Plant Archives Vol. 19, Supplement 2, 2019 pp. 1239-1246 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

THE EFFECTIVENESS OF NANO-SELENIUM AND VITAMIN E ADDED TO THE DIET IN IMPROVING THE PRODUCTIVE EFFICIENCY FOR BROILER CHICKENS EXPOSED TO THERMAL STRESS

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Abstract

This study was conducted in the poultry field belonging to the Animal Production Department, College of Agriculture, Al-Qasim green University for the period from 24/7/2018 to 28/8/2018, where used 360 chicks of unsexed broiler chickens (Ross 308), with one day age, which raised in pens with dimensions of (1 x 1.5 m). The chicks were randomly divided into 6 treatments with 3 replicates per treatment and each replicate included 20 chicks. The treatments of Experiment included (0, 300 mg vitamin E / kg feed, 1.0, 2.0 and 3.0 mg nano selenium / kg feed and 1.5 mg nano selenium + 150 mg vitamin E / kg feed for the treatments (T1, T2, T3, T4, T5, T6), respectively. The results showed that there was a significant (P<0.01) increase in the live body weight in the fifth week for the T4 and T6 treatment compared to all treatments and high significant (p<0.01) increase in the average total weekly gain for the two treatments (T4, T6) compared to other treatments. There was a significant (P <0.01) improvement in the total feed conversion ratio for the two treatments (T4, T6) compared to the rest of the treatments.

Keywords **:** Nano-selenium, Vitamin E, Broiler chicken, thermal stress.

Introduction

Poultry products are considered one of the most important sources of animal protein that is easy to digest and it is considered one of the ingredients of healthy food for the peoples of the world as a whole. The breeding of Poultry birds has received wide attention by many researchers and interested breeders in the development of poultry industry and commercial Hybrids production which characterized by rapid growth and high feed conversion efficiency, but this productive process accompanied by many problems, which resulted from different causes, from these causes are the high environmental temperature where high temperatures one of the most prominent problems facing the breeding of poultry birds, causing great economic losses for breeders in the hot regions, where thermal stress causes a deterioration in physiological and productive traits, a weak immune system of birds and a rising the percentage of mortality (Siegel, 1995). Changes in some blood components occur which including the decrease in total protein concentration, a high concentration of uric acid and glucose in blood plasma, a decrease in the concentration of calcium and activity of Alkaline phosphatase (ALP) in blood plasma for control treatment (Al-Khafaji, 2005; Al-Draghi and Al-Hassani, 2000). In the recent period, the poultry industry has seen several technologies, including nanotechnology, which are the study of materials at the nano-scale, where the size of particles is between 1-100 nm (Jiang *et al.*, 2008; Albanese *et al.*, 2012). Nanomaterials occupy a very small area but have relatively high surface areas. Thus, when massive materials are reduced to nano size, their surface becomes chemically more effective and the physical properties of matter change without altering their chemical properties (Albanese *et al.*, 2012). The expansion the ratio of surface to size allows nanoparticles to be more diverse and therefore more widely used, where nanomaterials can be used alone or carry other materials for the purpose of being delivered inside the body or encapsulated with other materials (Sharma, 2012). Vitamin E is essential for the growth of broiler chickens. Maryam *et al.* (2014) reported that the use of nano-selenium has improved the performance of growth and the weight gain compared to other treatments. Hamid *et al.* (2015) mentioned that vitamin E improved the productive and physiological performance for the birds. Gulyas *et al.* (2015) mentioned that using nano-selenium increased the level of antioxidants (Glutathione peroxidase and Malondialdehyde) and the level of protein and it reduced the oxidation of fat in the liver. Ahmadi *et al.* (2018) found that feeding nano selenium has significantly improved the live body weight and feed conversion ratio. Thus, the use of nano-selenium and vitamin E may reduce the effect of thermal stress on the raised birds, where the nano-selenium protects tissues against cell damage and prevents the generation of excess free radical oxygen through the pathway of Glutathione peroxidase, thus protecting the tissues against oxidation of fat and proteins (McDowell, 1989). Vitamin E also regenerates damaged cells by Glutathione peroxidase and Malondialdehyde pathways and protects them against lipid peroxidation and damage to body cells (Peri'c *et al.*, 2009), thus improving the performance of chicken growth. Therefore, the current study aims to know the effect of using different levels of nano-selenium and vitamin E in the productive and physiological performance for the broiler chickens that will breed under thermal stress conditions and determining the best level from them.

