \pm 4.09 ab	604.2 \pm 5.20 b	714 \pm 5.32 a	2117.5 \pm 11.45ab
T4	108 \pm 0.00	287.2 \pm 0.75 b	360.7 \pm 3.63 ab	619.7 \pm 2.28 ab	702.2 \pm 11.69 a	2115.5 \pm 14.21ab
T5	112.2 \pm 0.6 ab	287.7 \pm 4.40 b	360.7 \pm 3.94 ab	632.25 \pm 2.17 a	715.5 \pm 13.54 a	2150.5 \pm 16.03aa
T6	112.2 \pm 0.4 ab	284 \pm 1.87 bc	366.7 \pm 1.18 a	601.7 \pm 4.38 b	713.2 \pm 10.30 a	2115.7 \pm 13.04ab
T7	112 \pm 0.7 ab	286.7 \pm 4.49 bc	359.7 \pm 2.01 ab	632.5 \pm 2.17 a	716.7 \pm 13.76 a	2150.7 \pm 11.07a
T8	114.7 \pm 0.7 a	319.5 \pm 5.51 a	339.2 \pm 4.60 b	601.2 \pm 4.09 b	718.5 \pm 13.22 a	2153.7 \pm 12.12a
Significant level	*	*	*	*	*	*

*Different letters within the same column indicate the presence of significant differences at the probability level ($P \leq 0.05$). ** First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + 1/2 of the herbal methionine requirements and 1/2 of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

The result in table (6) showed an improvement in feed consumption in week one in treatment 6 compared to treatments 3, 4, 5, 7, and 8, also an improvement in all treatments compared to treatment 1. In week two, the result indicated a significant improvement in feed consumption in treatments 4 and 8 and it was higher than in other treatments. Feed consumption was lower in treatment 7 compared to treatment 6, also treatment 6 compared to treatments 3 and 5. It was lower in treatments 3 and 5 compared to treatment 2, and treatment 2 than treatment 1. In the third week, treatments 4 and 8 were significantly lower compared to treatment 7, while treatment 7 was higher than treatment 6, and the last one was higher compared to treatment 5. Results showed improvement in treatment 5 than in treatments 1, 2, and 3. Week four indicated a significant reduction in feed consumption in treatment 4 compared to other treatments. Also, treatment 6, 7, and 8 was lower than treatment 5. Treatment 5 was lower than treatments 3 and 2, while there were no differences between treatments 1 and 2. In week five, the result showed that treatment 4 was lower than all other treatments, also lower in treatment 8 compared to treatment 6. The last treatment was lower than treatments 3, 5, and 7. Treatment 2 was significantly lower ($P \leq 0.05$) than treatment 1. Week six showed a reduction in treatments 4 and 8 compared to treatments 1, 2, and 3, while these treatments were higher than treatment 7. Treatment 7 was lower compared to treatments 5 and 6, while treatment 8 was lower compared to other treatments. Also, treatment 4 was lower compared to treatment 7, whereas the last one was lower than treatments 3 and 6. In addition, treatments 3 and 6 were lower compared to treatments 2 and 5, while treatment 1 was higher 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).

Treatments	First week	Second week	Third week	Fourth week	Fifth week	Sixth week	Average total feed consumption
T1	0.64±183.50 a	0.00±550.00 a	2.35±681.25 a	2.13±835.75 a	14.43±1275.00a	30.48±1286.00bc	28.96±4811.50a
T2	1.31±177.75 b	1.08±543.00 a	0.86±678.50 a	2.59±836.75 a	23.08±122475ab	2.50±1272.50bc	32.48±4733.25ab
T3	0.47±179.25 b	1.77±537.00 b	0.47±677.75 a	0.86±832.50 a b	3.88±1189.75bc	2.62±1236.25bc	3.70±4652.50bc
T4	0.75±176.75 b	0.00±510.00 c	0.47±636.25 d	0.00±790.00 d	25.00±1025.00e	1.10±1222.75c	15.02±4455.00d
T5	0.47±178.25 b	1.75±534.25 b	2.06±665.50 b	3.48±827.00 b	14.43±1175.00bc	46.62±1361.00a	58.12±4741.00ab
T6	1.89±171.50 c	0.47±529.25 b	0.00±650.00 c	2.84±813.50 c	20.56±1152.50c	4.51±1355.50a	23.37±4672.25bc
T7	0.57±178.00 b	1.18±521.75c	0.00±640.00 d	1.65±815.75 c	1.25±1171.25bc	2.88±1295.00b	1.10±4617.25c
T8	1.18±177.25 b	0.62±512.25 c	0.95±635.50 d	1.03±812.75 c	14.93±1092.50d	0.86±1224.50c	25.41±4365.00e
Significant level	*	*	*	*	*	*	*

