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THE EFFECTIVE ROLE OF SELENIUM AND ZINC ON BROILERS PERFORMANCE

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SUMMARY

Ninety unsexed one day old Cobb 500 broiler chicks were used in this experiment. The experiment aimed to study the comparative effect of some feed additives as growth promoters such as selenium and zinc in their inorganic form on broiler growth rate, feed intake, feed efficiency, some blood metabolites and carcass traits by adding them in the drinking water. The chicks were randomly distributed into three equal treatments. Each treatment had 30 chicks divided equally into five replicates. The experimental treatments were: The first treatment was served as a control (T1), while the second (T2) was given 0.8 mg sodium selenite / L of drinking water and the third treatment (T3) was given 1 g zinc oxide/ L. Sodium selenite (T2) showed the heaviest body weight ($P<0.01$), gained more weight consumed more feed and recorded the best value of feed efficiency ratio ($P<0.001$) compared to the other treatments. There were non-significant differences between control and zinc treatments in body weight and gain and feed efficiency ratio. There was a significant reduction in feed intake from 21 to 35 days of age and from 1 to 35 days of age for zinc treatment compared to the other treatments and significant increase from 1 to 21 days of age for the same treatment. A significant increase in triiodothyronine (T_3) ($P<0.01$) was observed in selenium and zinc treatments (T2 and T3 respectively) compared to the control treatment. About plasma urea, creatinine, ALT and AST, total lipid, cholesterol, triglycerides, total protein, albumin, globulin and their ratio (A/G ratio) and carcass traits, there were nonsignificant ($P>0.05$) differences among the experimental treatments. Zinc treatment (T3) recorded the lowest percent (3.85%) of mortality. It was concluded that supplementation of selenium in broiler drinking water improved broiler performance and zinc addition did not have adverse effects on growth rate and the functions of blood.

Keywords: *Broiler, selenium, zinc, and drinking water.*

INTRODUCTION

There is growing concern about the way to increase the effectiveness and the bioavailability of trace minerals such as selenium and zinc in their inorganic form on the growth and productive performance of broiler. On the other hand, the recommended doses of trace minerals used in broiler nutrition are taken from the National Research Council documents (NRC, 1994) which are based on the results of old researches. So that, the amounts of trace elements which always add in poultry diets to completely meet their needs are not exactly known. Huang *et al*. (2007) recommended that Zn requirement for the broilers from hatch to 21 d of age is 84 mg/kg diet, twice the recommended value (40 mg/kg diet) of NRC (1994) to meet all the metabolic needs. Therefore, the Ross 308 (2009) management guide established broiler zinc requirements during the grower period is 120 mg Zn/kg diet. Selenium and zinc requirements for broilers are 0.15 and 40 mg/kg diet respectively according to NRC (1994). The absorption of minerals and their bioavailability is affected by the form which are ingested and principles of biochemistry show that minerals in a liquid medium can be expected to be more absorbed and efficient due to their smaller size and larger surface area and the solubility of a mineral has been shown to enhance its bioavailability (Schlussel, 2006), so that, minerals in solid forms must be dissolute prior to being available for absorption by poultry. Selenium and zinc are types of trace elements that have a vital role in various metabolic reactions that resulted in better growth rate and feed efficiency. Selenium is required as a component of antioxidant enzymes such as glutathione peroxidase which destroy free radicals produced during the metabolic activity (Rotruck *et al*., 1973). It also acts as an immuno-stimulating substance to increase the ability of the immune system to resist diseases. Therefore, selenium is important for digestive enzymes secretion and thereby improving nutrient digestibility and performance (Macpherson, 1994; Combs and Combs, 1986). Zinc has a catalytic role in over 200-300 enzymes, it increases the synthesis of metallo-thionein, a cystine-rich protein that acts as a free radical scavenger (Oteiza *et al*., 1996) so that, It acts as antioxidant substance. Zinc also has an important role in the immune system.

Based on these researches, the objective of this study is to compare the effectiveness of inorganic selenium and zinc on improving the performance of broiler by adding them in drinking water.

