TEMPERATURE AND SOME BLOOD TRAITS RESPONSE TO ORGANIC AND INORGANIC SELENIUM ADDED TO THE BROILER DIET REARED AT HIGH TEMPERATURES

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ABSTRACT

This study was conducted at the poultry farm -Animal Production Department/ College of Agricultural Engineering Sciences- University of Baghdad, for the period from 2018/8/17 to 2018/9/28, in order to study the effect of adding inorganic and organic selenium to the broiler diets reared at high temperatures in the physiological performance. A 420 un-sexed chicks of breed (Ross 308) were used in the experiment as a one-day old and with weight rate of 36.4g. The chicks were distributed randomly and equally on 7 treatments, each one included 3 replicates at 20 chicks/replicate. The experiment included the following treatments : T1,T2, and T3 as organic selenium treatments which are selenomethionin with a concentration of 0.3, 0.6, and 0.9 mg/kg feed, respectively, and T4, T5, and T6 as inorganic selenium treatments in the form of Sodium Selenite compound at a concentrations of 0.3, 0.6, and 0.9 mg/kg feed, respectively, and T7 control treatment without any addition of selenium, while the chicks were bred at a high temperature rate of 22.5 - 43.9 ℃. Organic and inorganic Selenium have not shown a clear effect in reducing body temperature compared to the control treatment, as well as, a high significant decreasing in the blood Hematocrit and Hemoglobin concentration for inorganic Selenium treatments compared to the organic Selenium and control treatments. Finally, The results indicated that there were no significant differences in the cholesterol and glucose levels in blood of organic and inorganic Selenium and control treatments.

Keywords: heat stress, cholesterol, body temperature
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إستجابة درجة حرارة وبعض صفات الدم الى السلينيوم العضوي واللاعضوي المضاف الى عليقة فروج اللحم المربى في درجات حرارة مرتفعة

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المستخلص

أجريت هذه الدراسة في حقل الطيور الداجنة, قسم الانتاج الحيواني, كلية علوم الهندسة الزراعية جامعة بغداد للمدة من 17/8/2018 الى 28/9/2018 وذلك لدراسة تأثير إضافة السلينيوم اللاعضوي Inorganic Selenium والسلينيوم العضوي Organic Selenium في علائق فروج اللحم المربى في درجات الحرارة المرتفعة في الأداء الفسلجي. استخدم في التجربة 420 فرخ لحم غير مجنس سلالة (Ross 308) عند عمر يوم واحد بمعدل وزن 36.4غم. وزعت الأفراخ عشوائياً وبالتساوي على 7 معاملات كل واحدة شملت 3 مكررات وبواقع 20 فرخاً للمكرر الواحد . تضمنت التجربة المعاملات الأتية: T3 T2, T1 معاملات السلينيوم العضوي عبارة عن سلينومثيونين Selenomethionin بتركيز 0.9,0.6,0.3 ملغم / كغم علف على التوالي و T6, T5 ,T4 معاملات السلينيوم اللاعضوي على هيئة مركب صوديوم سلينيت Sodium Selenite بتركيز 0.9,0.6,0.3 ملغم / كغم علف على التوالي وT7 معاملة السيطرة من دون أي إضافة للسلينيوم ربيت الأفراخ في معدل درجات حرارة مرتفعة تتراوح 22.5-34.9م^5. لم يظهر السلينيوم العضوي واللاعضوي تأثيراً واضحاً في خفض درجة حرارة الجسم مقارنة بمعاملة السيطرة. كما وضحت النتائج حصول انخفاضاً معنوياً عالياً في مكداس الدم وتركيز الهيموكلوبين في الدم لمعاملات السلينيوم اللاعضوي مقارنة بمعاملات السلينيوم العضوي والسيطرة. وأشارت النتائج الى عدم وجود فروق معنوية في مستوى الكولسترول والكلوكوز في الدم لمعاملات السلينيوم العضوي واللاعضوي ومعاملة السيطرة.

