Effect of Feed Supplementation of Selenium and Vitamin E on Production Performance and Some Hematological Parameters of Broiler*

Ihsan T. TAYEB[1], Gelawesh Khelil QADER[2]
[1] Ph.D. Poultry Management, Technical Institute of Amedy Foundation of Technical Education-Erbil, Iraq
[2] M.Sc. Poultry Production, Technical Institute of Akre Foundation of Technical Education-Erbil, Iraq

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Abstract: This study was conducted at the poultry production farm in Akre region for a period 49 days using it 420 Ross day old broiler chicks. The chicks were distributed randomly in to seven treatments. Selenium and Vitamin E added to the diet according to as follows: T1 (control group), no supplemented Se and Vitamin E; T2, 0.15 mg Se + 100 mg Vit.E/kg feed; T3, 0.3 mg Se + 100 mg Vit.E/kg feed; T4, 0.15 mg Se+ 150 mg Vit.E/kg feed; T5, 0.3 mg Se + 150 mg Vit.E/kg feed; T6, 0.45 mg Se+ 100 mg Vit.E/kg feed and T7, 0.45 mg Se +150 mg Vit.E/kg feed. The objective of this study was to study the effect of supplementation Selenium and Vitamin E in the diets on the production performance and some hematological parameters of broiler chick. Results were as fallow: There were no significant differences in live body weight, body weight gain, feed intake, and feed conversion ratio, carcass weight, dressing and mortality percentages among all treatments and control at 49 days of age. Significant differences ($p<0.05$) showed in ratio of wings for T6 on other treatments at 49 days of age. There were significant differences ($p<0.05$) in fat and protein percentage of breast between T6 and T7 at 42, 49 days of age. Significant differences ($p<0.05$) appears in packed cell volume, hemoglobin for T7 compared to other treatments and T1 at 42, 49 days of age. While, there were no significant differences in lymphocytes between all treatments compared to control group except T6 at 42 days of age, this treatment was significantly superior to control regarding heterophile %, H/L. Significant differences ($p<0.05$) in monophile, esonophile, basophile were resulted among all treatments at 42 days of age.
Keywords: Broiler, Selenium, Vitamin E, Performers and Immunity.

INTRODUCTION

Selenium is an essential micronutrient required for normal growth and maintenance in poultry. The Selenium requirement for broilers throughout the growth period is 0.15 part per million (ppm) (NRC, 1994). The maximum allowable level of selenium supplementation is 0.30 ppm (AAFCO, 2010). The Selenium supplement that primarily has been used in poultry diets is the inorganic form, Sodium Selenite (SS). There were many sources of organic selenium such as Selenocysteine (SC), Selenomethionine (SM), Se-enriched Yeast (SY), Selenium Chlorella (SCH) as supplemental sources of se. Recently however, there has been interest in the use of organic forms of selenium (Payne and Southern, 2005). Two forms of selenium are used as feed supplements. Inorganic forms, usually Selenites and Selenates have a history of almost 60 years in animal. Hegazy and Adachi, (2000) found that the mean lymphoid organs (bursa of fabricius, spleen and thymus) weight / body weight ratio of control birds was significantly lower than the birds fed on diet containing organic or inorganic selenium with or without vitamin E.

The Selenium content of animal feed ingredients is dependent on the selenium concentration in soil. Recently, studies related to the effects of selenium sources in poultry were conducted in order to assess the growth performance, carcass characteristics and lipid peroxidation (Sevescova et al., 2006). In growing broilers Sel-Plex is associated with: better growth improved FCR, decreased mortality, decreased drip loss and decreased lipid peroxidation during meat storage.

Nutrition plays a significant role in the development and function of the immune system (Khan et al., 1993). There are many immunostimulating substances that have been used in poultry with success such as selenium (El-Sheikh et al., 2006). Selenium supplementation for animals in diets enhances the immune status and ability of the immune system to respond to disease challenges. The influence of vitamin E on the development and functional activity of the immune system in broilers and their resistance to infectious diseases is well known. It increases humoral immunity in chickens (Franchini et al., 1991). A deficiency of selenium in growing chickens causes exudative diathesis. The early signs (unthriftiness, ruffled feathers) usually occur at 5-11week of age. The odema results in weeping of the skin, which is often seen on the inner surface of the thighs and wings. The birds bruise easily; large scabs often form on old bruises.

Vitamin E plays important roles in various biochemical and physiological processes, including antioxidation (Franchini et al., 1995). In nutritional and physiological research, vitamin E supplementation has been proven to improve growth performance, enhance immunity (Gatlin, 2002) and restore impaired immunity (Sheehy et al., 1997), as well as influence neuroendocrine function (Khan and Thomas, 2004).

Corresponding Author: Tayeb, I. T., ihsan.tayeb@hotmail.com
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Vitamin E, unlike antibiotics and other chemicals has been reported to enhance immune competence of chickens (Erf et al., 1998) and thereby enhance their immunity to several diseases including Escherichia Coli infection, Coccidiosis infectious, bursal disease, and Newcastle disease. Vitamin E is the most important lipid-soluble antioxidant and the biologically most active form is D and α-tocopherol, (Kennedy et al., 1991). The three main disorders seen in chicks deficient in vitamin E are encephalomalacia, exudative diathesis, and muscular dystrophy. The occurrence of these conditions depends on various dietary and environmental factors (management, temperature, humidity and other factors). The objective of this study was to investigate the effects of different levels of organic selenium and vitamin E on the productive performance traits and chemical component of meat, and some hematological parameters. Selenium should be added to the diet of the chicks in Iraq due to soil deficiency in selenium.