Materials and Methods

This study was conducted in the poultry field belonging to the Animal Production Department, College of Agriculture, Al-Qasim green University for the period from 24/7/2018 to 28/8/2018, where used 360 chicks of unsexed broiler chickens (Ross 308). Birds were divided into 6 treatments, with 3 replicates per treatment and each replicate included 20 chicks, distributed randomly within pens. Each pen with dimension was (1 x 1.5 m). nano-selenium and vitamin E were added to the diet and according to the following treatments:

T1: Treatment of standard diet without any additions

T2: Treatment of standard diet added to it vitamin E with a concentration of (300 mg/kg feed).

T3: Treatment of standard diet added to it a nano-selenium with a concentration of (1.0 mg/kg feed).

T4: Treatment of standard diet added to it a nano-selenium with a concentration of (2.0 mg/kg feed).

T5: Treatment of standard diet added to it a nano-selenium with a concentration of (3.0 mg/kg feed).

T6: Treatment of standard diet added to it a nano-selenium with a concentration of (1.5 mg) + vitamin E with a concentration of (150 mg/kg feed).

The chicks were fed on the initiator diet (23% protein content and the amount of energy is 3027 kcal/kg feed) from one day until the third week of the birds' age. It was then replaced by the growth diet (20% protein content and the amount of energy is 3195.3 kcal/kg feed) until the end of the fifth week. Feed and water were provided freely and the used diet is as shown in Table (1).

Table 1: shows the percentage of the diet ingredients used in the study and their chemical composition.

Feed materials	Initiator diet 1-21 day	Growth diet 22-35 day
yellow corn	30	40
wheat	28.25	24
Soybeans meal (48% protein)	31.75	24.8
concentrated Proteins*	5	5
Sunflower oil	2.9	4.4
limestone	0.9	0.6
Calcium diphosphate DCP	0.7	0.9
salt	0.3	0.1
A mixture of vitamins and minerals	0.2	0.2
Total	100	100
Crude protein (%)	23	20
The calculated metabolic energy (kcal / kg feed)	3027	3195.3
Lysine (%)	1.2	1.1
Methionine (%)	0.49	0.46
Cysteine (%)	0.36	0.32
Methionine + Cysteine (%)	0.85	0.76
Available phosphorus (%)	0.45	0.49
percentage of Energy: Protein C / P%	131.61	159.77

* Concentrated Protein (BROCON-5 SPECIAL W): Chinese origin, containing 40% raw protein, 3.5% fat, 1% fiber, 6% calcium, 3% available phosphorus, 3.25% lysine, 3.90% methionine + cysteine , 2.2% sodium, 2,100 kcal / kg metabolic energy, 20000 IU vitamin A, 40000 IU vitamin D3, 500 mg vitamin E, 30 mg vitamin K3, 15 mg vitamin B1 + B2, 150 mg B3, 20 mg B6,300 mg B12, 10 mg folic acid, 100 µg biotin, 1 mg iron, 100 mg copper, 1.2 mg manganese, 800 mg zinc, 15 mg iodine, 2 mg selenium, 6 mg cobalt, 900 mg anti-oxidant (BHT).

** the chemical analysis for the diet according to (NRC, 1994).

(1) Materials used in the experiment

Nano-selenium was obtained from Nanosany Corporation in Iran with a size of 30 nm and a purity of 99.95%. Vitamin E (a-Tocopherol) was obtained from a medical and veterinary equipment office in Bab al-Muadam, which produced by INDIAN company (HIMEDIA).

(2) The temperature of the breeding hall:

The temperature inside the hall was recorded daily in the hours of 600, 1200, 1800 and 2400 by 4 thermometers distributed inside the hall as shown in Table (2).

Table 2: Average periodic temperature for the period of 1-5 weeks.