الكلمات المفتاحيه: الاجهاد الحراري، الكولسترول، درجة حرارة الجسم
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INTRODUCTION

Poultry rearing is directly affected by climatic conditions, especially temperature and humidity. Iraq's climate is characterized by high temperatures in most days of the year that affecting poultry performance, as the consumption of feed decreases and causes a reduction in the availability of some essential nutrients (9,15), which negative effects on the growth rate (2, 25), As well as, food conversion efficiency (7, 24), and the meat quality, eggs and fertility which caused major economic losses (30). The modern breeds of broiler are characterized by fast growth and excellent food conversion efficiency that are sensitive to high temperatures, making them more susceptible to heat stress (16). The researchers applied several procedures in genetics (3, 1), and nutrition (4, 8, 10,26) and rearing (5, 6) in an attempt to overcome this problem. Many studies have indicated that the heat stress leads to oxidative stress as heat stress reduces the antioxidant role, which is one of the most important physiological changes in response to high temperatures and thus increases the oxidation state that affects the birds immune response (36, 37). Antioxidants such as Selenium were used to remove the effect of free radicals, where the using of antioxidants in feed provides a protection for the feed from oxidation during storage as well as, its role in interacting with free radicals formed. Thus, prevents oxidation of unsaturated fatty acids in the cells and tissues of the body (19). Selenium is found in several forms of organic, inorganic and Nano-Selenium, which varies in the absorption, efficiency, and metabolism mechanisms, researches indicates that organic Selenium has similar efficiency to Nano-Selenium compared to inorganic Selenium (27). Common sources of Selenium supplementation are Sodium Selenite, Selenium yeast, Selenomethionin and Nano-Selenium, where (48) indicated that organic sources are more effective than inorganic sources. Selenium is one of the most essential trace elements, which is involved in many of the physiological functions in the bird body. The most important of which is the antioxidant action, which is one of the essential components of the Glutathione peroxidase enzyme found in most of the body's tissues (11). It has been found that giving Selenium improves thyroid function (22), and plays an important role in breaking down free radicals that attack the cell membrane and plasma lipoproteins (35). Selenium supplementation has also been shown to enhance the performance and antioxidant activity of broiler during heat stress (34, 43). Furthermore, Selenium is important in improving the qualitative, quality, validity of poultry meat through its antioxidant capacity (40, 46). It provides also a protection for the cell by interacting with peroxide roots, the use of Selenium as additives in feed improves the healthy and productive performance of the animal and increases the content of Selenium in meat and eggs (23). The main advantage of Selenium is its ability to build a reserve in the body as a Selenomethionin, which can be used when it’s level decreases and enhances body defenses (42), while the level that poultry needed in the diet during growth period of broiler in optimum conditions it is 0.15 ppm (29). The levels of Selenium added to poultry have varied depending on the variation of environmental conditions such as high temperatures, bird species, age and production status, as well as the level of Selenium in the diet components. Several studies and research have also been carried out in the establishment the optimal levels of Selenium component in the various poultry diets, but at the same time, it is recorded there is a considerable shortage and conflict in the study results on the role of the Selenium in reducing the adverse effects of heat stress, especially on the physical qualities and broiler production efficiency reared under a condition of heat stress. Therefore, this study was aimed to using different sources and levels of Selenium added to the broiler diet, reared under high temperatures and its effect on some blood characteristics and body temperature that providing us the physiological condition of birds.

MATERIALS AND METHODS

The experiment was conducted at the poultry farm/Animal Production Department /College of Agricultural Engineering Sciences / University of Baghdad - Abu Ghraib, for the period from 2018/8/17 to 2018/9/28. The chicks were reared in a closed house type divided by pens-shaped with three air