*Different letters within the same column indicate the presence of significant differences at the probability level ($P \leq 0.05$). ** First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + 1/2 of the herbal methionine requirements and 1/2 of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

Table (7) showed a significant effect in the first week in treatment 8 compared to other treatments, while treatments 4, 5, 6, and 7 were higher than treatments 2 and 3. Also, treatments 2, and 3 were higher than treatment 1. In week two, treatment 8 was higher than all other treatments, and treatment 4 was higher than treatment 7. A significant effect ($P \leq 0.05$) was indicated in treatment 7 compared to treatments 2, 3, 5, and 6, while treatments 2, 3, 5, and 6 were higher than treatments 1 and 2. The third week, showed a significant effect in treatments 2, 3, 4, 5, 6, 7, and 8 compared to treatment 1, while there were no differences between treatments 2, 3, 4, 5, 6, 7, and 8. In week four, treatment 8 was higher than other treatments, also treatments 4, 5, 6, and 7 were higher than treatment 3, and the last one was higher than treatments 1 and 2. In week five, treatment 8 was higher than other

treatments, and treatment 4 was higher than treatments 3, 5, 6, and 7. In addition, treatments 3, 5, 6, and 7 were higher than treatment 2, whereas treatment 2 was higher than treatment 1. Week six showed that treatment 1 was lower than other treatments, while there were no differences between treatments 2, 3, 4, 5, 6, 7, and 8.

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

Treatments	First week	Second week	Third week	Fourth week	Fifth week	Sixth week	Average total FCR
T1	0.03 \pm 1.72 a	0.01 \pm 1.98 a	0.11 \pm 2.28 a	0.08 \pm 1.97 a	0.02 \pm 1.91 a	0.12 \pm 2.75 a	0.02 \pm 2.10a
T2	0.01 \pm 1.60 b	0.01 \pm 1.96 a	0.01 \pm 1.88 b	0.01 \pm 2.02 a	0.05 \pm 1.73 b	0.06 \pm 2.01 b	0.00 \pm 1.87 b
T3	0.00 \pm 1.60 b	0.01 \pm 1.88 b	0.02 \pm 1.88 b	0.01 \pm 1.37 b	0.01 \pm 1.66 cb	0.18 \pm 2.17 b	0.03 \pm 1.76c
T4	0.00 \pm 1.57 cb	0.00 \pm 1.78 c	0.01 \pm 1.76 b	0.01 \pm 1.35 cb	0.04 \pm 1.55 c	0.12 \pm 2.18 b	0.01 \pm 1.70c d
T5	0.00 \pm 1.58 cb	0.03 \pm 1.85 b	0.01 \pm 1.84 b	0.00 \pm 1.30 cb	0.02 \pm 1.64 cb	0.14 \pm 2.36 b	0.02 \pm 1.76c
T6	0.01 \pm 1.58 cb	0.01 \pm 1.86 b	0.00 \pm 1.77 b	0.00 \pm 1.35 cb	0.03 \pm 1.61 cb	0.04 \pm 2.10 b	0.00 \pm 1.71c
T7	0.01 \pm 1.58 cb	0.03 \pm 1.82 bc	0.00 \pm 1.77 b	0.00 \pm 1.28 cb	0.03 \pm 1.63 cb	0.14 \pm 2.25 b	0.02 \pm 1.72c
T8	0.01 \pm 1.54 0.01 c	0.02 \pm 1.59 d	0.02 \pm 1.88 b	0.00 \pm 1.27 c	0.05 \pm 1.42 d	0.14 \pm 2.12 b	0.01 \pm 1.64 d
Significant level		*	*	*	*	*	*

