Study effect of synergistic metabolism for Betaine and Taurine compounds with Herbal methionine upon Performance, carcass characteristics for Broiler

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Abstract

This experiment was conducted in poultry fields of the Department of Animal Production - College of Agriculture -University of Kirkuk for the period from 20/3/2021 to 1/5/2021 for a period of 42 days. The aim of this study was to determine the effect of Betaine and Taurine with the herbal methionine upon the productive performance, carcass characteristics for broiler ROSS 308. In this study we used 350 chicks of broiler ROSS 308 unsexed, at the age of one day, the weight rate was 42 gm per chicken, Chickens were distributed from the first day to 7 feeding treatments, (50 birds/ treatment) with 5 replications/ treatment. (10 birds/replicate), and each replicate included 10 birds in 35 cages by dimensions (90×190cm). The birds of experiment were fed with the following nutritional Treatments: The first treatment: (control)without any addition, the second treatment: (control) positive adding the Indian herbal methionine to meet the needs. The third treatment is Betaine instead of the herbal methionine to fill the body's need of methionine, and the fourth treatment is the replacement taurine instead of the herbal methionine to fill the body's need of methionine, and the Fifth transaction Add the Betaine compound by 50% and taurine by 50% of the body's need for the herbal methionine to fill the needs, and the sixth treatment is (Control) Addition of Betaine at 25% and Taurine at 75% instead of herbal methionine to meet the bird's methionine needs , and the sixth treatment (Control): Addition of Betaine at 75% and Taurine at 25% instead of herbal methionine to meet the bird's needs of methionine. The results of the statistical analysis showed that there were significant differences ($P\leq0.05$) in the rate of weight gain, we note that T6 was significantly ($P\leq0.05$) superior to T3, T4 and T5, and in the rate of feed consumption, we noticed a significant decrease in the total feed consumption for all treatments added to the two compounds betaine and taurine and herbal methionine compared with the control group, as for the characteristic of the rate of food conversion factor, we notice a significant improvement for all treatments added to it the two compounds betaine and taurine compared with the control group, and in the character of the relative weight of the internal organs eaten, it is noted that T1 was significantly ($P\leq0.05$) superior to T2. In the mean relative weight of the heart, liver, gizzard and abdominal fat. As for the carcass cuts, it was found that T3, T4, T5, T6 and T7 were significantly superior to the T2 in the average netting ratio, in the relative weight of the chest, a significant ($P\leq0.05$) was found for T5 and T7 over T3 . T7 significantly ($P\leq0.05$) over the rest of the treatments, and in the weight of the drumstick, a significant increase was observed in favor of T7 over T1 and T4. As for the relative weight of the back, T3 significantly ($P\leq0.05$) exceed T4, and it was noted in the relative weight for wings, T1 exceed T2, and the T1 ($P\leq0.05$) was significantly superior to T3 and T4 in neck weight.

Keywords: Betaine, Taurine, herbal methionine, broilers.

دراسة تأثير الايض التأزري للمركبين **Betaine** و **Taurine** مع الميثيونين العشبي في الاداء الانتاجي وصفات الذبيحة لفروج اللحم

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الخلاصة

أجريت هذه الدراسة في حقل الدواجن التابع لقسم الإنتاج الحيواني – كلية الزراعة - جامعة كركوك للفترة من 2021/3/20 الى 2021/5/1 ، وكان الهدف منها معرفة تأثير استجابة الايض التأزري للمركبين Betaine و Taurine مع الميثيونين العشبي في الاداء الانتاجي وصفات الذبيحة لفروج اللحم نوع Ross 308، اذ تم توزيع وبشكل عشوائي 350 فرخ بعمر يوم واحد من فروج اللحم نوع Ross 308 غير مجنس بمعدل وزن ابتدائي 42 غرام ، وزعت الأفراخ عشوائياً على 7معاملات (50 طيراً/معاملة) بواقع 5 مكررات/ معاملة (وضم المكرر الواحد 10 افراخ) وتم توزيع المكررات عشوائيا ابتداءً من اليوم الاول من العمر. ربيت هذه الأفراخ تربية أرضية في قاعة مغلقة باستخدام 35 قفص ذو أبعاد (90 X 190سم). غذيت طيور التجربة بالمعاملات التغذوية الآتية في أدناه وعلى النحو الآتي: المعاملة الأولى: (سيطرة (سالبة بدون أية اضافة للميثيونين من النوعين الصناعي والعشبي، المعاملة الثانية: (سيطرة(موجبة اضافة الميثيونين العشبي الهندي لسد الاحتياجات، المعاملة الثالثة احلال Betaineبدلاً من الميثيونين العشبي لسد حاجة الجسم من الميثيونين، المعاملة الرابعة احلال Taurine بدلاً من الميثيونين العشبي لسد حاجة الجسم من الميثيونين، المعاملة الخامسة اضافة مركب Betaine بنسبة 50% و Taurine بنسبة 50% من حاجة الجسم من الميثيونين العشبي لسد الاحتياجات، المعاملة السادسة (Control) اضافة مركب Betaine بنسبة 25% و Taurine بنسبة 75% بدلاً من الميثيونين العشبي لسد احتياجات الطير من الميثيونين، المعاملة السادسة (Control) اضافة مركب Betaine بنسبة 75% و Taurineبنسبة 25% بدلاً من الميثيونين العشبي لسد احتياجات الطير من الميثيونين. أظهرت نتائج التحليل الإحصائي وجود فروق معنوية($P\leq0.05$) في معدل الزيادة الوزنية، فنلاحظ تفوق المعاملة السادسة معنوياً ($P\leq0.05$) على المعاملات الثالثة والرابعة والخامسة ،وفي معدل استهلاك العلف فنلاحظ انخفاضاً معنوياً في استهلاك العلف الكلي لجميع المعاملات المضافة لها المركبين البيتين والتورين والميثيونين العشبي مقارنة مع مجموعة السيطرة، أما في صفة معدل معامل التحويل الغذائي فنلاحظ تحسناً معنوياً لجميع المعاملات المضافة لها المركبين البيتين والتورين مقارنة مع مجموعة السيطرة، وفي صفة الوزن النسبي للأحشاء الداخلية المأكولة يلاحظ تفوق المعاملة الاولى معنوياً ($P\leq0.05$) على المعاملة الثانية في معدل الوزن النسبي للقلب والكبد والقانصة ودهن البطن. أما قطعيات الذبيحة وجد تفوق المعاملات الثالثة والرابعة والخامسة والسادسة والسابعة معنوياً على المعاملة الثانية في معدل نسبة التصافي، في الوزن النسبي للصدر وجد تفوق معنوي ($P\leq0.05$) للمعاملتين الخامسة والسابعة على المعاملة الثالثة، ويلاحظ وجود فروق معنوية في معدل الوزن النسبي للفخذ اذ تفوقت المعاملة السابعة معنوياً ($P\leq0.05$) على بقية المعاملات، وفي وزن عصا الطبال لوحظ زيادة معنوية لصالح المعاملة السابعة على المعاملتين الاولى والرابعة، أما بالنسبة للوزن النسبي للظهر فقد تفوقت المعاملة الثالثة معنوياً ($P\leq0.05$) على المعاملة الرابعة، ولوحظ في الوزن النسبي للأجنحة تفوق للمعاملة الاولى على المعاملة الثانية، وتفوقت معنوياً(($P\leq0.05$المعاملة الاولى على المعاملتين الثالثة والرابعة في وزن للرقبة.