ventilators to move the air across the house. A 420 one day old un-sexed Ross 308 broiler chicks, 36.4g average weight were purchased from private hatchery distributed randomly inside the pens to seven treatments with 60 chicks/treatment, each treatment included 3 replicates, 20 chicks / replicate. The birds were reared in a continuous heat stress conditions, where water and food were provided freely (***Ad-Libitum***). The air cooler, as well as, a vertical fan was used for the lowering the very high house temperature and a continuous lighting system, 23 hour light/1 hour dark daily was used. Two sources of Selenium, including inorganic Selenium in a form of Sodium Selenite and its chemical formulation Na_2Se_3, a British origin with a molecular weight of 172.94, and a purity 99.9% in the form of white Powder, while the organic Selenium was a Selenomethionin of Zinpro products. Moreover, the feed was produced by crush and mixing of the dietary ingredients according to the required proportions in the feed plant of the Animal Production Department / College of Agricultural Engineering Sciences / University of Baghdad. Selenium was added according to its proportions in the various treatments diets, where the starter diet provided to the chicks during the first 10 days of age, then it was gradually replaced by a grower diet from the age of 11 to 24 days, then replaced by the finisher diet from the age of 25 to the marketing age 42 days (Table 1). The nutritional treatments have been divided as follows: The first treatment contained organic Selenium with a concentration of 0.3 mg/Kg diet, the second treatment contained organic Selenium with a concentration of 0.6 mg/kg diet, and the third treatment contained organic Selenium with a concentration of 0.9 mg/kg diet. Furthermore, the fourth treatment contained inorganic Selenium with a concentration 0.3 mg/kg diet, while the fifth treatment contained inorganic Selenium with a concentration of 0.6 mg/kg diet, and the sixth treatment contained inorganic Selenium with a concentration of 0.9 mg/kg diet, and the seventh treatment was the control diet, which represents the basal diet without adding Selenium. The house temperature and relative humidity was recorded hourly (Fig 1) by using an electronic device (TCH-4), manufactured by Restriction of Hazardous Substances (ROHS) Chinese origin . Bird body temperature was measured at 6 am, 12 pm, and 6 pm by measuring the rectal temperature of 5 birds of each replicate, birds whose temperature was measured has been marked in each replicate and for weeks (3, 4, 5).

Table 1. Composition and calculated chemical analysis of experimental diets for starter, grower and finisher phases.

Feed material	Starter diet (1-10) day	Grower diet (11-24) day	Finisher diet (25-42) day
Yellow maize	45.8	47.2	49.7
Local wheat	10	11.3	11.1
Soybean meal (48%)	34.3	30.6	27.1
Protein concentrate (1)	5	5	5
Sunflower oil	2.6	3.7	4.9
Limestone	1.1	1.1	1.1
Dicalcium phosphate (DCP)	0.7	0.6	0.6
Salt	0.3	0.3	0.3
Mixture of Vitamin and Mineral(2)	0.2	0.2	0.2
Total	100	100	100
Calculated Chemical Analysis(3)			
Crude protein (%)	23.00	21.5	20.00
Calculat metabolism energy (kcal/kg feed)	3004.25	3100.43	3200.5
Lysine (%)	1.35	1.25	1.16
Methionine (%)	0.512	0.49	0.47
Cysteine%	0.373	0.35	0.33
Methionine+ Cysteine (%)	0.885	0.84	0.80
Calcium%	1.02	0.99	0.98
Available p%	0.50	0.48	0.47

(1) The protein concentrate (WAFI) type BROC0N-5Jebur, manufactured in the Netherlands, each kg contains:30% crude protein, 3.50% crude fat , 4.86% crude fiber, 6.81% Ca, 2.65% phosphorus 5.34% available phosphorus, 3.85% Lysine, 3.70% Methionine, 4.06 % Methionine+ Cysteine, 2.40% Na, 174068 (Kcal/Kg feed) metabolism energy, also including vitamin A 200000IU, vitamin D3 80000IU, vitamin E 600Mg, vitamin K3 50 mg, vitamin B1 60 mg, vitamin B2 140 mg, vitamin B6 80 mg, vitamin B12 700 mg, folic acid 20 mg, Niacin 800 mg, Butane 2 mg, iron1000 mg, copper 200 mg, manganese 1600mg, zinc 1200 mg, Iodine 20 mg, Selenium 5 mg, antioxidants 33.50% (BHT).

(2) The vitamin and mineral mixture of colavita, each kg contains: 500 IU Vitamin A, 600 IU D3,10 mg E, 2mg K3,2 mg B1, 2 mg B2,2 mg B6, 5mg B12, 10 mg C, 15mg Niacin, 500 mg folic acid, 4.8 mg calcium, 3.18 mg p, 10 mg copper, 80 mg manganese, 80 mg zinc, 50mg iron, 0.2 mg selenium, 0.1 mg cobalt, 0.5 mg Iodine, 100 mg antioxidants.