MATERIALS and METHODS

The experiment was conducted at the poultry production farm in Akre region for period 49 days. At 42 and 49 days of age some blood parameters were taken such as Packed Cell Volume (PCV), Hemoglobin (Hb) concentration, White Blood Cells (WBC).

Experimental Design

Total of (420) days old chicks of commercial hybrid Ross 308 were used in this experiment. Selenium and vitamin E added to the diet according to as follows: T1 (control group), no supplemented Se and Vitamin E; T2, 0.15 mg Se + 100 mg Vit.E/kg feed; T3, 0.3 mg Se + 100 mg Vit.E/kg feed; T4, 0.15 mg Se+ 150 mg Vit.E/kg feed; T5, 0.3 mg Se + 150 mg Vit.E/kg feed; T6, 0.45 mg Se+ 100 mg Vit.E/kg feed and T7, 0.45 mg Se +150 mg Vit.E/kg feed.

Feeding

The chicks were fed using three rations system, starter (1-14 day), grower (15-21 day) and finisher (22-49 day), with adding Selenium + Vitamin E levels. The chemical analysis of diet was done in Animal Production Laboratory, in the College of Agriculture University of Dohuk (Table 1).

Table 1. The Experimental Broiler Starter, Grower and Finisher Rations, Calculated Analysis of Feed and Chemical Analysis of Feed

Feed stuff	Starter (1-14day)	Grower (15-21day)	Finisher (22- 49day)
Wheat	65	66	69
Soya bean meal	27	25	23
Sun flower oil	3.0	3.5	3.8
Limestone	1.2	1.2	1.0
Premix*	3.6	3.7	2.0
Antitoxin**	0.2	0.6	1.2
Total	100	100	100
	Calculated chemical analysis		
Metabolic energy kcal/kg	2900	3000	3100
Fiber %	2.31	2.49	2.59
Crud protein %	23.35	22.50	21.88
Ash%	5.48	5.66	5.88
Fat %	4.16	4.16	4.17
	Calculated chemical analysis		
Moisture%	8.5081	7.9142	8.1588
Dry matter %	91.4919	92.0858	91.8412
Crud protein %	23.15	22.65	20.98
Ash%	4.97	5.32	5.68
Fat %	3.89	4.04	4.12

*The nutritional requirement of chicks determined according to (NRC, 1994).

Water soluble powder, Composition: each 1 Kg contains: Vitamin A 8000000 I .U., Vitamin D3 1500000 I.U., Manganese sulfate 400 mg, Vitamin E 1000 mg, zinc sulfate 150 mg, Vitamin K3 2000 mg, Iron sulfate 500 mg,Vitamin B1 500 mg, Copper sulfate 40 mg, Vitamin B2 500 mg, Cobalt chloride 10 mg, Vitamin B6 200 mg, Vitamin B12 8 mg, Calcium pantothenate 4000 mg, Nicotine amide 6000 mg and Folic acid 50 mg.

**Each 1 Kg contains: Vitamin A 400000 IE, vitamin B6 40mg, Vitamin D3 80000 IE, Cholin chloride 1000 mg, vitamin E (acetate) 1000 IE, Cholecalciferol 2.000 mg, Vitamin K3 60 mg, Fe: Fe (II) sulf. 2000 mg, Vitamin B130 mg, Cu: $CuSO_4.5H_2O$ 200 mg, vitamin B2 200 mg, Zn: ZnOxyde 1600 mg, Pantothenic acid 300 mg, Mn: Mn (II) oxide 2400 mg, Niacin 1200mg, Co: Co (II) carbon 6 mg, Biotin 2000 mcg, I: Ca – Iodate 30 mg, Vitamin B12 600 mcg, Se: Na – selenite 4 mg and Folic acid 20 mg.

Broiler production traits

At one day old, four hundred twenty (420) birds were weighted and also at the first week (5) birds were weighted as group from each replicate by a balance. At the second week until the end of the experiment the chicks were weighted individually for each replicate.

Feed intake in each pen (replicate) was recorded and measured weekly.

The total feed consumption during the period was measured and then subtracted from it, the feed consumption by dead bird in each pen or replicate.

Mortality was recorded for each replicate and calculated by the equation:

Production index (PI) for all groups was calculated according the following equation:

$$\text{Production index} = \frac{\text{Average body weight X live ability \%}}{\text{Number of rearing days X feed conversion ratio} * 10}$$

(Naji et al., 2007)

Slaughtering and preparation of birds

Firstly, at the 6^{th} and 7^{th} weeks of age, two birds (1 male and 1female) from each replicates were randomly chosen and weighted, then were taken and collected two ml of blood from the wing vein (brachial vein) of six birds in each treatment and the blood portion added to an anticoagulant EDTA (1 mg ml-1) and used in hematological studies. Hb count, PCV %, differential leukocyte count, was determined according to methods described by Hoffmann (2007). Specific carcass characteristics, the dressing percentage and Percentages of (thigh and breast) cuts are calculated.

Blood parameters:

Packed Cell Volume (PCV) % Heamatocrit

The PCV was determined by the method described by (Benjamin, 1987). Micro heamatocrit tube filled up to the mark with the well mixed heparinized blood and then the capillary tubs placed in the centrifuge for 5 minutes at 1500 rpm. Then tubs were removed and the percent values of PCV were recorded directly by using the special ruler and this was done at 42 and 49 days of age.