الكلمات المفتاحية: البيتين ، التورين، الميثيونين العشبي، فروج اللحم

1. Introduction

The economic development and the rise in the standard of living for many countries has led to a change in the lifestyle of the people The demand for rich sources of nutrients and poultry products such as meat and eggs increased. It is the most important source of protein as a healthy food ingredient (adeola, 2006) . In the last two decades, Betaine has been used to relieve heat stress, and it is used as food additives in the diet or in drinking water because it has two important Physiological functions The first is being a donor of the methyl group, and the second is regulating the osmotic pressure of the cell, being an ionic dipole,(dipolar Zwitterions) Which is Quickly soluble in water and has the ability to maintain cell fluid balance (Essen and Enting, 2007).The methyl group is involved in many chemical reactions in the body and because it cannot be synthesized in the body, so it comes from the raw materials, the most important of which are (methionine, choline and betaine). Betaine is more efficient than methionine and choline in giving it the methyl group, noting that vertebrates, including poultry, have a limited ability to synthesize betaine in sufficient quantities (Rao Rama et al., 2008) ,and because the body's increased need for the methyl group (CH3) when exposed to any challenge, it became necessary to add betaine as a donor In addition to its role in preserving cell water (Eklund et al. 2005), stated that adding betaine to the ration reduces the dehydration to which the bird is exposed, facilitates the process of water retention inside the cell, especially the intestine cells, and encourages a change in the structure of the epithelium layer of the intestine(Kettunen et al., 2001). Leptin participates in protecting the intestinal epithelium, which leads to an improvement in growth rate and food utilization efficiency (Honarbakhsh et al., 2007a) , in addition to its role in improving carcass quality ,and it has an action in improving the mucous membrane of the gastrointestinal tract from heat stress and digestive disorders (Rama Rao et al., 2008). As for taurine, it is a semi-major amino acid It is found in high concentrations in all animal cells (Ripps and Shen, 2012). Taurine has a variety of regulatory functions and is considered a major regulator of cell homeostasis, although it does not include in protein synthesis or energy supply (Murakami, 2017). Methionine is an essential amino acid that is first specified in poultry feeding ,due to its vital role in the growth and production of poultry on the one hand, and most of the plant-source feed materials included in the composition of balanced feeds as energy sources such as grains or sources of vegetable protein such as vegetable cakes lack one or more of the amino acids. It is essential and important for optimum production performance and high quality(Abd El-Wahab et al., 2015 Ahmed and Abbas, 2015 and Manju et al., 2015). While ensuring the functioning of vital activities in the body, including the action of methionine as an inhibitor of oxidation by considering methionine as a generator of the compound Glutathione, especially the production of the enzyme (Glutathione Peroxidase) to break down peroxides and prevent the formation of free radicals that damage living cells (Thomas, 2014), that Methionine is an essential amino acid that contains sulfur (Bizini, 2018, Al-Hadidi and Al-Naimi 2018). It does not form in the body of a bird from other amino acids, so it must be available in the ration and in sufficient quantities to meet the needs of the bird (Walid, 2011 and Kahila, 2012, Farkhoy et al., 2012). and the addition of methionine more than the recommended nutritional requirement for broilers improves the performance of birds, especially body weight and feed conversion efficiency (Khan et al., 2011), and in order to raise the readiness of nutrients by reducing The effect of anti-nutritional factors such as tannin. Methionine has been added to diets to meet the needs of birds for growth and production since the fifties of the last century(Zangana and Al-Nuaimi 2020, Al-Naimi 1980).

the study aimed to know the effect of the synergistic metabolism of the two compounds Betaine and Taurine with herbal methionine and its effect on the productive performance, carcass characteristics of broilers.