MATERIALS AND METHODS

The present study was carried out at South Sinai Experimental Research Station (Ras-Suder City) which belongs to the Desert Research Center. The experiment aimed to study the comparative effect of some feed additives as growth promoters such as selenium and zinc in their inorganic form on broiler growth rate, feed intake, feed efficiency, some blood metabolites and carcass traits by adding them in the drinking water.

The selected source of selenium was a solution contains 80 mg sodium selenite (Na_2-SeO_3) and 5.486 gm vitamin E (Alpha - tocopherol acetate). The dosage used was 10 ml from the solution / liter of drinking water which provides 0.8 mg sodium selenite / liter of drinking water. About zinc oxide, the dose was 1 g powder / liter of water. Selenium and zinc were added per liter of drinking water with every new addition of water.

Ninety unsexed one day old Cobb 500 chicks purchased from a commercial hatchery and were randomly distributed into three treatments with five replicates per each treatment (six chicks for per replicate). All chicks were vaccinated. Light was constant for 24 hours daily throughout the first experimental week then 23 hours after that week. . Feed and water were offered *ad libitum*. Chick's body weight and feed intake were weekly recorded and feed efficiency ratio (g feed/g gain) was calculated per each pen. The mortality rate was recorded during the whole period of the experiment. The experimental birds were housed in ventilated open house into vertical batteries (160 cm length x 200 height x 160 width) contain three rows in each side, each row contains two cages (100 cm length x 40 height).

Three experimental diets were used and formulated based on the NRC (1994) for starter, grower and finisher periods (Table 1). The experimental treatments were control (T1), 0.8 mg sodium selenite / liter of drinking water (T2) and 1 g zinc oxide/ liter of water (T3). Vitamins and minerals mixture were added in the diet according to the requirements by NRC (1994). By calculation each kilogram of the experimental diets contained 0.13, 0.10 and 0.08 mg inorganic selenium and 26.12, 25.39 and 24.45 mg inorganic zinc for starter, grower and finisher diets respectively.. Water consumption for all treatments was recorded during different periods (Table 3).

At the end of the experiment at 5-weeks of age, four chicks were taken at random from each treatment and sacrificed by cervical dislocation, while blood samples were immediately taken, centrifuged at 3000 rpm for 20 minutes, and then plasma stored at -20ºC for later analysis. Blood metabolites were total lipid, cholesterol and triglycerides, total protein, albumin and globulin was calculated by subtract albumin from total protein, plasma urea, creatinine, alanine transaminase (ALT), aspartic transaminase (AST) and triiodothyronine (T_3)**.** All samples were determined calorimetrically by using commercial kits (By Bio Systems S.A. Costa Brava 30, Barcelona (Spain, Barcelona)). Thyroid hormone (Triiodothronine) was measured by ELISA method using IMMUNOSPEC kits supplied by (Immunospec Corporation, 7018 Owensmounth Ave. Suite 103 Canoga Park, CA 91303, USA). Globulin and albumin / globulin ratio were calculated.

Data were analyzed by one way analysis of variance (Completely Randomized Design), according to the General Linear Models (GLM) procedures of SAS (2002). The difference among means was determined by Duncan's Multiple Range Test (Duncan, 1955). The data were analyzed by the following model:

$$Yij = \mu + T_i + e_ij,$$

where: μ = General mean. T_i = random effect of treatment (i = 1, 2 and 3). e_i = a random error.

Table (1): Composition and calculated analysis of the experimental diets.

Item	Starter diet (0-10 days)	Grower diet (11-21 days)	Finisher (21-35 days)
Ingredient:			
Yellow corn	59.70	61.54	65.20
Soybean meal 44%	27.33	27.46	25.30
Corn gluten meal 60%	7.60	4.50	3.00
Sunflower oil	1.50	2.80	3.30
Calcium carbonate	1.10	1.00	0.93
Di-calcium phosphate	1.80	1.69	1.47
L-Lysine	0.35	0.25	0.18
DL-Methionine	0.12	0.16	0.12
Salt	0.25	0.30	0.25
Vit.&Min. Premix*	0.25	0.30	0.25
Total	100.00	100.00	100
Crude protein %	21.81	20.10	18.53
Calculated composition:	3037	3111.8	3178.7
Calcium %	0.91	0.84	0.76
Available P %	0.45	0.43	0.38
L-Lysine %	1.32	1.20	1.06
DL-Methionine %	0.51	0.50	0.43
Selenium (mg)	0.13	0.10	0.08
Zinc (mg)	26.12	25.39	24.45