Hemoglobin concentration (Hb)

The determination of hemoglobin concentration was done by the Spectrophotometer apparatus and Heamatocrit solution which was specialized for hemoglobin concentration measurement. The blood was pulled by special pipette to 0.5 and mixed with 5 milliliters of the solution and left for 5 min until it became constant, and then it was recorded by the Spectrophotometer apparatus according to *Jain* (1986).

White blood cells (WBC) H/L %

At both 42, 49 days of ages, blood was obtained via wing vein (brachial vein) and collected in tubes containing acid citrate dextrose (ACD) as anticoagulant. Two drops of blood were placed on the slide, and blood smear was prepared using Geimsa stain (Cross et al., 1983). All slides were coded, and heterophils and lymphocytes were counted to a total number of 100 cells per slide.

Chemical analysis of the meat (breast)

The chemical analysis of meat samples of (breast) was taken from the birds at 42 and 49 days of age, carried out by taking 3 replicates from each group.

Proximate analysis of breast meat was performed according to AOAC (1985). Fat was determined by Soxhlat extraction using petroleum ether. Ash was determined by using Muffle furnace (550ºC) for 3 hours.

Statistical Analysis

Completely randomized design (CRD) was used to study the effect of selenium and vitamin E on different traits.

Duncan multiple range test (2008) was used to test the difference among the means. The statistical analysis of data was carried out using the GLM (General liner model) with SPSS (2008) program version 15.

RESULTS and DISCUSSION

Table 2 refers to the effect of Selenium and Vitamin E on live body weight of chicks at different ages. Selenium and vitamin E had no significant differences of live body weight among the treatments at (1, 2, 3, 4, 5, 6 and 7) weeks of age. No differences were observed in final live weight of chickens with supplement Selenium plus Vitamin E. At 42 days the higher live body weight found in T5, but at 49 days the higher live body in T7 under normal condition this may be was due to organic selenium and vitamin E is more bioavailable than organic selenium and vitamin E. This result was in agreement with the findings of (Edens et al., 2000) where there was a seasonal suppression in live body weight due to the extreme heat of the summer. The result was in contrast with those of Choct et al., 2004, the significant differences in live body weight at 42 day was due selenium was an essential elements for growth performance. For (Shlig, 2009) the improvement in the live body weight of birds fed vitamin E and selenium could be attributed to some of its biological function such as its role on enzymatic oxidation-reduction, nucleic acid metabolism and in promoting the activity of easily oxidized substances as carotenoides and vitamin A. Moreover, such improvement may be due to the role of vitamin E as an immune stimulant (Franchini et al., 1991) which in turn raises the bird resistance.

Table 2. Effect of Selenium and Vitamin E on Live Body Weight (Grams) of Broilers at Different Age (Mean ± Standard Error)

Treatment	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week
T1 (Control)	142.91±1.92	304.41±3.66	584.89±27.12	934.66±22.83	1412.66±9.02	1978.66±8.17	2512.00±11.37
T2	142.00±5.26	341.82±19.74	609.41±33.71	982.66±42.33	1443.66±43.32	2013.33±30.24	2546.33±48.84
T3	142.75±1.42	309.98±17.88	608.92±23.23	989.33±22.21	1469.66±20.21	2011.00±14.01	2539.33±13.22
T4	139.75±4.75	304.16±16.24	547.37±27.89	925.00±29.81	1412.00±33.70	1967.66±48.25	2509.33±43.52
T5	134.83±3.65	343.11±16.36	618.46±20.19	1004.66±26.26	1450.00±30.98	2026.66±28.38	2545.00±42.66
T6	139.75±4.47	304.08±19.58	595.65±30.95	966.66±34.89	1429.33±22.84	2001.33±20.33	2559.66±36.12
T7	142.33±2.35	312.91±33.08	571.41±48.69	939.33±27.71	1408.33±34.93	1993.33±32.41	2588.00±44.83
Average	140.61±1.30	317.21±7.23	590.87±11.21	963.19±11.45	1432.23±10.56	1998.85±10.03	2542.80±13.05

Treatment: T1 (control group)= no supplemented Se and Vitamin E; T2= 0.15 mg Se + 100 mg Vit.E/kg feed; T3= 0.3 mg Se + 100 mg Vit.E/kg feed; T4= 0.15 mg Se+ 150 mg Vit.E/kg feed; T5= 0.3 mg Se + 150 mg Vit.E/kg feed; T6= 0.45 mg Se+ 100 mg Vit.E/kg feed; T7= 0.45 mg Se +150 mg Vit.E/kg feed.

Table 3 refers to the effect of selenium and vitamin E on Body Weight Gain (BWG) of chicks at different ages. Selenium and Vitamin E had no significant differences in growth performance of age from (1-6) weeks of age, as measured by BWG of broiler chicks, but there were significant differences ($p<0.05$) between treatment at 7 week of age only at T7 (594.66g). T4 and T6 treatment were numerically higher from the others groups and T7 significantly differs from others. The reason for reduced weight gain of Selenium deficient chicks might be the occurrence of dystrophy of the gizzard, heart and skeletal muscle (Basmacioglu et al., 2009). These results were in contrast with a significant improvement ($P <0.05$) in BWG was evident only during the on the higher concentration of Se. From the results it is clear that significant differences may be due Selenium is a trace element found in soil, and is required in small amounts to maintain good health. It is essential for many body processes. In addition improved feather growth may be improved growth performance (BWG) or may be due to increase of protein and water in cells.