*Different letters within the same column indicate the presence of significant differences at the probability level ($P \leq 0.05$). ** First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + 1/2 of the herbal methionine requirements and 1/2 of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

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 treatments 3, 4, 5, 6, 7, and 8 compared to treatment 2, while treatments 3, 4, 5, 6, 7, and 8 showed no differences.

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 \pm standard error).

Treatments	Abdominal fat	Gizzard%	Liver%	Heart%
T1	0.03 \pm 1.97a	0.07 \pm 2.31a	0.03 \pm 2.55a	0.01 \pm 0.54a
T2	0.131.58b	0.19 \pm 2.47a	0.16 \pm 2.79a	0.00 \pm 0.54a
T3	0.03 \pm 1.20c	0.01 \pm 2.46a	0.13 \pm 2.53a	0.01 \pm 0.51a
T4	0.03 \pm 1.18c	0.04 \pm 2.50a	0.07 \pm 2.82a	0.01 \pm 0.52a
T5	0.01 \pm 1.19c	0.01 \pm 2.43a	0.06 \pm 2.73a	0.00 \pm 0.52a
T6	0.03 \pm 1.14c	0.03 \pm 2.42a	0.05 \pm 2.74a	0.01 \pm 0.52a
T7	0.01 \pm 1.19c	0.02 \pm 2.43a	0.07 \pm 2.72a	0.01 \pm 0.53a
T8	0.01 \pm 1.19c	0.02 \pm 2.43a	0.05 \pm 2.74a	0.00 \pm 0.54a
Significant level	*	ns	ns	ns

*Different letters within the same column indicate the presence of significant differences at the probability level ($P \leq 0.05$). ** First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + 1/2 of the herbal methionine requirements and 1/2 of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

The result in table 9 showed that there was no significant effect between the experimental treatments in the percentage of carcass cuts, while carcass composition showed increasing in all treatments compared to treatment one (control).

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).

Treatments	Percentage of carcass cuts						
	Net Weight%	Neck %	Thigh %	drumstick %	Back%	Joint Thigh %	Chest%
T1	±73.99b 0.40	0.05±5.20a	0.04±10.29a	0.09±12.72	0.43±22.04a	0.14±16.49a	0.03±24.65
T2	±74.90ab 0.64	0.04±5.11a	0.02±10.48a	0.11±12.76	0.15±22.61a	0.11±16.53a	0.06±24.71
T3	±74.84ab 0.13	0.04±5.08a	0.03±10.08a	1.07±12.75	0.02±22.50a	0.05±16.74	0.05±24.75
T4	±75.76ab 0.70	0.10±5.27a	0.18±10.33a	0.06±12.66	0.17±22.43a	0.08±16.71	0.03±24.70
T5	±75.05ab 0.82	0.08±5.04a	0.04±10.09a	0.04±12.76	0.17±22.46a	0.09±16.72	0.10±24.69
T6	±75.89a 0.30	0.11±5.08a	0.21±10.06a	0.05±12.69	0.17±22.47a	0.09±16.75	0.06±24.75
T7	±75.08ab 0.74	0.18±5.19a	0.04±10.06a	0.17±12.52	0.39±22.64a	0.07±16.72	0.06±24.77
T8	±76.32a 0.25	0.15±5.10a	0.03±10.07	0.07±12.80	0.09±22.16a	0.04±16.63	0.05±24.77
Significant level	*	N.S	N.S	N.S	N.S	N.S	N.S