2. Materials and Methods

This study was conducted in the field of poultry of the Department of Animal Production / College of Agriculture / University of Kirkuk for the period from 20/3/2021 until 1/5/2021. ROSS 308. In this experiment, 350 unsexed chicks of Rose 308 strain were used at one-day old, with a starting weight of 42 g / chick. Chicks were raised ground in a closed room using 35 pens with dimensions of 90 x 190 cm on a bed of sawdust with a thickness of 3 - 5 cm. Sugar was added to drinking water during the first day at a concentration of 50 g / liter of water for 12 hours. The energy is fast and clean out the gastrointestinal tract, and water and feed were provided continuously in front of the bird throughout the experiment period. Plastic inverted manholes with a capacity of 2 liters were used in the first week, and they were gradually replaced by automatic hanging manholes. Gas incubators were used for the purpose of heating and obtaining appropriate temperatures of 35 m during the first week of life, then gradually reduced at a rate of two degrees per week until reaching 20-25 m at the end of the fifth week of the chicks 'life, as well as providing an appropriate light program during the breeding period, which includes 23 hours of lighting 1 hour of darkness in the first week and then to the end of the experiment, use 20 hours of lighting and 4 hours of darkness. Chicks were distributed randomly into seven treatments, each treatment included five replicates, and for each replicate 10 birds, the replicates were distributed randomly from the first day of life, Nutritional treatments for the productive stage were as follows:

1- first treatment (control) negative without any addition of methionine.
2- second treatment (control) positive addition of Indian herbal methionine to meet the needs.
3- third treatment Addition of Betaine to meet the bird's needs of herbal methionine.
4- Fourth treatment the addition of Taurine to meet the needs of the herbal methionine.
5- Fifth treatment to meet the needs of herbal methionine, Betaine is added at 50% and Taurine at 50%.
6- Sixth treatment to meet the needs of herbal methionine, Betaine is added at 25% and Taurine at 75%.
7- Seventh treatment to meet the needs of herbal methionine, betaine is added at 75% and taurine at 25%.

Table (1) Chemical composition and calculated percentages of the starter diet from 1 to 10 days age.

Ingredient (%)	T1	T2	T3	T4	T5	T6	T7
Wheat	58.14	57.94	57.84	57.84	57.84	57.39	57.39
Soybean meal, 47% CP	33.40	33.50	33.50	33.50	33.50	33.50	33.50
Vegetable oil	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Di calcium phosphate	2.66	2.66	2.66	2.66	2.66	2.66	2.66
Limestone	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Salt (NaCl)	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mineral and Vitamin premix	0.10	0.10	0.10	0.10	0.10	0.10	0.10
L-Lysine	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Herbal-Methionine	-	0.10	-	-	-	-	-
Betaine	-	-	0.20	-	0.10	0.50	0.15
Taurine	-	-	-	0.20	0.10	0.15	0.50
Total	100	100	100	100	100	100	100
Calculated Analysis **							
ME (kcal / kg)	2966	2964	2959	2959	2959	2946	2946
Crude Protein(%)	22.71	22.75	22.73	22.73	22.73	22.68	22.68
Calcium (%)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Available phosphorus (%)	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Lysine (%)	1.48	1.48	1.48	1.48	1.48	1.48	1.48
Methionine (%)	0.31	0.31	0.31	0.31	0.31	0.31	0.31

a- use protein concentrate Wafi (Originating Hollander) and contain on 40% crude protein and 2100 (Kcal/ Kg) and 5% crude fat and 3.85% Lysine and 3.70% Methionine and 4.12% Methionine + cysteine and 5% Calcium and 4.68% phosphor

b- Calculated analysis depending for ingredient incoming in National Research Council (NRC, 1994).

Table (2) Chemical composition and calculated percentages of the growth diet from 11 to 24 days age.

Ingredient (%)	T1	T2	T3	T4	T5	T6	T7
Wheat	61.70	61.60	61.50	61.50	61.50	61.05	61.05
Soybean meal, 47% CP	29.50	29.50	29.50	29.50	29.50	29.50	29.50
Vegetable oil	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Di calcium phosphate	2.42	2.42	2.42	2.42	2.42	2.42	2.42
Limestone	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Salt (NaCl)	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mineral and Vitamin premix	0.10	0.10	0.10	0.10	0.10	0.10	0.10
L-Lysine	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Herbal Methionine	-	0.10	-	-	-	-	-
Betaine	-	-	0.20	-	0.10	0.50	0.15
Taurine	-	-	-	0.20	0.10	0.15	0.50
Total	100	100	100	100	100	100	100
Calculated Analysis **							
ME (kcal / kg)	3036	3033	3030	3030	3030	3014	3014
Crude Protein(%)	21.26	21.24	21.23	21.23	21.23	21.18	21.18
Calcium (%)	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Available phosphorus (%)	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Lysine (%)	1.37	1.37	1.37	1.37	1.37	1.37	1.37
Methionine (%)	0.29	0.29	0.29	0.29	0.29	0.29	0.29

a- use protein concentrate Wafi (Originating Hollander) and contain on 40% crude protein and 2100 (Kcal/ Kg) and 5% crude fat and 3.85% Lysine and 3.70% Methionine and 4.12% Methionine + cysteine and 5% Calcium and 4.68% phosphor

b- Calculated analysis depending for ingredient incoming in National Research Council (NRC, 1994).