Age (week)	Hour			
	The average temperature at 600 hr (ºC)	The average temperature at 1200 hr (ºC)	The average temperature at 1800 hr (ºC)	The average temperature at 2400 hr (ºC)
1	33.76	35.14	35.21	33.24
2	29.94	35.38	35.55	29.38
3	28.81	35.62	36.08	28.07
4	29.42	36.67	36.28	28.33
5	27.65	36.85	36.44	29.38

(3)The studied traits

The weight of the live body and weight gain (g/bird).

The average weight of the live body for each replicate was calculated at the end of each week and for weeks (1-5) by weighing all birds of one replicate. The live weight of the birds was calculated as follows (Al-Fayadh and Naji, 1989):

The weight of the live body (g/bird)

$$= \frac{\text{Total live weights for birds of one replicate at the end of the week (g)}}{\text{Number of birds in replicate}}$$

As for the weekly average weight gain (g/bird), it is as follows (Al-Fayadh and Naji, 1989):

The average weight of the live body at the end of weeks (g) - The average weight of the live body at the beginning of the week (g).

Feed consumption (g)

The weekly average feed consumption for the birds one replicate and for weeks (1 - 5) was calculated by weighing of the supplied feed at the beginning of the week minus the weight of remaining feed at the end of the feed. In the case of presence mortality in the replicate, the Feed consumption was calculated as follows (Al-Zubaidi, 1986).

$$\text{Average daily of feed consumption (g/bird)} = \frac{F}{C \times 7 \times D}$$

Where

F = represents the amount of consumed feed within a week

C = represents the number of live chicks at the end of the week

D = The number of days in which the mortality birds were fed

Feed conversion ratio (g feed/g weight gain)

The feed conversion ratio was calculated according to the equation indicated by (Al-ubaidi, 1986).

Feed conversion ratio (g feed/g weight gain)

$$= \frac{\text{The average amount of consumed feed (g) within a week}}{\text{Average weight gain (g) within a week}}$$

Percentage of total mortality %

The mortalities were recorded from the start of the experiment until the end of the fifth week, which calculated as follows:

Percentage of total mortality

$$= \frac{\text{Number of mortality birds throughout the experiment}}{\text{Total number of birds}} \times 100$$

Productive Index and Economic index

The productive index and the economic index were calculated as follows (Naji and Hanna, 1999):

The productive index =

$$\frac{\text{The average weight of the body (g)} \times \text{vital ratio}}{\text{Number days of breeding} \times \text{feed conversion ratio} \times 10}$$

Vital ratio = 100 - Percentage of total mortality

The feed conversion ratio

$$= \frac{\text{The Total amount of consumed feed during breeding (g)}}{\text{Total live weight of marketed birds (g)}}$$

Economic index =

$$\frac{\text{Total weight of marketed birds (g)}}{\text{Number of chicks} \times \text{the duration of breeding in days} \times \text{Feed conversion ratio}} \times 1000$$

Results

The average weight of the live body (g/bird)

Table (3) shows the effect of adding nano-selenium and vitamin E to the diet in the weight of the live body, where it was noted in the first week, the excelling of the T3 treatment significantly (P<0.01) on the rest of the treatments. Treatment T2 was excelled on the T5 treatment and did not show significant differences between (T1, T4, T6) from one hand and between (T2, T5) on the other hand. In the second week, the T4, T6 treatments were significantly (P <0.01) excelled on the rest of the treatments and did not show significant differences between (T1, T2, T3, T5). The third week showed the excelling of the T6 treatment significantly (P <0.01) on the rest of the treatments. The T3, T4, and T5 treatments were also significantly excelled on the T1 and T2 treatments, which did not show significant differences between them. The T2 treatment was excelled on the T1 treatment and the excelling of the T6 treatment continued in the fourth week, which significantly (P <0.01) excelled on the rest of the treatments. The treatment T3 and T4 were excelled on the T1, T2, and T5 treatments, while T2 and T5 treatments were excelled on the T1 treatment and there were no significant differences between the two treatments (T5, T2). Also, there were no significant differences between the T4 and T3 treatments. In the fifth week, the treatments (T4 and T6) were significantly (p<0.01) excelled on the rest of the treatments followed by the T3 treatment compared to the T1, T2, and T5 treatments. The T2 and T5 treatments were excelled to T, where the weight of the birds for the treatments (T1, T2, T3, T4, T5, T6) are (1765.42, 1825.45, 1886.57, 1954.93, 1831.82, 1967.82 g/bird), respectively.