*Different letters within the same column indicate the presence of significant differences at the probability level ($P \leq 0.05$). ** First: Standard diet (Control) , Second: Contains 5% of sunflower oil, Third: Contains 5% sunflower oil + 200 mg/kg of L. Carnitine, Fourth: Contains 5% sunflower oil + 250 mg/kg of L. Carnitine, Fifth: Contains 5% sunflower oil + 300 mg/kg of L. Carnitine, Sixth: Contains 5% sunflower oil + 1/3 of the herbal methionine requirements and 2/3 of the diet. , Seventh: Contains 5% sunflower oil + 1/2 of the herbal methionine requirements and 1/2 of the diet., Eighth: Contains 5% sunflower oil + 100% of the herbal methionine requirements.

Discussion

The addition of L. Carnitine showed significant improvement compared to the control diet in average body weight and weight gain at age 42 days at the addition level of 0.2%, 0.25% (300% mg/kg diet as in treatments 3, 4, and 5) respectively. Also, where treatments the artificial methionine was replaced with herbal methionine at levels 0.33, and 0.66 as in treatments 6, 7, and 8 respectively. The reason behind that is related to the active role of L. Carnitine as well as to the role of herbal methionine. The addition of herbal methionine to the diet improved the internal environment of the intestine in birds, and increased mineral absorption, thus the increase in live body weight as referred by Igbasan and Olugosi (2013). In addition, methionine has a positive effect because the herbal and artificial amino acids

play a role in protein synthesis and energy production, increasing the digestion rate, therefore increasing weight gain and feed conversion ratio as mentioned by Kalbande et al (2009). The lowest feed consumption between the birds to the total feed consumption from day 1 to 42 was in treatment 8 compared to the control treatment. The reason is related to the herbal methionine for its role in balancing the amino acids and the body proteins (Makinde et al, 2017). Furthermore, the improvement in feed conversion in treatment (4; 0.25% of L. Carnitine mg/kg diet and treatment 8; 100% herbal methionine) is because that the methionine improved the feed consumption via improving the palatability of the diet (Yusuf et al, 2014). Also, the improvement in feed consumption in treatment 4 is related to the methionine since the methionine provided long chain fatty acids to B-Oxidation in the mitochondria and which that provides energy to the body (Lehninger, 1975 and Zhan, 2006). The current study showed a reduction in feed consumption when herbal methionine was added to the diet compared to the control diet. These results were agreed with Igbasan and Olugosi (2013). The improvement in feed conversion ratio in treatments 4 and 8 compared to the other treatments related to the herbal methionine and L. Carnitine which added an optimum balance between the amino acids and thus improved the growth and production (Binder, 2003; Sayed et al, 2001). Another reason could be that there was no negative effect on the body of the birds from the addition of herbal methionine as referred to by Al-Daradji et al (2008). Therefore, there were no differences in the weight of the heart, liver, and gizzard as well as the carcass cuts. These results agreed with (Nobakht et al, 2001). At age 42 and after slaughtering, the result showed a reduction in the abdominal fat ratio in the treatment where L. Carnitine were added to the diets (0.2%, 0.25%, 300 mg/kg diet). Also, in treatments 3, 4, and 5 respectively the herbal methionine was replaced with artificial methionine (0.33, 0.66, 100%) as well as in treatments 6, 7, and 8 compared to the control diet. The reason is related to the role of methionine in donating the methyl group CH₃ which plays role in the L. Carnitine components, and the last play role in transporting the long chain fatty acids through the intracellular membrane to the mitochondria for oxidation, thus a reduction in fat accumulation in the fat tissue (Makinde, 2017; Al-Hashemi, 2020). Another reason behind the reduction in the percentage of the abdominal fat of the carcass in treatment 4, 5, and 6 is because of the role of L. Carnitine in the processes of B-Oxidation since L. Carnitine increase the lipase activity and decrease the cholesterol concentration and triglyceride in the plasma Zhan et al (2006).

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