Table (3) Chemical composition and calculated percentages of the final diet from 25 to the age of marketing.

Ingredient (%)	T1	T2	T3	T4	T5	T6	T7
Wheat	64.57	64.47	64.37	64.37	64.37	63.92	63.92
Soybean meal, 47% CP	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Vegetable oil	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Di calcium phosphate	2.19	2.19	2.19	2.19	2.19	2.19	2.19
Limestone	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Salt (NaCl)	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mineral and Vitamin premix	0.10	0.10	0.10	0.10	0.10	0.10	0.10
L-Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Herbal-Methionine	-	0.10	-	-	-	-	-
Betaine	-	-	0.20	-	0.10	0.50	0.15
Taurine	-	-	-	0.20	0.10	0.15	0.50
Total	100	100	100	100	100	100	100
Calculated Analysis **							
ME (kcal / kg)	3070	3067	3064	3064	3064	3048	3014
Crude Protein(%)	20.39	20.38	20.37	20.37	20.37	20.31	21.18
Calcium (%)	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Available phosphorus (%)	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Lysine (%)	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Methionine (%)	0.28	0.28	0.28	0.28	0.28	0.28	0.28

a- use protein concentrate Wafi (Originating Hollander) and contain on 40% crude protein and 2100 (Kcal/ Kg) and 5% crude fat and 3.85% Lysine and 3.70% Methionine and 4.12% Methionine + cysteine and 5% Calcium and 4.68% phosphor

b- Calculated analysis depending for ingredient incoming in National Research Council (NRC, 1994).

3. Results

From the results shown in Table (4) the effect of adding Betaine and Taurine with herbal methionine on the average body weight of broilers, it is inferred that there were no significant differences between the control treatment and the treatments to which betaine, taurine and herbal methionine were added in the first week, while T4, T5 and T7 were significantly superior ($P\leq0.05$) on the T6 during the second week, while in the third week, T2 , T3, T4, T5, T6 and T7 with betaine and taurine were significantly ($P\leq0.05$) superior to T1 (control), while it was found that during the fourth and fifth weeks the superiority of the two treatments T5 and T7 were significantly ($P\leq0.05$) on T3, T4 and T6. During the sixth week, the T5 and T6 were significantly ($P\leq0.05$) superior to T3, T4 and T7, and the final weight average was (2287.20, 2539.00, 2692.00, 2688.40, 2754.80, 2790.00, 2713.60) grams for the seven treatments in a row.

Table (4) effect of synergistic metabolism for Betaine and Taurine compounds with Herbal methionine in average body weight of broiler meat at the age of (42) days (median ± standard error).

treatments	Average live body weight in w1	Average live body weight in w2	Average live body weight in w3	Average live body weight in w4	Average live body weight w5	Average live body weight in w6
T1	0.58 ± 151.20 a	1.98 ± 423.20 c	11.51 ±724.20 b	3.14 ± 1145.60 d	8.71 ± 1806.00 d	13.45 ± 2287.20 d
T2	0.92 ± 150.40 a	0.37 ± 425.80 bc	3.86 ± 793.60 a	3.80 ±1198.40 c	4.29 ±1908.40 c	14.71 ±2539.00 c
T3	0.58 ± 150.20 a	0.50 ± 428.60 bc	1.87 ± 796.00 a	4.25 ± 1401.80 b	2.63 ± 2114.80 b	41.76 ± 2692.00 b
T4	0.37 ±151.20 a	1.20 ± 437.40 a	0.94 ±798.00 a	3.77 ±1399.40 b	11.22 ±2114.20 b	28.18 ±2688.40 b
T5	0.48 ± 152.20 a	3.35 ±438.40 a	0.97 ± 798.60 a	1.76 ±1433.00 a	12.80 ±2160.80 a	23.25 ±2745.80 ab
T6	0.38 ± 151.60 a	1.42 ±430.80 b	0.63 ±795.00 a	3.77 ±1399.40 b	11.22 ±2114.00 b	6.97 ±2790.00 a
T7	0.50 ± 152.40 a	3.16 ± 439.20 a	0.63 ± 800.00 a	1.70 ± 1431.00 a	12.64 ± 2153.80 a	20.76 ± 2713.60 b
Level significant	NS	*	*	*	*	*

* the different letters within the same column refers to Significantly differences at possibility level ($p\leq0.05$)

** T1 (control):(Control diet devoid of any addition), T2: (1g DL-methionine), T3: (2g Betaine), T4:(2g Taurine), T5:(1g Betaine +1g Taurine), T6: (0.5g Betaine +1.5g Taurine), T7: (1.5g Betaine + 0.5g Taurine) .