The weekly average weight gain (g/bird)

Table (4) shows the effect of adding nano-selenium and vitamin E to the diet in the weekly average weight gain for the birds of the studied traits, where it was noted in the first week, the excelling of the T3 treatment (P<0.01) on the rest of the treatments and the table did not record significant differences between the treatments (T1, T2, T4, T5, T6). In the second week, the T4, T6 treatment were significantly (P <0.01) excelled on the rest of the treatments and the statistical analysis did not show significant differences between (T1, T2, T3, T5), In the third week, it was noted the excelling of the T6 treatment significantly (P <0.01) on the rest of the treatments. The T3 treatment was excelled on the treatments (T1, T2, T4) and the T4 treatment on the treatments (T1, T2). The T2 treatment was excelled on the T1 treatment and there was no significant difference between the T5 treatment and the treatments (T4, T6). In the fourth week, the statistical analysis showed a significant excelling (P <0.01) for the treatments (T3, T4, T6) on the rest of the treatments and the T2 was excelled on the treatments (T1, T5), and There were no significant differences between the T5 treatment and the T1 treatment. The fifth week showed excelling the T4 treatment followed by the T6 treatment compared to the other treatments. The table did not show significant differences between the treatments (T1, T2, T3, T5). As for the total weight gain, the treatments (T3, T6) have continued excelling compared to the rest of the treatments. The T3 treatment was excelled on the treatments (T1, T2, T5) and the treatments (T2, T5) on the T1 treatment. There was no significant difference between the treatments (T5, T2), where the total weight gain for treatments (T1, T2, T3, T4, T5, T6) amounted to (1725.50, 1785.12, 1846.07, 1914.75, 1792.07, 1927.07 g / birds), respectively.

Feed consumption (g/bird)

There were no significant differences between the treatments (T6, T5, T4, T3, T2). The table did not show any significant differences between the studied treatments during the third and fourth weeks. In the fifth week, treatment T3 was excelled on the treatment T1 and there were no significant differences between the treatments (T2, T4, T5, T6). Statistical analysis also showed no significant differences in the average of total feed consumption between the studied treatments

Feed conversion ratio (g feed/g weight gain)

Table (6) shows the effect of adding nano selenium and vitamin E to the diet in the weekly feed conversion ratio. In the first week, there were no significant differences between the studied treatments. In the second week, the feed conversion ratio has improved (P <0.01) for the T4 treatment compared to the other treatments. The treatments (T5, T6) were also improved compared to the treatment (T1, T2) and there was no significant difference between the treatments (T3, T2, T1) and the two treatments (T6, T5). In the third week, the treatments (T5 and T6) were improved compared to the rest of the treatments. Treatment T3 was also improved compared to the treatments (T1, T2, T4). the treatment T4 was also improved compared to the treatments (T1, T2) and there was no significant difference between the two treatments (T2, T1) and the two treatments (T6, T5). In the fourth week, the treatments (T3, T4, T6) was excelled compared to the rest of the treatments. Treatment T2 was improved compared to the treatmentT5 and there was no significant difference between the two treatments (T2, T1) and the two treatments (T5, T1). In the fifth week, the treatments (T4, T6) were significantly improved compared to the treatments (T1, T2, T3, T5). The table showed no significant differences between the treatments (T1, T2, T3, T5). In the total feed conversion ratio, The two treatments (T4, T6) were improved compared to the treatment (T1, T2). The two treatments (T3, T5) were also improved compared to the two treatments (T1, T2) and there was no significant difference between the treatments (T2, T1), (T3, T2), and (T6, T4) where the average of feed conversion ratio amounted to (1.426, 1.425, 1.403, 1.344, 1.409, 1.337) for the treatments (T1, T2, T3, T4, T5, T6), respectively.

Table 3: Effect of adding nano-selenium and vitamin E to the diet in the weight of the live body (g / bird) for different weeks for broiler chickens exposed to thermal stress (Average ± standard error).