(3) Calculated Chemical Analysis of the diet according to NRC (1994).

A sensitive digital thermometer for one decimal point was used by inserting the thermoprobe of the thermometer through the Cloaca vent inside the rectum for 6 cm and until the reading stabilizes, and record the temperature, then take the reading average (47). Blood was collected from birds for each treatment (4 of each sex) at 25, and 42 days of age from the brachial vein, where the blood was discharged directly into two types of tubes, the first tubes contain on an antithrombotic potassium-Ethylene (Diamin Tetra Acid K-EDTA), used to measure the packed cell volume (PCV) and the hemoglobin (Hb). The second was a tubes contain on a gel with a capacity of 6ml, where placed in the centrifuge at 4000 rpm for 10 minutes for the separating serum then its keept at (-20℃) until tests are carried out. (PCV) estimated as (13) pointed out, and (Hb) was calculated based on the equation that mentioned by (17). Finally, the glucose was estimated by using a Kit test tool manufactured by a Spanish company called Linear Chemicals.S.L. The cholesterol test was performed using a Kit test tool manufactured by the same company mentioned previously. The experiment data were analyzed using Complete Randomized Design (CRD) to determine the effect of treatments in the studied traits, then the significant differences were compared between averages with the multiple range test (20) and used statistical analysis system (38).

RESULTS AND DISCUSSION

Figure 1 illustrates the average temperature and humidity inside the rearing house being recorded hourly in each day of the experiment. The figure shows that birds were exposed to high temperatures, where the highest temperature recorded 43.9 ℃ at 3pm and the lowest temperature of 22.5 ℃ at 6 am, and the highest average temperature was between 1-5 pm, while the high humidity was recorded 55.3% at 7am and the lowest level was 19.6%

at 5:00 pm, and the highest average humidity was between 9-4 am, these indicate that the birds have been subjected to severe heat stress was consistent with the aim of the experiment. The optimum house temperature for broiler chicken is 25-20 ℃, so when it rise over 30 ℃, it causes several problems for broiler (2). El Boushy and Van Marie (21) observed that the temperatures between 25-15 ℃ and humidity 65-60% is an ideal condition for broiler chicken. During the duration of the experiment, the humidity was not high, which helped to dissipate the high heat, as high temperatures accompanied by high humidity are dangerous and can kill birds. (32) indicated that during heat stress, a large part of the birds body's heat is dissipated by evaporation, which may be a hindrance if the humidity is high.