The results of the weight gain in Table (5) show the effect of adding Betaine and Taurine with herbal methionine on the rate of weight gain for broilers, as there were no significant differences between treatments added to betaine, taurine and herbal methionine and T1 (control) in the first week, while T4 exceed T5 and T7 were significantly (P≤0.05) over T6 during the second week, while the T2, T3, T4, T5 and T6 were significantly (P≤0.05) superior to T1 (control) during the third week, and in the fourth week T5 and T7 were significantly exceed (P≤0.05) on T3, T4 and T6, and T2, T3, T4, T5, T6 and T7 with betaine and taurine added significantly (P≤0.05) over T1 (control) during the fifth week of the experiment, and it was found during the sixth week that there was a significant increase (P≤0.05) In T2 and T6, which exceed T3, T4, and T7, as for the total weight gain, we notice that T6 and T7 exceed T3, T4 and T7. Significantly (P≤0.05) on e T3, T4 and T5, and the total weight gain was recorded (2245.20, 2497.00, 2650.00, 2646.40, 2671.60, 2748.00, 2703.80) g/bird for the seven treatments, respectively.

Table (5) effect of synergistic metabolism for Betaine and Taurine compounds with Herbal methionine in average weight gain of broilers at (42) days of age (medium ± standard error).

Treatments	W1	W2	W3	W4	W5	W6	Total weight gain
T1	0.58 ± 119.20 a	1.92 ± 272.00 c	12.80 ±301.00 b	13.64 ± 421.40 c	6.21 ± 660.40 b	17.62 ± 481.20 c	13.45 ± 2245.20 d
T2	0.92 ± 108.40 a	0.74 ± 275.40 bc	3.56 ± 367.80 a	3.27±404.80 c	4.63 ±710.00 a	18.01 ±630.60 ab	14.71 ±2497.00 c
T3	0.58 ± 118.20 a	0.81 ± 278.40 bc	1.74 ± 367.40 a	4.42 ± 605.80 b	4.03 ± 713.00 a	42.65 ± 577.20 b	41.76 ± 2650.00 b
T4	0.37 ±119.20 a	1.20 ± 286.20 a	1.80 ±360.60 a	3.38±601.40 b	7.87 ±714.60 a	25.56 ±574.40 b	28.18 ±2646.40 b
T5	0.48 ± 119.20 a	3.27 ±286.20 a	3.00 ± 361.20 a	1.51±632.40 a	12.49 ±722.80 a	33.00 ±592.00 bc	20.76 ±2671.60 b
T6	0.37 ± 119.20 a	1.28 ±279.60 b	1.20 ±367.20 a	3.69±601.40 b	7.87 ±714.60 a	14.48 ±676.00 a	6.97 ±2748.00 a
T7	0.48 ± 119.20 a	3.52 ± 287.00 a	2.85 ± 361.80 a	1.88 ± 631.00 a	12.49 ± 722.80 a	28.92 ± 559.80 b	23.25 ± 2671.60 ab
Level significant	NS	*	*	*	*	*	*

* the different letters within the same column refers to Significantly differences at possibility level (p≤0.05)

** T1 (control):(Control diet devoid of any addition), T2: (1g DL-methionine), T3: (2g Betaine), T4:(2g Taurine), T5:(1g Betaine +1g Taurine), T6: (0.5g Betaine +1.5g Taurine), T7: (1.5g Betaine + 0.5g Taurine) .

It is inferred from the results shown in Table (6) the effect of adding Betaine and Taurine with herbal methionine on the rate of feed consumption for broilers. and manufactured methionine, while in the second week it was found that T1 (control) was significantly (P≤0.05) superior to T3 to which betaine was added, and T1 (control) was significantly (P≤0.05) superior to T3 in the rate of feed consumption during the third week. In the fourth week, T1 (control) was significantly (P≤0.05) superior to T2 and T3, and T1 (control) was significantly (P≤0.05) superior to the rest of the treatments during the fifth week, and during the sixth week it was observed that T1 (control) was significantly superior. (P≤0.05) on T2 to which betaine was added, and as for the total feed consumption, we notice a significant decrease in the total feed consumption for all treatments added to it betaine,

taurine and herbal methionine, which amounted to (4260.00, 4260.20, 4133.60, 41 27.40, 4133.60, 4126.00) g/bird for T2, T3, T4, T5, T6 and T7 compared with the control group, which recorded 4784.40 g/bird.

Table (6) effect of synergistic metabolism for Betaine and Taurine compounds with Herbal methionine in average feed consumption of broilers at (42) days of age (medium ± standard error).

Treatments	W1	W2	W3	W4	W5	W6	Total feed intake
T1	0.50 ± 173.40 a	0.89 ± 525.00 a	2.42 ± 684.00 a	4.23 ± 779.60 a	29.32 ± 1050.00 a	20.73 ± 1572.40 a	51.75 ± 4784.40 a
T2	0.50 ± 170.40 bc	0.50 ± 412.60 b	20.59 ± 559.80 bc	2.54 ± 739.00 b	2.50 ± 937.40 b	15.38 ± 1440.80 b	33.17 ± 4260.00 b
T3	0.67 ± 171.40 ab	2.54 ± 402.60 cd	3.21 ± 580.20 b	1.30 ± 737.00 b	6.13 ± 932.00 b	8.28 ± 1437.00 bc	15.77 ± 4260.20 b
T4	0.66 ±170.20 bc	1.28 ±406.80 c	1.46 ±545.40 c	1.97 ±695.00 c	2.00 ±912.00 b	1.90 ±1404.20 c	5.52 ±4133.60 c
T5	0.48 ± 170.20 bc	1.16 ± 398.40 de	4.07 ± 546.20 c	3.72 ± 701.20 c	0.50 ± 907.40 b	1.77 ± 1404.80 c	4.45 ± 4127.40 c
T6	1.90 ± 168.20 c	1.28 ± 406.80 c	1.46 ± 545.40 c	1.97 ± 695.00 c	1.91 ± 912.40 b	1.77 ± 1405.80 c	5.20 ± 4133.60 c
T7	0.48 ± 170.20 bc	1.60 ± 397.40 e	4.07 ± 546.20 c	3.72 ± 701.20 c	0.73 ± 907.20 b	3.41 ± 1403.80 c	5.44 ± 4126.00 c
Level significant	*	*	*	*	*	*	