Treatments	First day	First week	Second week	Third week	Fourth week	Fifth week
T1	0.36 ± 39.91	1.20 ± 136.67bc	1.16 ± 446.72b	5.46 ± 755.45d	7.74 ± 1289.48d	18.21 ± 1765.42d
T2	0.08 ± 40.33	1.10 ± 138.83b	1.94 ± 446.50b	1.88 ± 766.58c	4.34 ± 1329.05c	3.55 ± 1825.45c
T3	0.28 ± 40.50	1.53 ± 144.08a	1.86 ± 452.16b	1.87 ± 801.55b	6.72 ± 1397.67b	3.38 ± 1886.57b
T4	0.30 ± 40.16	0.43 ± 137.25bc	1.80 ± 462.25a	4.01 ± 802.87b	4.26 ± 1390.52b	3.24 ± 1954.93a
T5	0.14 ± 39.75	1.31 ± 133.91c	2.67 ± 446.67b	3.09 ± 803.15b	1.97 ± 1338.92c	10.17 ± 1831.82c
T6	0.38 ± 40.75	1.70 ± 137.25bc	2.07 ± 458.73a	2.78 ± 823.64a	3.81 ± 1427.85a	3.60 ± 1967.82a
LSD	NS	**	**	**	**	**

** The averages with different letters within the same column differ significantly between them at the level (P <0.01).
T1, T2, T3, T4, T5, T6, control treatment, 300 mg vitamin E / kg feed, 1.0 mg nano selenium / kg feed, 2.0 mg nano selenium / kg feed, 3.0 mg nano selenium / kg feed, 1.5 mg nano Selenium + 150 mg vitamin E / kg feed, respectively.

Table 4: Effect of adding nano-selenium and vitamin E to the diet in the weekly average weight gain (g/bird) for different weeks for broiler chickens exposed to thermal stress.

Treatments	First day	First week	Second week	Third week	Fourth week	Fifth week	Total weight gain
T1	1.50 ± 96.75b	310.05 ±2.27 b	4.37 ± 308.73e	6.94 ± 534.02c	1.75 ± 475.94c	1.92 ± 1725.50d	1.50 ± 96.75b
T2	1.18 ± 98.50b	2.97 ± 307.67b	1.62 ± 320.08d	3.62 ± 562.46b	0.85 ± 496.40c	3.48 ± 1785.12c	1.18 ± 98.50b
T3	1.72 ± 103.58a	1.87 ± 308.08b	2.65 ± 349.38b	8.03 ± 596.11a	3.35 ± 488.90c	3.58 ± 1846.07b	1.72 ± 103.58a
T4	0.72 ± 97.08b	1.52 ± 325.00a	4.11 ± 340.62c	8.02 ± 587.63a	5.82 ± 564.41a	3.48 ± 1914.75a	0.72 ± 97.08b
T5	1.29 ± 94.16b	1.77 ± 312.75b	4.82 ± 356.48ab	4.94 ± 535.76 c	11.83 ± 492.90c	10.31 ± 1792.07c	1.29 ± 94.16b
T6	1.39 ± 96.50b	3.31 ± 321.48a	1.71 ± 364.91a	1.08 ± 604.20a	4.61 ± 539.96b	3.24 ± 1927.07a	1.39 ± 96.50b
LSD	**	**	**	**	**	**	**

** The averages with different letters within the same column differ significantly between them at the level (P <0.01).
T1, T2, T3, T4, T5, T6, control treatment, 300 mg vitamin E / kg feed, 1.0 mg nano selenium / kg feed, 2.0 mg nano selenium / kg feed, 3.0 mg nano selenium / kg feed, 1.5 mg nano Selenium + 150 mg vitamin E / kg feed, respectively.

Table 5: Effect of adding nano-selenium and vitamin E to the diet in the average of feed consumption (g/bird) for different weeks for broiler chickens exposed to thermal stress.