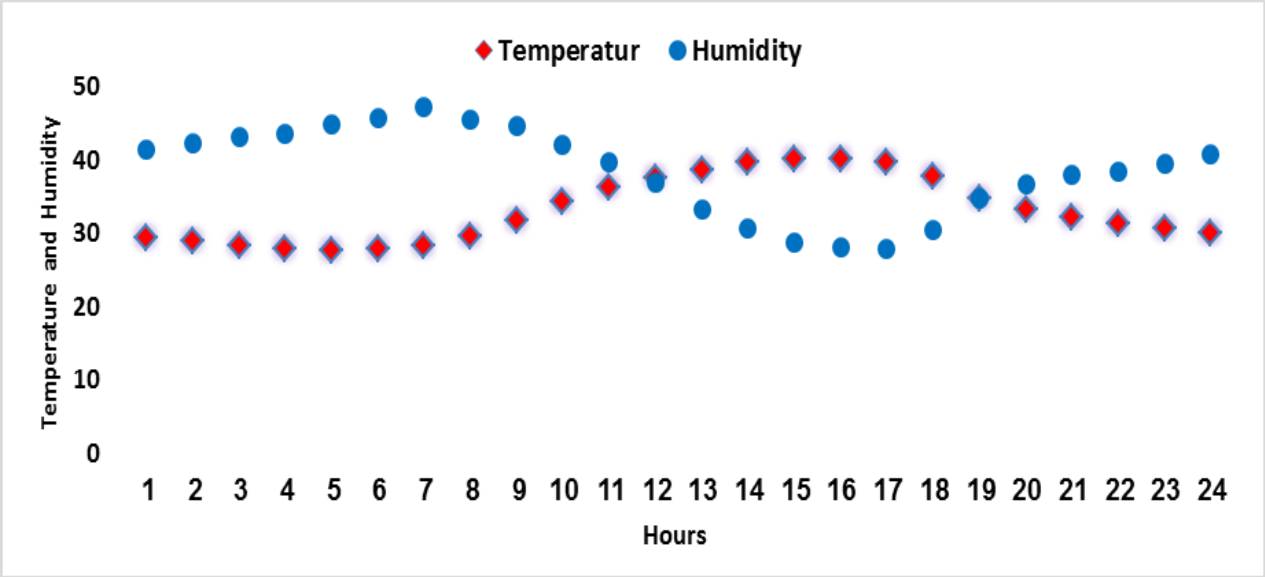

Figure 1.The average temperature and humidity for 24 hours throughout the experiment period

Table 2 exhibited a significant decrease in body temperature at the 3rd week of age in treatments T3, T5, T6 and T7 compared to the treatment T1, which did not differ significantly from T2 and T4 at 6.00 hour , while there was a high significant decrease in body temperature of 12.00 for T5 and T6 compared to the rest of the treatments. Furthermore, a significant decrease in treatment T6 compared to the T5 and T7 treatments at 18.00 hour. Results of 4th week showed a significant decrease in body temperature in T5 and T6 compared to the rest of the treatments at 6.00 hour. The body temperature in T6 decreased compared to the rest of the treatments at 12.00 hour. At 18.00 hour there was a significant decrease in body temperature in T5 compared to other treatments. Table 2 also shows no significant differences in the body temperature in the 5th week of age at 6.00 and 12.00 hour, while there were a significant differences at 18.00 hour, where the body temperature decreased in the control treatment, T2 and T4 compared to other treatments. Statistical analysis showed a variation in birds body temperature at 3, 4, and 5 weeks of age which was due to the variation of house temperature, since the organic and inorganic Selenium levels did not have a clear effect in lowering body temperature. The data generally indicate that the body temperature rises as the temperature of poultry house increases, while the lowest body temperature was coinciding with lowest house temperature of the day (6.00 am). (12) indicated that the increasing of the environment temperature by one degree Celsius leads to a rise in a bird's body temperature at a range of 0.121℃. As well as, (2 , 45) also pointed out that when the broiler exposed to a high temperature at an early age, it reduces body temperature and improves the long-term broiler resistance to heat stress. The results of the study are consistent with what (28) stated, where the different sources of Selenium (organic, inorganic and Nano Selenium) did not have aclear effect on rectal temperature**.**

Table 2. Effect of adding different levels of organic Selenium (Selenomethionin) and inorganic (sodium selenite) to the diet in the body temperature for the weeks (3, 4, 5) of broiler age rearing at a high temperatures (general average ±standard error).

Treatments	Hours								
	3rd week			4rd week			5rd week		
	6.00	12.00	18.00	6.00	12.00	18.00	6.00	12.00	18.00
T1	41.61±^{A}0.12	42.43±^{A}0.11	42.37±^{A}0.05	41.45± ^{A}0.14	42.09± ^{A}0.11	41.77± ^{A}0.07	41.47±0.08	42.24±0.07	41.80±^{AB}0.09
T2	41.36±^{AB}0.07	42.37± ^{A}0.17	42.42± ^{A}0.11	41.29±^{ABC}0.09	42.07± ^{A}0.09	41.73± ^{A}0.13	41.33±0.05	42.27±0.08	41.63± ^{B}0.08
T3	41.13± ^{B}0.10	42.19± ^{A}0.11	42.45± ^{A}0.06	41.00 ±^{CD}0.11	41.93±^{AB}0.06	41.54±^{AB}0.09	41.21±0.08	42.13±0.07	41.73±^{AB}0.05
T4	41.36±^{AB}0.10	42.18± ^{A}0.10	42.37± ^{A}0.09	41.06±^{BCD}0.08	41.88±^{AB}0.08	41.55±^{AB}0.17	41.33±0.07	42.05±0.06	41.71± ^{B}0.07
T5	41.03± ^{B}0.12	41.79± ^{B}0.09	41.97± ^{B}0.12	40.75±^{D}0.10	41.91±^{AB}0.05	41.33± ^{B}0.12	41.29±0.08	42.21±0.06	41.80±^{AB}0.07
T6	41.13±^{B}0.14	41.65± ^{B}0.13	41.70± ^{C}0.07	40.81± ^{D}0.11	41.67± ^{B}0.09	41.45±^{AB}0.06	41.48±0.10	42.11±0.11	41.77±^{AB}0.06
T7	41.23± ^{B}0.09	42.47± ^{A}0.07	42.49± ^{A}0.05	41.37± ^{AB}0.10	42.08± ^{A}0.12	41.71± ^{A}0.05	41.21±0.12	42.14±0.06	41.93±^{A}0.06
Significant level	0.05	0.01	0.01	0.01	0.01	0.05	N.S	N.S	0.05