* the different letters within the same column refers to Significantly differences at possibility level ($p \leq 0.05$)

** T1 (control):(Control diet devoid of any addition), T2: (1g DL-methionine), T3: (2g Betaine), T4:(2g Taurine), T5:(1g Betaine +1g Taurine), T6: (0.5g Betaine +1.5g Taurine), T7: (1.5g Betaine + 0.5g Taurine) .

It is inferred from the results shown in Table (7) the effect of adding the two compounds Betaine and Taurine with herbal methionine on the feed conversion factor (gram feed/gram weight gain) for broilers, and there was a significant improvement ($P \leq 0.05$) in T6, which recorded (1.54 grams feed/ A gram of weight gain compared to T1 , T2, T3, T4, T5 and T7, which amounted to 1.58, 1.57, 1.58, 1.55, 1.55, and 1.55 grams of feed/gram, respectively, during the first week, while during the second, third, fifth and sixth week, a significant improvement was found in the treatment T2, T3, T4, T5, T6 and T7 with betaine, taurine, and herbal methionine compared to T1 (control) free of addition, and during the fourth week a significant superiority ($P \leq 0.05$) was found for T3, T4, T5, T6 and T7 compared to T1 and T2, as for the total feed conversion factor. We notice a significant improvement in all the treatments added to it the two compounds betaine, taurine and herbal methionine, which amounted to (1.66, 1.59, 1.55, 1.52, 1.49, 1.54) grams of feed / grams of weight gain for the second treatments Intention, T3, T4, T5, T6 and T7 compared with the control group, which recorded 2.07 g of feed / g weight gain.

Table (7) effect of synergistic metabolism for Betaine and Taurine compounds with Herbal methionine in average feed conversion factor of broilers at (42) days of age (medium ± standard error).

Treatments	W1	W2	W3	W4	W5	W6	Total feed conversion ratio
T1	0.01 ± 1.58 a	0.01 ± 1.93 a	0.09 ± 2.27 a	0.06 ± 1.85 a	0.04 ± 1.58 a	0.15 ± 3.26 a	0.01 ± 2.07 a
T2	0.01 ± 1.57 ab	0.02 ± 1.49 b	0.06 ± 1.52 b	0.01 ± 1.82 a	0.01 ± 1.32 b	0.07 ± 2.28 bc	0.01 ± 1.66 b
T3	0.01 ± 1.58 a	0.01 ± 1.44 c	0.01 ± 1.57 b	0.01 ± 1.21 b	0.01 ± 1.30 b	0.17 ± 2.48 b	0.01 ± 1.59 c
T4	0.01 ±1.55 ab	0.01 ±1.42 cd	0.01 ±1.51 b	0.01 ±1.15 bc	0.01 ±1.27 b	0.12 ±2.44 bc	0.01 ±1.55 d
T5	0.01 ±1.55 ab	0.01 ± 1.39 d	0.02 ± 1.51 b	0.01 ± 1.10 c	0.02 ± 1.25 b	0.15 ± 2.37 b	0.01 ± 1.52 d
T6	0.01 ± 1.54 b	0.01 ± 1.45 c	0.01 ± 1.48 b	0.01 ± 1.15 bc	0.01 ± 1.27 b	0.04 ± 2.07 c	0.01 ± 1.49 d
T7	0.01 ± 1.55 ab	0.01 ± 1.38 d	0.02 ± 1.50 b	0.01 ± 1.11 c	0.02 ± 1.25 b	0.13 ± 2.50 bc	0.01 ± 1.54 d
Level significant	*	*	*	*	*	*	*

* the different letters within the same column refers to Significantly differences at possibility level ($p \leq 0.05$)

** T1 (control):(Control diet devoid of any addition), T2: (1g DL-methionine), T3: (2g Betaine), T4:(2g Taurine), T5:(1g Betaine +1g Taurine), T6: (0.5g Betaine +1.5g Taurine), T7: (1.5g Betaine + 0.5g Taurine) .

The results shown in Table (8) show the effect of adding the two compounds Betaine and Taurine with herbal methionine on the average relative weight of edible internal organs and belly fat of broilers during the experiment period. It is noted from the results shown in Table (8) that T1 (control) was significantly ($P \leq 0.05$) superior to T2 in The mean relative weight of the heart, liver, gizzard and abdominal fat, and the weight of the heart was (0.57, 0.50, 0.47, 0.47, 0.49, 0.45, 0.48)%, and the weight of the liver was (2.39, 2.16, 2.03, 2.04, 2.01, 1.96, 1.99)% And the relative weight of the gizzard was (2.17, 1.95, 1.83, 1.84, 1.82, 1.77, 1.80)%. The weight of belly fat was (1.99, 1.65, 1.22, 1.18, 1.21, 1.13, 1.19)%.

Table (8) effect of synergistic metabolism for Betaine and Taurine compounds with Herbal methionine on the percentage of viscera edible and abdominal fat of broilers at (42) days of age (medium ± standard error).