Table 4 refers to the effect of Selenium and Vitamin E on feed intake of chicks at different ages. Selenium and Vitamin E had no significant effect on feed intake, and the feed intake was not influenced by the levels of Selenium at (2, 3, 5, 6, average feed intake 1-42 days and 1-49 days of age) because there was no difference in body weight at different ages between all treatments. The reduction in feed intake by a high selenium concentration in feed resulted in an improved Feed Conversion Ratio (FCR). These results were in agreement with the findings of (Skrivan et al., 2008a), where the results indicating that feed intake were not significantly affected by diets containing increased levels of Se. On the other hand, they had significant differences ($P < 0.05$) at 1, 4 and 7 weeks of age between treatment groups. The chicks in T7 (1302.12 g) consumed more feed than T4 (1081.81 g) because the high doses of selenium and vitamin E may be increase appetite of birds than received low doses and then increased feed intake. The result was in agreement with Zelenka and Fajmonova (2005). Naylor et al. (2000), show the feed intake increase may be due selenium make to increase feathering speed and growth speed and then need to feed and this apply the role of selenium and vitamin E, as antioxidant and improved feed intake.

Table 5 refers to the effect of selenium and vitamin E on FCR of chicks at different ages. Selenium and vitamin E had no significant differences on FCR at 1, 2, 3, 5, and 6 weeks, 1-42 days and 1-49 days between treatment groups, the better feed conversion efficiency was found in T7. These results were in agreement with the findings of (Hoffman, 2007; Ozkan et al., 2007, Zelenka and Fajmonova, 2005 and Surai, 2006) noted that the improved FCR of broilers fed organic Se supplemented diet could be related to the increased concentrations of the active form of thyroid hormone in the serum of chickens supplemented with organic Se as well as to the immunomodulating properties of Se, and suggested that improvement in FCR could be related to the better feathering of chickens fed with a diet supplemented with organic Se. From the results it is clear that improving FCR may be due with increased dietary protein or energy, and there were relationship between feed intake and FCR when feed intake decrease FCR decreased and because of the role of selenium and vitamin E which improved FCR

Table 6 refers to the effect of selenium and vitamin E on total mortality rate. There were no significant differences in mortality rate between experimented groups. The chicken in T7 did not found mortality. The large intake of vitamin E (100 to 150 ppm) was necessary for the prevention of clinical signs of disease in selenium-deficient chicks considerably exceeds the normal nutritional requirement. The ability of most semi purified low selenium diets to maintain growth and health when supplemented with vitamin E can be attributed to contamination with selenium and apply the role of selenium which was decrease mortality (Hoffmann, 2007).

Table 3. Effect of Selenium and Vitamin E on BWG (Grams) of Broiler at Different Age (Mean ± Standard Error)

Treatment	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	1-42 days	1-49 days
T1 (Control)	102.91±1.92	161.50±5.00	280.48±26.27	349.76±24.84	478.00±25.48	566.00±11.13	533.33±3.84^{b}	1938.66±8.17	2472.00±11.37
T2	102.00±5.26	199.82±17.26	267.58±16.90	373.25±16.63	461.00±1.00	569.66±15.45	533.00±21.51^{b}	1973.33±30.24	2506.33±48.84
T3	102.75±1.42	167.23±18.37	298.93±9.03	380.40±5.76	480.33±9.17	541.33±20.86	528.33±6.96^{b}	1971.00±14.01	2499.33±13.22
T4	99.75±4.75	164.41±15.76	243.21±22.84	377.62±12.93	487.00±9.01	555.66±22.84	541.66±11.78^{ab}	1927.66±48.25	2469.33±43.52
T5	94.83±3.65	208.28±19.49	275.35±24.51	386.19±7.68	445.33±10.72	576.66±18.94	518.33±14.37^{b}	1986.66±28.38	2505.00±42.66
T6	99.75±4.47	164.33±16.04	291.57±12.00	371.01±9.87	462.66±12.19	572.00±6.02	558.33±18.22^{ab}	1961.33±20.33	2519.66±36.12
T7	102.33±2.35	170.58±33.78	258.50±15.87	367.91±24.19	469.00±7.23	585.00±57.51	594.66±29.53^{a}	1953.33±32.41	2548.00±44.83
Average	100.61±1.30	176.59±7.35	273.66±7.24	372.31±5.66	469.04±4.97	566.61±8.97	543.95±7.59	1958.85±10.03	2502.80±13.05

Means with different letters significantly different at p<0.05 according to Duncan multiple range test. Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 4. Effect of Selenium and Vitamin E on Feed Intake (Grams) /Bird of Broiler At Different Age (Mean ± Standard Error)