Note: T1,T2,T3 Organic Selenium treatments with a concentration 0.3.0.6.0.9 mg/kg feed, T4, T5,T6 inorganic Selenium treatments with a concentration of 0.3,0.6.0.9 mg/kg feed, T7 control treatment without the addition of Selenium.

The different letters within one column indicate the presence of a significant difference (P ≤0.01) (P ≤0.05).

N.S indicates that there are no significant differences within one column

Table 3 Shows the effect of organic and inorganic Selenium on blood Hematocrit and Hemoglobin concentration, as the results indicated a high significant (P ≤0.01) superiority for T1, T3 and T7 treatments, which did not differ significantly from T2 and T4 on T5 , T6 at 21 days of age. Moreover, the results showed at 42 days, a high significant superiority for T1,T7 on treatment T3, and inorganic Selenium treatments T4, T5 and T6, which did not differ significantly from T2, whereas T4 treatment was exceeded on T5 and T6, and T5 also exceeded on T6. While the results for the general average of the two readings showed a high significant (P ≤0.01) superiority for T1 and T7 over the rest of the treatments, as well as, high significant (P ≤0.01) superiority of T2, T3 and T4 treatments compared to T5 and T6. The cause of poisoning in inorganic Selenium treatments and the results of the tests generally indicate that may be caused the decreases in packed cell volume (PCV) and the hemoglobin (Hb) values, as (44) pointed out that the general average of blood Hematocrit and Hemoglobin for broiler Ross 308 in normal conditions was 30.73. The reason may be due to the high temperatures that led to increased water consumption by birds and the occurrence of hemodilution. Thus, a decrease in erythrocytes, which led to a decrease in blood Hematocrit and Hemoglobin values (7). The study results were not agree with what (39) findings, when adding organic Selenium at 0.15 and 0.3 mg/kg diet, it increased the average of blood Hematocrit and Hemoglobin, as well as, an improving of cells and immune blood pictures compared to organic Selenium treatments, which are consistent with(33) results, while there are no differences in the erythrocytes number and blood Hematocrit and Hemoglobin concentration, when using Selenium as a dietary supplement compared to the control treatment(14,31)

Table 3. Effect of adding different levels of organic Selenium (Selenomethionin) and inorganic (sodium selenite) to the diet in the blood Hematocrit (%) and Hemoglobin (mg/100ml) at the age of 21 and 42 days and the general rate of broiler diet rearing at a high temperatures (general average ±standard error).