Treatments	Heart	Liver	Gizzard	Abdominal fat
T1	0.01 ± 0.57 a	0.01 ± 2.39 a	0.01 ± 2.17 a	0.03 ± 1.99 a
T2	0.01 ± 0.50 b	0.01 ± 2.16 b	0.01 ± 1.95 b	0.12 ± 1.65 b
T3	0.01 ± 0.47 bc	0.02 ± 2.03 c	0.02 ± 1.83 c	0.03 ± 1.22 c
T4	0.01 ±0.47 bc	0.01 ±2.04 c	0.01 ±1.84 c	0.02 ±1.18 c
T5	0.01 ± 0.49 bc	0.02 ± 2.01 cd	0.01 ± 1.82 cd	0.01 ± 1.21 c
T6	0.01 ± 0.45 c	0.01 ± 1.96 d	0.01 ± 1.77 d	0.02 ± 1.13 c
T7	0.01 ±0.48 bc	0.01 ± 1.99 cd	0.02 ± 1.80 cd	0.01 ± 1.19 c
Level significant	*	*	*	*

* the different letters within the same column refers to Significantly differences at possibility level (p≤0.05)

** T1 (control):(Control diet devoid of any addition), T2: (1g DL-methionine), T3: (2g Betaine), T4:(2g Taurine), T5:(1g Betaine +1g Taurine), T6: (0.5g Betaine +1.5g Taurine), T7: (1.5g Betaine + 0.5g Taurine) .

The results shown in Table (9) show the effect of adding the two compounds Betaine and Taurine with herbal methionine on the purification percentage and the relative weight of carcass cuts for broilers. T3, T4, T5, T6 and T7 significantly (P≤0.05) over T2 in the average clearance ratio which reached (72.50 , 74.27, 75.16, 75.18, 76.26, 75.24, 77.42)% for the seven treatments in a row, and it is noted that there are significant differences in the average relative weight of the thigh among the treatments, as T2, T5 and T7 were significantly (P≤0.05) superior to the rest of the treatments which amounted to (14.86, 16.10, 15.02, 15.62, 16.26, 15.55, 15.59)% for the seven treatments, respectively. As for the relative weight of the back, T1 (control), T2, T3, T5 , T6 and T7 significantly exceed the treatment (P≤0.05) over T4, which amounted to (20.00, 19.43 , 20.19, 19.09, 19.75, 19.72, 20.08)% for the seven treatments in a row, and it was noted in the relative weight of the wings that T1 (control) outweighed T2, and the relative weight of the wings was (9.78, 9.18, 9.01, 9.01, 8.89, 8.66, 8.76) % for parameter. The relative weight of the chest was found to be significant (P≤0.05) for T5 and T7 over T3, and the relative weight of the chest was (35.89, 36.92, 37.29, 37.01, 38.75, 37.13, 38.48)% for the seven treatments, respectively, and it exceed significantly(P≤0.05) T1 (control) on T3 and T4 in the relative weight of the neck, which reached (5.34, 4.72, 4.95, 4.96, 4.90, 4.76, 4.85)% for the seven treatments, respectively.

Table (9) effect of synergistic metabolism for Betaine and Taurine compounds with Herbal methionine on the average dressing ratio and relative weight of carcass cuts of broilers at (42) days of age (medium ± standard error).

Treatments	dressing percentage	Chest piece	Thigh piece	Drum stick	Back	Wings	Neck
T1	0.01 ± 72.50 c	0.08 ± 35.85 c	0.22 ± 14.34 c	0.32 ± 14.69 c	0.46 ± 20.00 ab	0.12 ± 9.78 a	0.04 ± 5.34 a
T2	0.08 ± 74.27 b	0.45 ± 35.63 bc	0.35 ± 16.60 ab	0.24 ± 14.95 ab	1.53 ± 19.43 ab	0.07 ± 8.67 b	0.01 ± 4.72 d
T3	0.22 ± 75.16 a	0.50 ± 36.29 b	0.25 ± 15.02 c	0.19 ± 15.54 ab	0.28 ± 20.19 a	0.16 ± 8.01 bc	0.08 ± 4.95 b
T4	0.14 ±75.18 a	0.43 ±36.01 bc	0.29 ±15.45 bc	0.12 ±15.94 bc	1.16 ±19.30 b	0.11 ±8.40 bc	0.05 ±4.90 b
T5	0.10 ± 76.26 a	0.41 ± 37.55 a	0.30 ± 15.26 ab	0.30 ± 14.45 ab	1.53 ± 19.44 ab	0.07 ± 8.62 bcd	0.02 ± 4.68 bc
T6	0.41 ± 75.24 a	0.26 ± 37.13 bc	0.15 ± 15.50 bc	0.09 ± 14.55 ab	0.28 ± 19.62 ab	0.05 ± 8.54 d	0.04 ± 4.66 cd
T7	0.12 ± 77.42 a	0.44 ± 37.27 a	0.22 ± 15.38 a	0.25 ± 16.05 a	1.16 ± 18.09 ab	0.08 ± 8.76 cd	0.06 ± 4.45 bcd
Level significant	*	*	NS	*	*	*	*

* the different letters within the same column refers to Significantly differences at possibility level ($p \leq 0.05$)

** T1 (control):(Control diet devoid of any addition), T2: (1g DL-methionine), T3: (2g Betaine), T4:(2g Taurine), T5:(1g Betaine +1g Taurine), T6: (0.5g Betaine +1.5g Taurine), T7: (1.5g Betaine + 0.5g Taurine) .