Treatment	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	1-42 days	1-49 days
T1 (Control)	125.58±5.04^{ab}	253.82±13.01	422.37±8.17	715.26±24.90^{a}	832.12±12.66	1025.00±15.26	1194.15±17.51^{abcd}	3374.18±8.24	4568.33±23.47
T2	133.33±1.12^{a}	276.75±1.25	438.25±2.63	681.85±10.88^{ab}	824.44±11.53	1066.86±9.18	1106.37±75.82^{cd}	3421.51±32.50	4527.88±94.92
T3	122.66±2.09^{ab}	262.91±15.21	424.33±11.69	678.33±8.47^{ab}	835.45±24.24	1097.57±52.84	1172.62±27.42^{bcd}	3380.30±95.15	4593.91±95.77
T4	131.93±3.09^{a}	283.25±2.92	430.82±4.92	666.57±12.54^{b}	836.18±18.29	1041.96±30.47	1081.81±17.57^{d}	3390.74±57.04	4472.56±50.71
T5	124.66±4.67^{ab}	264.25±16.89	434.00±5.37	642.41±7.62^{b}	850.90±14.88	1064.06±35.77	1214.68±37.60^{abc}	3380.30±63.66	4594.99±88.90
T6	120.50±2.36^{b}	271.08±14.34	435.91±6.70	662.54±10.24^{b}	834.21±26.74	1090.93±10.18	1238.69±16.35^{ab}	3415.18±21.01	4653.87±37.27
T7	128.33±2.97^{ab}	286.08±2.16	442.05±3.02	681.83±8.04a^{b}	836.75±9.43	1046.66±13.40	1302.12±34.80^{a}	3421.71±25.06	4723.84±41.03
Average	126.71±1.43	271.16±4.33	432.53±2.59	675.83±6.21	835.72±5.89	1061.86±10.46	1187.21±19.73	3403.56±16.85	4590.77±28.87

Means with different letters significantly different at p<0.05 according to Duncan multiple range test. Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 5. Effect of Selenium and Vitamin E on Feed Conversion Ratio (Feed: Weight Gain) of Broiler at Different Age (Mean ± Standard Error)

Treatment	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	1-42 days	1-49 days
control T1	1.21±0.02	1.57±0.11	1.53±0.15	2.07±0.22[a]	1.75±0.11	1.81±0.02	2.23±0.02[ab]	1.74±0.01	1.84±0.00
T2	1.31±0.08	1.40±0.10	1.65±0.10	1.83±0.06[ab]	1.78±0.02	1.87±0.05	2.07±0.10[ab]	1.73±0.02	1.80±0.00
T3	1.19±0.01	1.59±0.09	1.42±0.04	1.78±0.01[ab]	1.74±0.08	2.02±0.07	2.22±0.07[ab]	1.73±0.03	1.83±0.03
T4	1.33±0.08	1.75±0.17	1.80±0.16	1.76±0.04[ab]	1.71±0,04	1.87±0.06	1.99±0.01[b]	1.75±0.01	1.81±0.01
T5	1.31±0.06	1.27±0.04	1.60±0.14	1.66±0.05[b]	1.91±0.07	1.84±0.04	2.34±0.11[a]	1.70±0.04	1.83±0.06
T6	1.21±0.06	1.66±0.08	1.49±0.03	1.78±0.06[ab]	1.80±0.01	1.90±0.01	2.22±0.10[ab]	1.74±0.02	1.84±0.04
T7	1.25±0.01	1.79±0.30	1.72±0.11	1.87±0.14[ab]	1.78±0.03	1.81±0.14	2.19±0.07[ab]	1.75±0.01	1.85±0.02
Average	1.26±0.02	1.58±0.06	1.60±0.04	1.82±0.04	1.78±0.02	1.88±0.02	2.81±0.03	1.73±0.01	1.83±0.01

Means with different letters significantly different at $p<0.05$ according to Duncan multiple range test. Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

This result was in agreement with the findings of Basmacioglu et al. (2009), where the non significant differences in mortality rate between experimented groups may be due Se enhances immune responses; one possibility is through greater glutathione peroxidase activity which may protect the membranes and organelles of the lymphocytes from the detrimental effects of pro-oxidants. Moreover, Se may also be involved in modifying the metabolism of arachidonic acid to prostaglandin precursors or related compounds, enhancing immune responses by reducing the endogenous production of prostaglandin. Surai (2006) and Seven et al., (2009) suggested that the growth response of birds to Se supplementation would also depend on the birds' stress level, with stressed birds being more responsive.

Table 6 refers to the effect of selenium and vitamin E on PI of chicks at 42 and 49 days of age. There were no significant differences on production, this may be due when delay the marketing age PI increase with addition different levels of selenium and vitamin E to the diet and because the higher live body weight will cause to consume more feed because the feed requirement for maintenance and PI increase by increase the body weight and the cause of higher value of PI generally was due to the big development in poultry production and introduction of new commercial strains with high production efficiency and also by using the new technology in poultry feeding and management.

Table 7 refers to the effect of selenium and vitamin E on carcass weight, dressing percentage of chicks at 42 and 49 days of age. Selenium and vitamin E had no significant effect on both carcass weight and dressing percentage at 42 and 49 days of age, between treatment groups, but numerically dressing percentage at 49 days of age was higher than dressing percentage at 42 days this due to the differences of selenium and vitamin E levels and also dressing percentage is differ according to the live body weight of broiler, sex, and age of broiler at marketing, generally dressing percentage will increase by increasing live body weight and by advancing age of broiler (Naji et al., 2007). These results were in agreement with findings of (Downs et al., 2000; Surai, 2002, Choct and Naylor, 2004; Payne and Southerm 2005; Sevescova et al., 2006). The result was in contrast with (El-Sheikh et al., 2005) who noted that the effect of selenium on meat yield could be due to changes in thyroid hormone metabolism or a result of changes in broiler feathering. Correct feathering is important for broiler chickens because it helps regulate body temperature and protects the skin and muscle from damage (Peric et al., 2009).