Treatments	First day	First week	Second week	Third week	Fourth week	Fifth week	Total feed consumption
T1	1.04 ± 98.25bc	3.97 ± 366.29a	1.44 ± 521.46	1.80 ± 809.33	1.18 ± 895.58b	2.04 ± 2690.93	1.04 ± 98.25bc
T2	1.04 ± 99.00bc	1.17 ± 360.67ab	1.11 ± 528.16	1.85 ± 824.41	5.92 ± 912.00ab	2.53 ± 2724.25	1.04 ± 99.00bc
T3	1.58 ± 104.91a	3.96 ± 356.16b	1.45 ± 542.91	1.26 ± 830.25	1.28 ± 930.16 a	1.77 ± 2764.42	1.58 ± 104.91a
T4	0.28 ± 99.31b	0.60 ± 357.91b	1.73± 541.75	2.49 ± 817.47	5.78 ± 912.67ab	1.55 ± 2729.12	0.28 ± 99.31b
T5	1.20 ± 95.67c	1.46 ± 355.50b	3.08 ± 535.16	1.30 ± 822.08	4.94 ± 918.58ab	4.30 ± 2727.00	1.20 ± 95.67c
T6	0.62 ± 98.25bc	1.22 ± 359.79ab	1.97 ± 542.20	1.85 ± 820.58	1.04 ± 921.91ab	3.44 ± 2742.74	0.62 ± 98.25bc
LSD	**	*	NS	NS	*	NS	**

** The averages with different letters within the same column differ significantly between them at the level (P <0.01).
T1, T2, T3, T4, T5, T6, control treatment, 300 mg vitamin E / kg feed, 1.0 mg nano selenium / kg feed, 2.0 mg nano selenium / kg feed, 3.0 mg nano selenium / kg feed, 1.5 mg nano Selenium + 150 mg vitamin E / kg feed, respectively.

Table 6: Effect of adding nano-selenium and vitamin E to the diet in the feed conversion ratio (g feed/g weight gain) for different weeks for broiler chickens exposed to thermal stress.

Treatments	First day	First week	Second week	Third week	Fourth week	Fifth week	Average
T1	0.005 ± 1.015	0.020 ± 1.181a	1.688 0.029 ±a	0.022 ± 1.515ab	0.043 ± 1.883a	0.014 ± 1.456a	0.005 ± 1.015
T2	0.001 ± 1.004	0.014 ± 1.172a	0.0031 ± 1.650ab	0.021 ± 1.465b	0.014 ± 1.836a	0.010 ± 1.425ab	0.001 ± 1.004
T3	0.005 ± 1.012	0.019 ± 1.155ab	0.034 ± 1.553cd	0.015 ± 1.392c	0.030 ± 1.902a	0.012 ± 1.403b	0.005 ± 1.012
T4	0.010 ± 1.023	0.004 ± 1.100c	0.013 ± 1.589bc	0.014 ± 1.391c	0.010 ± 1.616b	0.005 ± 1.344c	0.010 ± 1.023
T5	0.004 ± 1.015	0.002 ± 1.136 bc	0.030 ± 1.498d	0.015 ± 1.534a	0.045 ± 1.865a	0.005 ± 1.409b	0.004 ± 1.015
T6	0.008 ± 1.018	0.008 ± 1.119bc	0.023 ± 1.485d	0.022 ± 1.357c	0.012 ± 1.707b	0.010 ± 1.337c	0.008 ± 1.018
LSD	NS	**	**	**	**	**	NS

** The averages with different letters within the same column differ significantly between them at the level (P <0.01).
T1, T2, T3, T4, T5, T6, control treatment, 300 mg vitamin E / kg feed, 1.0 mg nano selenium / kg feed, 2.0 mg nano selenium / kg feed, 3.0 mg nano selenium / kg feed, 1.5 mg nano Selenium + 150 mg vitamin E / kg feed, respectively.