**Vitamins and minerals premix, each kg contains: Vit A 12000 IU, Vit D3 3000 IU, Vit E 12 mg, Vit K 1 mg, Vit B12 0.02 mg, Vit B1 1 mg, Vit B2 4 mg, Vit B6 1.5 mg, Nicotinic acid 20 mg, Folic acid 1 mg, Biotin 0.05 mg, Choline chloride 160 mg, Copper 3 mg, Iron 30 mg, Manganese 40 mg, Zinc 45 mg and Selenium 3 mg.*

RESULTS AND DISCUSSIONS

Live body weight and body weight gain:

The data of live body weight (g) showed that there was nonsignificant difference among treatments in the initial body weight. Broiler that drank water containing sodium selenite (T2) showed the heaviest (P<0.01) body weight at 21 and 35 days compared to the other treatments. This increase was 22.17 and 14.44% for treatment T2 at 21 and 35 days of age, respectively compared with (Table 2).

Body weight gain (g/bird/period) had the same trend with live body weight. The treatment of broiler that received sodium selenite (T2) in the drinking water gained (P≤0.01) more weight than the other treatments during the first three weeks of age and the entire period of the experiments (1-35 days of age) with an increase equal 24.18 and 14.87%, respectively than T1. Although, there was a numerical improvement in body weight gain for the experimental group that drank water containing sodium selenite (T2) during the last two weeks of age (21-35 days of age) but this improvement was non-significant . This improvement was 10.47 and 15.2%%, respectively than T1 and T3. The significant increase of body weight and gain in sodium selenite group (T2) may be due to the ability of sodium selenite to dissolve well in water and its amount was enough to improve the performance of birds. Selenium may affect metabolism and performance because it is essential for the synthesis of active thyroid hormones. Thyroid hormones increased metabolic rate (Hadley, 1984).

Shlig (2009) indicated that the improvement in the live body weight of birds fed 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 oxidized substances as carotenoids and vitamin A. Selenium may affect metabolism and performance because it is essential for the synthesis of active thyroid hormones. Thyroid hormones increased metabolic rate (Hadley, 1984) and improved the digestibility coefficients of nutrients and nutritive values (Abd El- Galil *et al*., 2007).

There were non-significant differences between zinc oxide (T3) and control treatment (T1).

Table (2): Growth performance of Cobb broilers as affected by adding Se and Zn in drinking water.

	Treatment				
	Control	Se	Zn		
Item	T1	T2	T3	SE (±)	Significant
Body weight (g)					
Initial	46.10	46.19	46.20	0.06	NS
At 21 days	553.80^{b}	676.60^{a}	579.40^{b}	23.44	**
At 35 days	1629.00^{b}	1864.20^{a}	1610.80^{b}	39.57	**
Body gain (bird/g/period)					
1-21 days	507.80^{b}	630.60^{a}	533.40^{b}	23.44	**
21-35 days	1075.00^{ab}	1187.60^{a}	1031.00^{b}	48.41	NS
1-35 days	1582.60^{b}	1818.00^{a}	1564.40^{b}	39.58	**
Feed intake (bird/g/period)					
1-21 days	984.00^{b}	885.00^{c}	1012.00^{a}	7.77	***
21-35 days	2708.00^{b}	3050.00^{a}	2480.00^{c}	53.80	***
1-35 days	3694.00^{b}	3936.20^{a}	3496.00c	61.35	***
Feed efficiency ratio (feed/gain)					
1-21 days	1.95^{a}	1.42^{b}	1.91^{a}	0.09	***
21-35 days	2.53	2.59	2.41	0.09	NS
1-35 days	2.34	2.17	2.23	0.05	NS

a,b,c : Means within the same row showing different letters are significantly different.
*** = (P<0.01* *** = (P<0.001)* NS = *not significant.*