Tables 8 and 9 refer to the effect of selenium and vitamin E on carcass parts percentage of chicks at 42 and 49 days of age. Selenium and vitamin E had no significant effect each carcass parts percentage (breast, thigh, back, neck, wing and abdominal) % between treatment groups at 49 days of age, also there were no significant differences between treatment groups compared with control group at 42 days of age. While had significant differences between treatment groups compared with control group at 42 days of age of neck and wing percentages. Selenium is an important antioxidant mineral in animals and is known to influence the production of feathers and the maintenance of cellular integrity in tissues in avian species or selenium can increase levels in muscle tissue (Peric et al., 2009; Seven, 2009; Tatli Seven, 2009).

Table 6. Effect of Selenium and Vitamin E on Mortality Percentage and Production Index (PI) of Broiler at 42 Days and 49 Days of Age of Broiler (Mean ± Standard Error)

Treatment	Mortality, %	PI at 42 days	PI at 49 days
T1 (control)	1.75 ±1.75	270.68 ±1.86	277.40±1.10
T2	3.84±3.57	276.55±7.15	287.65±5.25
T3	5.88±5.88	276.07±3.77	282.18±4.71
T4	1.75±1.75	266.40±9.14	282.78±7.11
T5	3.70±3.70	284.02±11.05	283.74±13.18
T6	3.70±3.70	273.77±6.70	283.08±10.00
T7	0.00±0.00	270.99±7.20	284.98±8.43
Average	2.71±2.81	274.07±2.58	283.11 ±2.60

Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 7. Effect of Selenium and Vitamin E Chicks on Carcass Weight (Gram) and Dressing Percentage of Broiler at 42 and 49 Days of Age (Mean ± Standard Error)

Treatment	At 42 days		At 49 days	
	Carcass weight, g	Dressing, %	Carcass weight, g	Dressing, %
T1 (control)	2080.83±119.07	73.52± 2.07	2184.66±66.03	74.06 ±0.78
T2	1843.33±130.64	73.51±1.59	2210.83±168.63	74.15±1.43
T3	1915.83±89.21	74.68±0.44	2309.16±12.88	74.85±0.15
T4	1805.83±84.36	74.52±0.70	2138.00±87.44	75.04±1.15
T5	1940.00±69.34	73.89±0.72	2216.33±20.65	74.23±0.80
T6	1896.66±58.77	74.12±0.94	2256.50±40.89	74.43±1.96
T7	1998.33±67.92	74.70±2.10	2129.50±80.42	75.48±0.76
Average	1925.83±34.85	74.13±0.44	2206.42±29.59	74.61±0.37

Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 8. Effect of Selenium and Vitamin E on Carcass Parts Percentages of Broiler at 42 Days of Age (Mean ± Standard Error)

Treatment	Breast, %	Thigh, %	Back, %	Neck, %	Abdominal, %	Wing, %
T1 (control)	33.69±1.32	26.81±1.09	18.34±0.84	$6.29{\pm}0.23^{ab}$	4.95±0.31	$10.44{\pm}0.55^{b}$
T2	34.30±0.42	27.07±0.98	17.53±0.94	$6.26{\pm}0.05^{ab}$	4.71±0.35	$11.12{\pm}0.23^{b}$
T3	32.70±0.93	27.80±0.76	17.19±0.26	$6.50{\pm}0.31^{ab}$	5.16±0.33	$11.71{\pm}0.27^{ab}$
T4	34.61±0.30	27.09±0.55	17.69±0.32	$5.03{\pm}1.17^{b}$	5.26±0.26	$10.68{\pm}0.13^{b}$
T5	34.07±1.18	27.01±0.09	17.08±0.74	$6.45{\pm}0.12^{ab}$	5.29±0.22	$11.07{\pm}0.36^{b}$
T6	34.47±1.09	27.31±0.90	17.40±0.04	$7.50{\pm}0.78^{a}$	5.75±0.65	$12.77{\pm}0.85^{a}$
T7	36.52±0.70	25.72±0.48	16.85±0.38	$6.18{\pm}0.11^{ab}$	4.58±0.02	$10.80{\pm}0.15^{b}$
Average	36.61±0.36	27.29±0.25	17.47±0.21	6.32±0.23	5.11±0.13	11.24±0.21

Means with different letters significantly different at $p<0.05$ according to Duncan multiple range test. Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 9. Effect of Selenium and Vitamin E on Carcass Parts Percentages of Broiler at 49 Days of Age (Mean ± Standard Error)

Treatment	Breast, %	Thigh, %	Back, %	Neck, %	Abdominal, %	Wing, %
T1 (control)	36.81±0.79	25.50±0.47	17.40±0.08	5.43±0.38	5.08±0.23	9.78±0.38
T2	35.30±0.80	25.55±0.73	18.50±0.70	5.51±0.13	5.09±0.38	9.72±0.26
T3	37.01±1.04	25.15±0.75	18.10±0.22	5.20±0.11	4.49±0.18	10.11±0.07
T4	35.33±0.58	25.37±0.41	18.71±0.61	5.52±0.45	5.01±0.48	9.85±0.08
T5	38.21±1.59	24.60±0.83	18.30±0.77	5.17±0.19	4.50±0.29	9.61±0.09
T6	36.30±0.88	25.12±0.09	18.60±0.72	5.20±0.32	4.53±0.09	10.11±0.25
T7	36.13±0.88	25.21±0.13	17.49±0.28	5.64±0.51	4.74±0.14	10.36±0.50
Average	36.54±0.39	25.31±0.18	18.20±0.21	5.52±0.11	4.83±0.10	9.97±0.10

Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 10 shows the effect of selenium and vitamin E on PCV of chicks at 42 and 49 days of age. PCV was significantly (P<0.05) differences in selenium + vitamin E treated groups compared with the control group at 42 and 49 day of age. The higher value of PCV at 42 and 49 day was 33.16 and 33.83 (%) respectively of chicks in T7. This is may be due to the effect of selenium and vitamin E on physiological parameter which increase immune system then increase PCV concentration therefore selenium and vitamin E represent an essential role in improved performance or greater safety (El-Sheikh et al., 2006). The protective effect of vitamin E against the alterations induced by salinomycin on blood picture (PCV) could be attributed to the role of vitamin E as fat soluble antioxidant which protects the biological membranes from oxidative damage and decrease osmotic fragility of erythrocytes (Dlouha et al., 2008). This result was in agreement with the findings of (El-Sheikh et al., 2006); Shlig, 2009) where the significant differences of selenium and vitamin E on PCV may be due to the role of selenium and vitamin E as antioxidant or may be due to selenium and vitamin E improved physiological traits.

Table 10 show the effect of selenium and vitamin E on Hemoglobin (Hb) % of chicks at 42 and 49 days of age. Hemoglobin was significantly (P<0.05) differences in selenium treated groups compared with the control group at 42 day. There were significant differences at 49 day of age. The highest value of Hb at 42 and 49 day was (10.69 and 10.91, %) chicks in T7. This result was in agreement with finding of (El-Sheikh et al., 2006) and it in contrast with Swain et al. (2000). From the result, it is clear that the significant differences of selenium and vitamin E on Hb percent was may be due to the positive affect for the role selenium and vitamin E on the hematological parameter which improved blood parameters or increase PCV will increase Hb count.

Tables 11 and 12 refer to the effect of selenium and vitamin E on WBC at 42 day and 49 day of age. The results refer that there were no significant differences on monophile, esonophile, basophile percentages at 42 day. While there were significant differences (p<0.05) on lymphocytes, heterophile percentages and H/L ratio between treatment group. This result was in agreement with finding of Shlig (2009). The improved growth rate of broilers fed an organic Se supplemented diet could be related to the increased concentrations of the active form of thyroid hormone in the serum of chickens supplemented with organic Se as well as to the immunomodulating properties of selenium (Surai, 2006).

Table 13 refers to the effect of selenium and vitamin E levels on chemical composition (protein percentages, fat and ash) of breast meat of chicks at 42 and 49 days of age. The results showed significant differences (p<0.05) for fat and protein percentage. These results were in agreement with the findings of (Tatli Seven and Seven, 2009) this may be was due the higher intake of energy tended to increase total body protein deposition rate. Gatlin (2002) reported that neither ambient temperature nor diet showed a significant effect on the digestibility coefficients of the ether extract, and this is in agreement with our data.

CONCLUSIONS

The use of selenium and vitamin E leads to significantly increase LBW and BWG in different levels, the supplementation of (0.45 mg Se +100 mg vitamin E) was the best treatment among other treatments. The FI and FCR were better with use of selenium and vitamin E at 6 weeks of age. The use of selenium and vitamin E decreased significantly the mortality in different levels and led to improve the PI numerically. The selenium and vitamin E significantly increased the carcass weight, dressing percentage and carcass parts percentages at (6 weeks of age). The chemical composition in breast meat such as protein percentage increased at (0.45 mg Se + 150 mg vitamin E). Selenium and vitamin E at level (0.45 mg Se + 100 mg vitamin E) leads to improve the immunity in broiler by increasing of lymphocytes and H/L ratio at 6 weeks of age.

Table 10. Effect of Selenium and Vitamin E on PCV and Hb of Broiler at 42 Days and 49 Days of Age (Mean ± Standard Error

Treatment	PCV at 42 days	PCV at 49 days	Hb at 42 days	Hb at 49 days
T1 (control)	29.50 ±0.28^{c}	30.33±0.76^{b}	9.51 ±0.09^{c}	9.78±0.14^{b}
T2	30.00±0.50b^{c}	29.66±0.76^{b}	9.67±0.09b^{c}	9.56±0.14^{b}
T3	30.50±1.50b^{c}	30.33±0.57^{b}	9.83±0.27^{bc}	9.78±0.10^{b}
T4	32.00±1.00^{ab}	29.50±0.50^{b}	10.32±0.18^{ab}	9.51±0.09^{b}
T5	30.16±2.02^{bc}	30.83±1.25^{b}	9.73±0.37^{bc}	9.94±0.23^{b}
T6	30.83±0.76^{bc}	31.00±1.80^{b}	9.94±0.14^{bc}	10.00±0.33^{b}
T7	33.16±0.76^{a}	33.83±1.60^{a}	10.69±0.14^{a}	10.91±0.29^{a}
Average	30.88±1.54	30.78±1.67	9.96±0.10	9.93±0.11

Means with different letters significantly different at p<0.05 according to Duncan multiple range test. Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 11. Effect of Selenium and Vitamin E on WBC Count of Broiler at 42 Days of Age (Mean ± Standard Error)