Discussion

The superiority of live body weight, weight gain, and improving feed conversion efficiency in the birds of the two treatments (T6, T4) may be attributed to the role of vitamin E, which is considered a major antioxidant in the body responsible for protecting Phospholipids in cell membranes from oxidation by effect of free radicals, which inhibit free radical formation reactions resulting from normal metabolic processes, thus protecting tissues from damage leading to improve productive performance (Englmaierová *et al.*, 2011; Shit *et al.*, 2012). It can also be attributed to the role of vitamin E, an antioxidant that preserves red blood cells through its protective role for the cell membrane from oxidation, thus improving the level of bio-processes within the body and its role in supporting the immune system (Valk and Hornstra, 2000; Leshchinsky and Klasing, 2001; Arslan *et al.*, 2001; Barroeta, 2007). Or it may be the antioxidant activity of nano-selenium in conditions of high ambient temperature where the heat stress effect significantly reduces the growth performance for the broiler chickens (El-Deep *et al.*, 2014). Thermal stress is considered an environmental factor affecting birds through low body weight and feeds consumption, with deterioration in feed conversion efficiency and an increase in the percentage of mortality (Mujahid *et al.*, 2009). While antioxidants such as rare minerals and vitamins have been proved to be beneficial in mitigating the adverse effects of rising environmental temperature (Eid *et al.*, 2003 and 2008; Lin *et al.*, 2006; Sahin *et al.*, 2009). The cause may be the effect of nano-selenium in the activity of antioxidant enzymes. Yone *et al.*, (2007) and Ebeid *et al.*, (2013) indicated that nano-selenium improves the state of antioxidants by activating the activity of the enzyme Glutathione peroxidase. Eszenyi *et al.*, (2011) mentioned that the nano-selenium nanoparticles are spherical and Which have a range of 100 to 500 nm which increased antioxidant activity (Torres *et al.*, 2012), where has a high capacity to decomposition the free radicals (Huang *et al.*, 2003; Bagheri *et al.*, (2015). The reason for improving the live body weight and weight gain may be due to the fact that nano-selenium is associated with the proteins inside the body. These proteins have antioxidant properties and thus reduce fat oxidation, which improves metabolism within the bird body and relieves the stress that birds expose, these results agree with (Ševčíková *et al.*, 2006; Dlouhá *et al.*, 2008; Upton *et al.*, 2008). Aparna and Karunakaran (2016) reported that nano-selenium at the concentration of (0.1, 0.2 mg/kg) caused an increase in the activity of glutathione peroxidase and Malondialdehyde compared to the control treatment, which improved the resistance of oxidation, oxidation of fat and elimination of free radicals, thus increased body weight and growth performance of birds. These results agree with (Zhou and Wang, 2011), who found that nano-selenium under high ambient temperature improved the weight of the live body and weight gain, and reduced the average of feed consumption compared to the control treatment, Or the improvement of the productive traits for the birds of the experiment may be due to the fact that vitamin E protects cells from oxidative stress (Lin *et al.*, 1989; Wang *et al.*, 1997). Eder and Kirchgessner, (1998) reported that with the low concentration of vitamin E in the diet, the sensitivity of low-density lipoprotein to lipid peroxidation increased slightly, but with the high concentration of vitamin E there was no adverse effect on sensitivity LDL to lipid peroxidation. Higher levels of vitamin E may be sufficient to remove the free radicals or increase the saturation of fatty acids and reduce oxidation, thus making fats more resistant to lipid oxidation (Barja *et al.*, 1996; Iqbal *et al.*, 2002). This indicates that vitamin E may be important to reduce mortality and increase the immunity of birds against pathogens, which will have a positive effect on growth performance parameters and carcass weights (Gardini, 2000). The growth performance of the birds may also be attributed to the relationship between nano-selenium and vitamin E, and their effect on thyroid hormones. Orten and Neuhaus, (1982); Al-Murrani *et al.* (1997); Kazim *et al.* (2002) noted that the reduction of the thyroid hormone triiodothyronine (T3) and Thyroxine (T4) and the occurrence of atrophy in the chest muscles and the emergence of fluids and low body weight in the chicks that lack vitamin E. They also noted the high level of the two hormones T4, T3, the level of feed Consumption, and body weight with a high concentration of vitamin E in feed, and that nano-selenium affects the thyroid gland and the production of T3 and T4 hormones and that the lack of selenium weakens the ability of the thyroid gland to metabolize thyroid hormones and make it in the form that the cells need. As well as that Nano selenium protects the tissues of the thyroid from stress and that these hormones have a direct impact on the metabolism of the body and is the first responsible for the production of metabolic heat and stimulate the consumption of oxygen and increase the storage of Glycogen in the liver. The high temperature of the environment reduces the concentration of T4 hormone in the plasma, which reflected negatively on the metabolism inside the body, thus Nano-selenium and vitamin E reduced the impact of heat stress on birds. Vitamin E protects vitamin A from oxidation in birds, which is an important vitamin that affects the growth and formation of bones and nerves and regulates the Anabolism and Catabolism in the body (Shlig, 2009). The antioxidant and stress effect of vitamin E in this experiment has an important role in improving the weight and health of birds. These results agree with (Herrera and