Feed intake and feed efficiency ratio:

The results of feed intake demonstrated that the treatment of broilers received water containing sodium selenite (T2) consumed (P<0.001) more feed than the other groups during the last two weeks (21-35 days of age) and the whole experimental period (1-35 days of age). This increase was 12.6 and 6.56% for the two periods respectively. Furthermore, this treatment (T2) consumed less (P<0.001) feed than the other treatments during the first three weeks of age (1-21 days of age) (Table 2). There was a significant (P<0.001) reduction in feed intake from 21 to 35 days of age and from 1 to 35 days of age in zinc treatment compared with the other treatments and significant (P<0.001) increase from 1 to 21 days of age for the same treatment. Regarding feed efficiency ratio, the best ratio was noticed for the treatment T2 during the periods from 1 to 21 days of age (1.42) and from 1 to 35 days of age (2.17) compared to the other treatments, while there was non-significant (P>0.05) variation among treatments during the period from 21 to 35 days of age.

Our results are in agreement with Upton *et al*. (2008) and El-Sheikh *et al*. (2010) who reported that live body weight of broiler chicks were significantly (P<0.05) increased in selenium (Sel-Plex™) treatment compared to the control treatment. Therefore, the body weight and feed efficiency were better in the treatment supplemented with excess of selenium and vitamin E in the diet than the control treatment (Bobade *et al*., 2009). Many studies have reported beneficial influences of selenium supplementation on feed intake, body weight, weight gain and the prevention of selenium deficiency symptoms and mortality in poultry (Christine *et al*., 2002, Choct *et a*l., 2004 and Ibrahim *et al*., 2011). On the contrary, Dalia *et al*. (2017) demonstrated that supplementation of inorganic selenium did not change body weight, weight gain, feed intake and feed efficiency ratio. Moreover, Chen *et al*. (2013) investigated the effect of different levels of organic selenium (0.3, 0.5,1 and 2 mg/kg diet) on growth performance and mortality rate and found that there were non-significant differences among treatments until 2mg/kg diet. Likewise, selenium supplementation until 0.3 mg/ kg diet did not influence the growth performance of broilers (Yoon *et al*., 2007). Using different combination levels of selenium and vitamin E in broiler chick's diet didn't result in any significant differences in feed intake and feed efficiency ratio among all treatments and control (Tayeb and Qader, 2012).

Regarding zinc oxide, the current results agree with those of Kim and Patterson (2004) who investigated that zinc oxide treatments (0.5, 1 and 1.5 gm) had no negative effects on growth performance and there were no significant differences in weight gain compared to the control treatment. Therefore, Collins and Moran (1999) reported that body weight and feed efficiency were not influenced by feeding excessive levels of supplemented Zn. The significant reduction in feed intake of chicks fed soluble form of Zn at concentrations above 600 mg/kg in diets has been reported by Henry *et al*. (1987) and Sandoval *et al*. (1998). On the contrary, Dönmez *et al*. (2001) showed that body weight gain was significantly lower and feed efficiency was significantly higher in chicks supplemented with excess amounts of zinc (500 or 1000 mg Zn as $ZnSO_4$/L of drinking water) compared to chicks supplemented with control treatment or 125 mg Zn / L of drinking water at the end of the experiment. Likewise, Sarvari *et al*. (2015) represented that birds fed the diets containing 0.01% ZnO presented higher weight gain than those fed the diets with no ZnO ($P<0.01$).. In our study, there was no difference in body weight gain and feed efficiency ratio between birds received 1000 mg ZnO/L of drinking water and control group. These differences among researches could be due to differences in period of time for exposure to Zn and Zn source.

Water consumption:

The results of water consumption are represented in Table (3). Treating birds with sodium selenite led to an increase in water consumption. This increase was 50.49, 15.63 and 29.28% during the first three weeks (1-21 days), the last two weeks (21-35 days) and whole period (1-35 days) of experiment respectively. About zinc oxide treatment (T3), the birds consumed more water than the control treatment during the last two weeks of age (21-35 days) and all period of experiment (1-35 days). This increase was 20.31 and 11.41% respectively. This result may be due to addition of selenium and zinc in broiler drinking water improved water taste compared to control treatment. Broiler has a keen sense of taste and prefers water that is slightly acidic (Kare, 1970).