Treatments	PCV			Hb		
	21	42	1-42	21	42	1-42
T1	27.14± ^{A}0.86	29.93± ^{A}0.43	28.54±^{A}0.49	9.05± ^{A}0.29	9.98± ^{A}0.14	9.51±^{A}0.16
T2	25.33±^{AB}0.80	28.50±^{AB}0.84	26.63±^{B}0.62	8.44±^{AB}0.27	9.50±^{AB}0.28	8.88±^{B}0.21
T3	25.93 ± ^{A}0.37	27.38± ^{B}0.72	26.61±^{B}0.50	8.64± ^{A}0.12	9.13± ^{B}0.24	8.87±^{B}0.17
T4	25.36±^{AB}1.21	24.56± ^{C}0.26	24.93±^{B}0.64	8.45±^{AB}0.40	8.19± ^{C}0.09	8.31±^{B}0.21
T5	22.07± ^{C}1.43	22.44± ^{D}0.55	22.25±^{C}0.58	7.36± ^{C}0.48	7.48 ± ^{D}0.18	7.42±^{C}0.19
T6	22.40±^{BC}0.48	20.00± ^{E}0.37	21.35±^{C}0.17	7.47±^{BC}0.16	6.67 ± ^{E}0.12	7.12±^{C}0.06
T7	27.92± ^{A}1.42	29.00± ^{A}0.46	28.54±^{A}0.77	9.31± ^{A}0.47	9.67± ^{A}0.15	9.51±^{A}0.26
Significant level	0.01	0.01	0.01	0.01	0.01	0.01

Note: T1,T2,T3 Organic Selenium treatments with a concentration 0.3.0.6.0.9 mg/kg feed, T4, T5,T6 inorganic Selenium treatments with a concentration of 0.3,0.6.0.9 mg/kg feed, T7 control treatment without the addition of Selenium.

The different letters within one column indicate the presence of a significant differences (P ≤0.01).

The results in Table 4 show that there are no significant differences between the sources of Selenium and its levels in the broiler diet at a concentration of glucose and cholesterol in the blood plasma at 21 and 42 days of age, as well as the general average of two readings. Results showed that it is not possible to ignore the influence of Selenium in lowering cholesterol and glucose levels at 42 days of age compared to their 21-days of age levels in all treatments. Although, there are no significant differences, this may be due to the role of Selenium as an antioxidant and its role in curbing free radicals as well as, the addition of Selenium in the diet has led to increasing the Selenium concentration within the body. Thus, it improves antioxidant defenses and protects cellular membranes from oxidation and damage and works to increase the efficiency of antioxidant activities. Furthermore the effect of Selenium on thyroid activity and the conversion of thyroxin (T4) to Triiodothyronine (T3) was the most effective in increasing metabolism and the metabolic rate within the body, which may explain the low level of glucose (18). (41) stated that the thyroid gland has a directly related to cholesterol metabolism, as the high activity of

thyroid hormones leads to reduce cholesterol levels.

Table (4) The effect of adding different levels of organic Selenium (Selenomethionin) and inorganic (sodium selenite) to the diet in the glucose concentration (mg/dl) and cholesterol concentration (mg/dl) at 21 and 42 days of age and the general average of broiler reared at a high temperatures (general average ±standard error).

Treatments	Glucose concentration			Cholesterol concentration		
	21	42	1-42	21	42	1-42
T1	259.80±5.68	228.60±6.23	244.20±5.25	130.00±9.15	121.40± 8.13	125.70± 6.35
T2	259.80±5.68	228.00±5.51	243.90±4.32	123.40±5.29	130.40± 3.43	126.90± 3.33
T3	262.60±5.57	212.60±15.85	237.60±9.37	127.40± 9.75	112.80± 8.30	120.10± 4.69
T4	261.60±5.66	221.60±15.45	241.60±7.70	135.20± 7.07	121.20± 6.74	128.20± 3.70
T5	267.40±6.52	248.00±16.86	257.70±8.93	146.00± 7.19	133.60±8.72	139.80± 7.38
T6	255.20±8.30	219.00±17.08	237.10±9.65	144.00±11.10	132.80±15.42	138.40±10.07
T7	263.00±3.94	22.07±204.20	233.60±9.85	124.00± 4.84	129.60± 8.48	126.80± 4.23
Significant level	N.S	N.S	N.S	N.S	N.S	N.S

Note: T1,T2,T3 Organic Selenium treatments with a concentration 0.3.0.6.0.9 mg/kg feed, T4, T5,T6 inorganic Selenium treatments with a concentration of 0.3,0.6.0.9 mg/kg feed, T7 control treatment without the addition of Selenium.

N.S indicate that there is no significant differences within one column.

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