Barbas, 2001; Michel *et al.*, 1999). Our results agree with (He-Jianhua *et al.*, 2000) that mentioned that the feeding with nano-selenium at a concentration of (0.3 mg/kg) has improved feed conversion ratio and feed consumption, which is due to the fact that nano-selenium stimulates the thyroid hormones that cause Decreased bird needs for energy for sustainability and thus improved utilization of fodder for growth and increase the weight of the live body. Patching *et al.* (1999) mentioned that nano selenium plays important roles in the regulation of thyroid hormone, cell growth, and antioxidant defense systems. Thus, in association with Alpha-tocopherol, prevent cells from oxidation and damage by oxidative stress. Gao *et al.* (2002) demonstrated antioxidant properties of spherical nano-selenium that reduce the risk of selenium toxicity as well as its anti-oxidant use while reducing the risk of toxicity. Selenium deficiency is associated with disruption of the thyroid hormone synthesis (Kohrle *et al.*, 1992). Since thyroid hormones play an important role in protein synthesis and metabolism (Jianhua *et al.*, 2000), the lack of selenium affects the overall growth performance and feather development in poultry by weakening the production of T3 (Edens, 2000), thus weakening the overall growth of birds. The improvement in the growth performance of the treatments of the birds may also be attributed to the close working relationship between vitamin E and nano selenium within the tissues, as nano selenium has an effect on vitamin E and delays the appearing the signs of deficiency. Likewise, vitamin E and Sulfur amino acids are partially protected against or delayed The emergence of several forms of syncytial selenium deficiency where tissue breakdown occurs in most species that feed on deficient diets of both vitamin E and nano selenium, mainly through the process of oxidation by hydroperoxides, Which are very damaging to tissue integrity and lead to disease, where vitamin E in the cellular and sub-membranes is the first line of defense against bio-phospholipid peroxide, but even with sufficient amounts of vitamin E, some of the peroxides, but selenium as part of the enzyme glutathione peroxidase is the second line of defense that destroys these peroxides before they have the opportunity to damage the membranes so the nano selenium and vitamin E and amino acids containing sulfur, through some of the various biochemical processes are mechanisms Capable of preventing some of the same nutritional diseases (Mc Dowell, 2000). This study agree with (Biswas *et al.*, 2011) who used 150 IU of vitamin E / kg + 0.5 mg / kg of selenium, 300 IU of vitamin E / kg + 1.0 mg / kg of selenium, where the weight of the body was higher with level (P <0.05) in the treatment added to it selenium and vitamin E compared to the control treatment and there were no significant differences in the feed conversion ratio. Where the weight gain of the body was significantly observed in the treatments added to it nano selenium and vitamin E compared to the control treatment. Thermal stress can be a major cause of poor performance, low muscular development and an increase in chicken mortality, which weakens growth (Zhang *et al.*, 2012) by increasing body temperature and Panting rate with reducing subsequent growth in chickens (Teeter *et al.*, 1985). Thermal stress may impair the growth performance and immunity of birds by damaging the function of gastrointestinal tract barrier (Gabler *et al.*, 2013). The cause of this phenomenon is due to low blood flow to the intestines and other tissues that can cause hypoxia and damage caused by oxidation (Dunshea *et al.*, 2008). In this way, nano selenium and vitamin E reduce the effect of thermal stress on fertilized birds. Selenium protects tissue against cell damage and generates excess free radical oxygen via the pathway of glutathione peroxidase, Thus protecting the tissues against oxidation of fat and proteins (McDowell, 1989). Vitamin E also regenerates damaged cells by pathways of glutathione peroxidase and Malondialdehyde and protects them against lipid peroxidation and damage to body cells (Peri'c *et al.*, 2009) thus improving the performance of chicken growth (Hosseini- Mansoub *et al.*, 2010).

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