Table (3): Water consumption of Cobb broilers as affected by adding Se and Zn in drinking water.

	Treatment		
	Control	Se	Zn
Item	T1	T2	T3
Water consumption (L)			
1-21 days	206	310	179
21-35 days	320	370	385
1-35 days	526	680	586

Blood biochemical profiles:

Data of plasma total protein, albumin, globulin, albumin/globulin ratio, total lipid, cholesterol, triglycerides, T_3, urea, creatinine, ALT and AST is shown in Table (4). The current results demonstrated that there were non-significant ($P>0.05$) differences among treatments for plasma total protein, albumin, globulin and their ratio (A/G ratio). These results are in agreement with those obtained by Sarvari *et al*. (2015) who reported that the effects of dietary zinc oxide on total protein and albumen were non-significant. Likewise, Barman *et al*. (2009) did not report any significant effect of different dietary zinc supplementation level on serum protein. On contrary, Bahakaim *et al*. (2014) reported that those of organic zinc supplementation significantly increased plasma total protein, albumin, and globulin and improved A/G ratio in laying hens compared to the control treatment. In the same way, Refaie (2009) found that the group of chicks fed diets supplemented with organic zinc (Biozink) at either 120 mg, 80 mg or 40 mg Zn/kg diet recorded the highest total protein, globulin and significantly differed compared to all other groups which fed the control or 40, 80, and 120 mg supplemental Zn as zinc oxide.

Regarding selenium addition, the results agree with Yang *et al*. (2012) and Dalia *et al*. (2017) who demonstrated that supplementation of inorganic or bacterial organic selenium did not affect total protein, albumin, globulin, albumin/globulin ratio in broiler chicks. Contrary to our findings, Mohapatra *et al*. (2014) stated that supplementation of 0.3 ppm nano Se in layer chicks up to 8 weeks significantly increased total protein and serum globulin levels and also significantly lowered albumin/globulin ratio compared to control treatment.

Table (4): Blood biochemical profiles of Cobb broilers as affected by adding Se and Zn in drinking water.

	Treatment				
	Control	Se	Zn		
Item	T1	T2	T3	SE (±)	Significant
Total protein (mg/dl)	4.1	3.85	3.64	0.39	NS
Albumin (mg/dl)	2.48	2.52	2.48	0.08	NS
Globulin (mg/dl)	1.62	1.33	1.17	0.33	NS
A/G ratio	1.83	2.27	2.2	0.40	NS
Total lipid (mg/dl)	413.30	424.55	374.30	18.83	NS
Colesterol (mg/dl)	141.4	136.15	140.65	8.11	NS
Triglycerides (mg/dl)	174.3	211.55	167.55	36.83	NS
T3 (nmol/l)	3.26^{c}	3.62^{ab}	3.80^{a}	0.11	*
Urea (g/dl)	12.25	12.75	12.5	1.53	NS
Createnine (mg/dl)	1.58	1.80	1.72	0.08	NS
ALT (g/dl)	166.45	187.2	173.2	20.40	NS
AST (g/dl)	21.28	20.65	16.93	6.89	NS

a,b,c: Means within the same row showing different letters are significantly different.
** = (P<0.05)* *** = (P<0.01)* NS = *not significant.*

There were not significant differences among treatments for plasma total lipid, cholesterol and triglycerides. There was a numerical decrease in plasma cholesterol for selenium (T2) treatment compared to the control treatment and zinc treatment (T3). About plasma total lipid and triglycerides, there was a numerical decrease for zinc oxide treatment (T3). These results are in agreement with, Sarvari *et al*. (2015) who reported that the effects of dietary zinc oxide on plasma cholesterol and triglycerides were non-significant. On contrary, Ahmadi *et al*. (2013) represented that zinc oxide nanoparticles had resulted in low triglycerides and total cholesterol. Likewise, Kucuk *et al*. (2003) concluded that supplementing Zn to broiler diets decreased blood cholesterol.