4. Discussion

Our results in terms of live body weight and weight gain converge agreed with what was found by researchers Al-Jubouri ,(2013) ; Al Shukri , (2011); Al Shukri et al (2012); Al Khafaji et al (2013) Mahmoudain and Madani (2012); Rama Rao et al (2008), They indicated that there is a significant superiority in the mentioned traits when adding betaine and taurine to the diet of birds. The results of our study regarding live body weight did not agree with Al-Rubaie, (2010); Mike, (2014); Sakomura et al, (2013). Those who indicated that there were no significant differences in body weight by adding betaine and taurine to the diet or drinking water for birds (Wang et al, 2004) .such as methionine, and may improve the availability of sulfur amino acids (methionine, cysteine), which is a basic requirement in the formation of body proteins Eklund et al, (2006).The improvement in weight gain in favor of taurine treatments did not agree with the results reached by Alzawqari et al (2016), : Lu et al. (2018).they reported that taurine did not show improvement in performance for broilers when exposed to most stresses during the care period. It is evident from Table (6) that there are significant differences in the amount of feed consumed between treatments in the cumulative feed consumption. Our results with the findings of Al-Rubaie (2010); Al-Shukry (2011); Konca et al (2008). The cumulative feed conversion, it was noted that there was a significant improvement for all treatments compared to the first treatment (control).This result is consistent with what was found by Sakomura et al. (2008), Enting and Eissen, (2007): Zarei and Yazdani, (2008), as a significant improvement was observed in The feed conversion factor for birds exposed to heat stress and betaine added to the ration .Our results converge with Wang and Xu (1999) who indicated that betaine added to the ration increases the efficiency of the feed by increasing the secretion of GH and insulin-like growth factor. To the osmotic properties of betaine that are involved in improving the functions of the epithelial layer lining the intestine and strengthening the intestinal wall. Moeckel et al. (2002) and Siljander-Rasi et al. (2003) reported that betaine accumulation in intestinal tissues can it reduces the energy needs of the ion pump and provides the energy available for growth and production, thus increasing the efficiency of utilizing the food

consumed. The results of this study differ with the findings of Tollba and El-Nagar (2008), Ezzat et al. (2011) and Al Shukri et al. (2012), who indicated that there was a significant decrease in the feed conversion factor in laying hens' diets. And broilers containing different concentrations of betaine and taurine compared to the control treatment (without addition). Our results converge with what was found by Al-Khafaji and others (2013), who found a significant superiority in the weight of the heart and the weight of gizzard when adding betaine to the broiler diet, and converge with what was found by Khoja Neama (2014), which indicated that there was a significant superiority in the weight of the liver and gizzard when adding betaine the role of betaine in increasing the weight of the liver and gizzard may be due to the role of betaine in reducing heat stress on treated birds with betaine and taurine added compared to the control treatment (T1), and our results differed with what was found by Enting et al. (2007) who indicated that there were no differences Significant in the weight of the internal organs of broilers, and our results differed with what was found by Masoud et al.(2014), as they indicated that there was no significant effect on the weight of the heart and liver when adding betaine to the diets of broilers. The significant decrease in abdominal fat in betaine treatments may be due to the important role of betaine in the manufacture of important CH3 methyl compounds in the liver and muscles, such as creatine and carnitine Zhan and others (2006): Rama Rao et al. (2008).Carnitine is required to transport long-chain fatty acids across the inner mitochondrial membrane for the purpose of oxidation and thus reduce the amount of long-chain fatty acids that can be deposited in adipose tissue. Wang and Feng, (2004) or it may be decreased Body fat due to the role of betaine in conferring the CH3 group that is used to form lecithin, which facilitates the transfer of fat through the body. Also, adding betaine increases the activity of lipase enzyme in poultry (Zhan and Zhao (2006). Our results differed with what was found by Enting et al. (2007): Al-Rubaie (2010): Zulkifli et al. (2004), as they recorded the absence of a significant effect of betaine added to the diet on the percentage of belly fat. The moral height of the breast meat of betaine-treated birds is close to what was found by Rama Rao and others (2008): Al Shukri (2011): Khoja Nima (2014) who indicated that there was a significant improvement in the breast meat yield of broilers when adding betaine and taurine together to the diet or drinking water, It converges with what was found by Al-Shukry et al. (2012), as they recorded a significant improvement in the yield of breast meat for broilers and turkeys added to the betaine and taurine relationship. Our results differed with what was found by Al-Rubaie (2010), which did not record any significant differences in The yield of breast meat for broilers The moral improvement that occurs in breast meat may be due to the role of betaine in increasing the activity of the enzyme Homocysteine- Methyltrans Ferase Betaine, which are aiding factors in transferring ready-made methyl groups from betaine to homocysteine and converting it to Csteine, which promotes the formation of body protein and chest muscle. also for the role of betaine in increasing amino acids, especially methionine from homocysteine, and thus increasing protein deposition in body muscles, especially chest muscle. Maghoul et al., (2009).

5. Conclusions

The addition of betaine, taurine or both together (T3, T4, T5, T6 and T7) to the herbal methionine-free diets leads to a significant difference from the T1 and T2 in the productive performance and the percentage of dressing and the relative weight of the chest, thigh and back compared to the birds fed on herbal methionine.

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