Treatment	Lymphocytes, %	Heterophile %	Monophile, %	Esonophile, %	Basophile, %	H/L ratio
T1 (control)	49.00±6.25^{a}	48.50±6.50^{b}	0.83±0.16	0.83±0.33	0.83±0.16	1.05±0.11^{b}
T2	41.83±1.96^{ab}	56.16±1.92^{ab}	1.00±0.28	0.83±0.60	0.16±0.16	1.35±0.08^{ab}
T3	43.00±2.29^{ab}	54.16±2.16^{ab}	0.83±0.60	1.16±.0.16	0.66±0.16	1.27±0.01^{ab}
T4	40.50±1.73^{ab}	57.33±1.87^{ab}	0.66±0.16	1.00±0.28	0.50±0.28	1.42±0.08^{ab}
T5	40.83±3.01^{ab}	56.16±3.08^{ab}	1.16±0.16	1.33±0.16	0.50±0.28	1.40±0.05^{ab}
T6	36.83±1.20^{b}	60.50±1.32^{a}	0.83±0.16	1.00±0.28	0.83±0.16	1.64±0.01^{a}
T7	46.33±2.45^{ab}	51.50±2.56^{ab}	1.00±0.28	0.50 ±0.28	0.50±0.00	1.12±0.08^{b}
Average	42.61±1.28	54.90±1.30	0.90±0.10	0.95±0.13	0.57±0.07	1.32±0.10

Means with different letters significantly different at p<0.05 according to Duncan multiple range test. Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 12. Effect of Selenium and Vitamin E on WBC Count of Broiler at 49 Days of Age (Mean ± Standard Error)

Treatment	Lymphocytes, %	Heterophils, %	Monophile, %	Esonophile, %	Basophile, %	H/L ratio
T1 (control)	43.66±2.66	50.33±2.31^{ab}	1.83±0.60^{b}	0.83±0.16	1.66±0.44	1.16±0.11
T2	42.83±1.09	48.66±2.33^{b}	3.50±0.57^{a}	1.16±0.44	2.66±0.44	1.14±0.08
T3	41.33±0.44	51.50±0.76^{ab}	2.83±0.16^{ab}	1.00±0.28	3.33±1.33	1.24±0.01
T4	39.66±2.08	53.83±0.44^{a}	2.33±0.16^{ab}	0.83±0.33	1.66±0.44	1.36±0.08
T5	41.33±1.16	51.00±1.00^{ab}	3.50±0.28^{a}	1.50±0.28	2.33±0.33	1.23±0.05
T6	39.66±0.33	54.00±0.86^{a}	3.00±0.28^{ab}	1.33±0.72	2.16±0.44	1.36±0.01
T7	43.66±2.07	51.00±1.52^{ab}	1.83±0.16^{b}	1.00 ±0.28	1.66±0.33	1.17±0.08
Average	41.73±0.62	51.47±0.61	2.69±0.18	1.09±0.13	2.21±0.23	1.24±0.10

Means with different letters significantly different at p<0.05 according to Duncan multiple range test. Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

Table 13. Effect of Selenium and Vitamin E on Chemical Composition in Breast Muscle (Fat, Ash, and Protein) of Broiler at 42 and 49 Days of Age (Mean ± Standard Error)

Treatment	At 42 days			At 49 days		
	Fat, %	Ash, %	Protein, %	Fat, %	Ash, %	Protein, %
T1 (control)	2.15 ± 0.07 ^{c}	1.40 ± 0.31	22.18 ± 0.01^{c}	2.35 ± 0.02 ^{b}	2.12 ± 0.321	22.32 ± 0.01^{e}
T2	2.43 ± 0.17 ^{be}	1.85 ± 0.31	22.26 ± 0.02 ^{bc}	2.84 ± 0.01^{ab}	2.07 ± 0.46	22.34 ± 0.02^{e}
T3	2.43 ± 0.22 ^{bc}	2.00 ± 0.15	22.29 ± 0.01^{bc}	2.36 ± 0.17 ^{b}	2.30 ± 0.33	22.34 ± 0.01^{e}
T4	2.70 ± 0.06 ^{ab}	1.90 ± 0.27	22.54 ± 0.23 ^{b}	2.87 ± 0.03^{ab}	2.65 ± 0.30	22.51 ± 0.01^{d}
T5	2.28 ± 0.04 ^{c}	1.72 ± 0.32	22.40 ± 0.01^{bc}	2.35 ± 0.04 ^{b}	2.41 ± 0.28	22.63 ± 0.01^{c}
T6	2.81 ± 0.04 ^{a}	1.85 ± 0.20	23.25 ± 0.12 ^{a}	3.20 ± 0.31 ^{a}	2.03 ± 0.42	23.61 ± 0.01^{b}
T7	2.86 ± 0.01^{a}	1.89 ± 0.27	23.44 ± 0.02 ^{a}	3.17 ± 0.35 ^{a}	2.91 ± 0.04	23.82 ± 0.02^{a}
Average	2.52 ± 0.06	1.80 ± 0.09	22.62 ± 0.11	2.73 ± 0.09	2.35± 0.12	22.80 ± 0.13

Means with different letters significantly different at p<0.05 according to Duncan multiple range test. Treatment: T1 (control)= no supplemented Se + vitamin E; T2= 0.15 mg Se + 100 IU or mg/kg feed; T3= 0.3 mg Se + 100 mg vitamin E; T4= 0.15 mg Se + 150 mg vitamin E; T5= 0.3 mg Se + 150 mg vitamin E; T6= 0.45 mg Se + 100 mg vitamin E; T7= 0.45 mg Se + 150 mg vitamin E.

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