Selenium results disagree with Fawzy *et al*. (2016) who showed that sodium selenite caused a decrease in serum cholesterol and triglycerides of broiler.

Our results of plasma T_3, urea, creatinine, ALT and AST showed a significant (P<0.05) increase in triiodothyronine (T_3) (P<0.01) for selenium and zinc treatments (T2 and T3 respectively) compared to the control treatment while, there were non-significant differences among the experimental treatments for plasma urea, creatinine, alanine transaminase (ALT) and aspartic transaminase (AST).

The high level of plasma thyroid hormone (T_3) for selenium and zinc treatments (T2 and T3, respectively) compared to the control treatment may be due to selenium is required for the expression of the selenoenzymes type I (ID-I) and type II (ID-II) iodothyronine deiodinase, which are necessary for the generation of the active hormone 3,3′,5-tri-iodiothyronine (T3). Type I iodothyronine deiodinase (ID-I) catalyzes the deiodination of thyroxin (T4) to 3, 3’5-tri-iodothyronine (T3). Therefore, there is a close relationship between zinc concentration and thyroid hormone level in body (Fujimoto et al., 1986). The later authors added that triiodothyronine (T_3) level decreased significantly in zinc-deficient rats. The enzymes which play an important role on the deiodenation of thyroxine (T_4) to Triiodothyronine (T_3) need selenium and zinc to function (Nishiyama *et al*., 1994).

The results of triiodothyronine (T_3) agree with Srimongkol (2003), Upton et al. (2008) and El-Sheikh *et al*. (2010) who indicated that triiodothyronine (T_3) hormone was significantly (P<0.05) increased in broiler fed selenium supplementation compared to those fed a basal diet. On contrary, Pappas *et al*. (2017) concluded that supplementation with selenium alone or in combination with vitamin E in broiler diets above their requirements did not affect thyroid hormone metabolism. Therefore, Dönmez *et al*. (2001) reported that serum triiodothyronine level was significantly reduced with high zinc levels (500 and 1000 mg Zn as $ZnSO_4$/ L of drinking water) of zinc intake. The difference between our findings and other experiments may be due to the type of used selenium and zinc and their characteristics, the time of the experiment and age of broiler.

Plasma urea and creatinine are commonly used as indicator of kidney function (Perrone *et al*., 1992) while ALT and AST are biochemical markers of liver function and health (Nyblom *et al*., 2004 and Che *et al*., 2011). An elevation in the levels of these parameters is considered to be a sensitive indication of liver injury while the reduction means increasing protection for the broiler health.

Regarding selenium supplementation, there were non-significant differences between selenium treatment and control for urea, creatinine, ALT and AST. These results agree with the results of Gružauskas *et al*. (2013), Okunlola *et al*. (2015) and Dalia *et al*. (2017) who indicated that there were no differences in urea and creatinine in poultry supplemented with organic or inorganic selenium. At the opposite way, Perić *et al*. (2009), Biswas *et al*. (2011) and Dalia *et al*. (2017) showed that Se supplementation as inorganic or organic forms significantly decreased ($P < 0.05$) the activities of AST , ALT enzymes and creatinine level in birds fed selenium compared to basal diet.

Carcass traits:

The effect of the experimental treatments on the carcass weight (g) and relative value of carcass, empty carcass, head, legs, liver, heart, gizzard, bursa, spleen, pancreas, gastrointestinal tract weight, intestine weight and intestine long as percent (%) of live body weight is shown in Table (5). All treatments had no significant effect on carcass traits. These results are in agreement with those of Payne and Southern (2005) who reported that carcass traits were not affected ($P>0.05$) by selenium source or level of supplementation. Likewise, Tayeb and Qader (2012) showed that selenium and vitamin E had no significant effect on carcass weight, carcass parts and dressing percentage at 42 and 49 days of age.

Table (5): Carcass traits of Cobb broilers as affected by adding Se and Zn in drinking water.

	Treatment				
	Control	Se	Zn		
Item	T1	T2	T3	SE (±)	Significant
Final live weight (g)	1616.7	2023.3	1811.7	109.10	NS
Carcass weight (%)	96.89	95.95	97.72	0.76	NS
Empty carcass weight (%)	87.15	88.75	89.59	1.18	NS
Head weight (%)	2.26	2.15	2.30	0.15	NS
Leg weight (%)	4.43	3.41	4.12	0.69	NS
Liver weight (%)	2.53	3.21	2.58	0.26	NS
Heart weight (%)	0.67	0.65	0.59	0.06	NS
Gizzard weight (%)	3.41	3.11	2.91	0.29	NS
Bursa weight (%)	0.12	0.14	0.10	0.03	NS
Spleen weight (%)	0.19	0.17	0.11	0.04	NS
Pancreas weight (%)	0.28	0.32	0.31	0.04	NS
Gastrointestinal tract weight (%)	10.92	10.98	10.23	0.69	NS
Intestinal weight (%)	6.28	7.91	2.51	1.52	NS
Intestinal long (%)	11.50	11.06	10.45	0.63	NS

Ns = not significant.

As well, our carcass traits findings are consistent with Liu *et al*. (2011), Sarvari *et al*. (2015) and Zakaria *et al*. (2017) who showed that carcass traits were not affected by Zn source or the interaction between Zn source and supplemental Zn level or the high Zn concentration. On contrast, Jahanian *et al*. (2008) reported that increasing Zn supplemental levels from 40 to 80 mg/kg from both inorganic and organic zinc sources increased liver weight percentage.

The final results of each experiment are affected by many factors such as the source and the concentration of minerals, the administration methods for broiler, the environmental conditions of each experiment and age of broiler.

Mortality rate:

The results of the mortality rate were represented in Figure (1). The data of the mortality rate during the whole period of the experiment showed that zinc treatment (T3) recorded the lowest percent (3.85%) of mortality followed by selenium treatment (T2) (6.25%), while the control treatment recorded the highest percent of mortality rate (10.81%). These findings may be due to zinc and selenium act as antioxidant and immuno-stimulating substances which increase the ability of the immune system to resist diseases by improving immune response. Calnago *et al*. (1984) and Madron and Vrzgulova (1988) reported that selenium supplementation enhanced the immune system in chicken and increased the natural resistant of broiler by increasing their response to antigenic stimuli. Our data are on contrary with Cantor *et al*. (1975 a,b), Edens *et al*. (2001) and Payne and Southern (2005) who reported that mortality was not affected by selenium source or level.

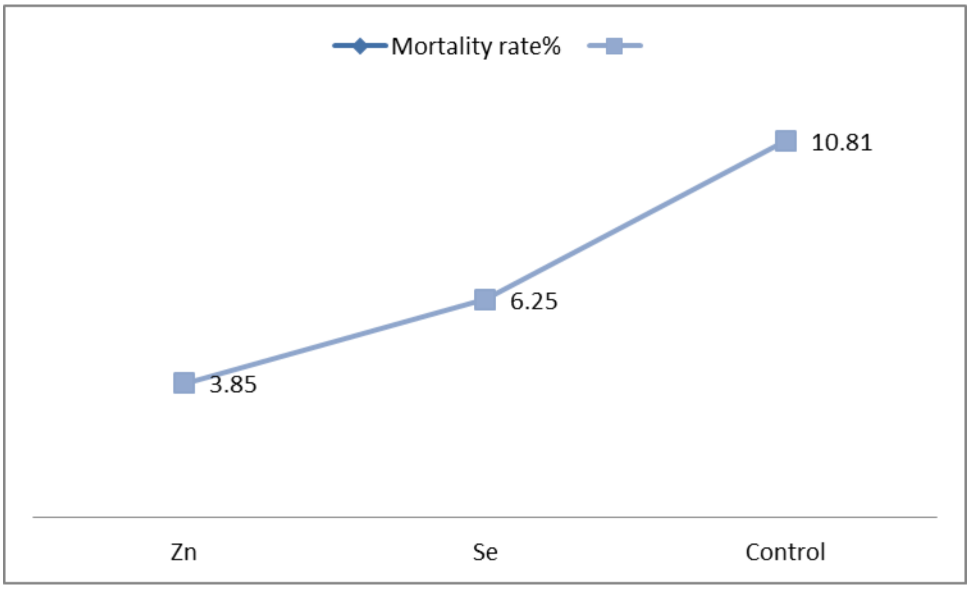

Figure (1): Mortality rate (%) of Cobb broilers as affected by adding Se and Zn in drinking water.

CONCLUSION

The results concluded that supplementation of sodium selenite (0.8 mg/liter) on broiler drinking water improved growth performance and zinc oxide (1000 mg/liter) did not have adverse effects on growth rate and the functions of blood.

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الدور المؤثر للسيلينيوم و الزنك على اداء بداري التسمين

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تم استخدام عدد تسعين كتكوت Cobb 500 عمر يوم غير مجنس فى هذة التجربة. يهدف هذا العمل الى زيادة المتاح و التاثير الايجابى لكل من السلينيوم و الزنك فى صورتهم غير العضوية على معدل النمو و الغذاء الماكول و كفائة الاستفادة من الغذاء و بعض مقاييس الدم و صفات الذبيحة عن طريق اضافتهم لماء الشرب. تم توزيع كتاكيت التسمين بالتساوى على ثلاث معاملات تجريبية, كل معاملة بها ثلاثين كتكوت مقسمة بالتساوى على خمس مكررات. المعاملات التجريبية هى معاملة المقارنة (T1) و 0.8 مجم سلينيت الصوديوم/لتر ماء شرب (T2) و 1جم اكسيد الزنك/لتر ماء (T3) . سجل اثقل وزن جسم و افضل زيادة وزنية مع معاملة سلينيت الصوديوم (T2) مقارنة بالمعاملات الاخرى. كذلك لوحظ ان افضل قيمة للغذاء الماكول و معدل التحويل الغذائى كانت لنفس المعاملة (T2) مقارنة بالمعاملات الاخرى. لم يوجد اى اختلافات معنوية بين معاملة المقارنة و معاملة الزنك (T3) و ذلك بالنسبة لوزن الجسم و الزيادة الوزنية و معامل التحويل الغذائى اما الغذاء الماكول سجل اقل قيمة لمعاملة الزنك مقارنة بالمعاملات الاخرى خلال الفترة من 21 الى 35 يوم من العمر و من 1 الى 35 يوم من العمر و اعلى قيمة من 1 الى 21 يوم من العمر. لوحظ وجود زيادة معنوية فى مستوى هرمون T_3 (الترای ایودوثریونین) بالنسبة لمعاملات السلينيوم و الزنك (T2 و T3 على التوالى) مقارنة بمعاملة المقارنة. بين المعاملات التجريبية. لم يوجد اى اختلافات معنوية بين المعاملات التجريبية بالنسبة لمستوى اليوريا و الكرياتينين و ALT و AST فى البلازما. لم يوجد اختلافات معنوية بين المعاملات التجريبية لمستوى الدهون الكلية الكوليسترول و التراى جلسريد فى البلازما و كذلك بالنسبة لمستوى البروتين الكلى و الالبيومين و الجلوبيولين و النسبة بينهما. كل المعاملات التجريبية لم يوجد لها اى تاثير معنوى على صفات الذبيحة. سجلت معاملة الزنك (T3) اقل نسبة لمعدل النفوق. نستنتج من هذة النتائج ان اضافة السلينيوم فى ماء الشرب حسن اداء نمو بدارى التسمين و اضافة الزنك لم يؤثر سلبيا على معدل النمو و بعض المقاييس الفسيولوجية. ولذا فان الدراسة توصى باستخدام مستويات اضافة اعلى لكل من السلينيوم و الزنك فى ماء شرب بدارى التسمين فى صورتهم الغير عضوية لتغطية باقى احتياجات الطائر للقيام بجميع العمليات الحيوية التى تحتاج لوجود السلينيوم او الزنك داخل الجسم و كذلك ضرورة اجراء بحوث مستقبلية لتغطية كل العوامل المؤثرة و العوامل التطبيقية.

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