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THE EFFECT OF ORGANIC SELENIUM SUPPLEMENTATION ON PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE IN A LOCAL STRAIN OF CHICKEN.

2- IMMUNE SYSTEM AND SOME PHYSIOLOGICAL ASPECTS IN BANDARAH CHICKS AFFECTED BY ORGANIC SELENIUM.

By

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Abstract: *The experiment was conducted to study productive, physiological and immunological parameters in Bandarah local chicks as affected by dietary organic selenium (Sel- Plex™). All chicks were used in the present work produced from females and males fed diets with 0.0, 0.1, 0.2 and 0.3 mg Se / kg diet in the form of selenium yeast (Sel-Plex™). Two hundred unsexed one- day old chicks (50 chicks per parental treatment group) of Bandarah chicks were placed in brooder at 4 pens and fed a basal diet supplemented with the same concentrations of organic selenium (Sel-Plex™) as the same of their parents until they were 12 weeks of age. The obtained results indicated that:*

1- Selenium supplementation especially at 0.2 and 0.3 mg/ kg diet diet significantly ($P \leq 0.05$) increased live body weight of Bandarah chicks during the experimental period. Also, live body weight of males was significantly ($P \leq 0.05$) heavier than females.

2- Blood hemoglobin (Hb), red blood cells (RBC`s), white blood cells (WBC`s), antibody responses against infectious bursal disease viruses (IBDV) and Triiodothyronine (T_3) were significantly ($P \leq 0.05$) increased in groups fed selenium (Sel-Plex™) compared with the control group. While, serum thyroxine (T_4) had not significantly influenced by selenium supplementation. All previous mentioned traits were not significantly affected by sex, except, WBC`s in females which was significantly higher than those for males. Serum total protein, globulin and glutathione peroxidase concentrations significantly increased for groups fed 0.2 and 0.3 selenium compared with the control group. While, no significant effects on

serum albumin concentrations was observed. Moreover, serum selenium concentrations significantly increased for all groups fed selenium (Sel-Plex™) compared with the control group. All previous mentioned traits were not significantly affected by sex, except, serum selenium concentration in females which was significantly higher than for males.

3- Relative weights of carcass and lymphoid organs (spleen, bursa of fabricius, and thymus gland) of Bandarah chicks were significantly increased by all concentrations of organic selenium (Sel-Plex™) supplementation compared with the control group. Previous mentioned traits were significantly higher in females than males except relative weight of carcass males.

INTRODUCTION

Selenium (Se) is an essential micronutrient required for normal growth and maintenance in poultry. The Se requirement for broilers throughout the growth period is 0.15 ppm **(NRC, 1994)**, and this requirement often can be met by natural feedstuffs in the diet. However, due to the considerable regional variation in Se content of natural feedstuffs, it is common practice in the United States to supplement broiler diets with Se. The maximum allowable level of Se supplementation is 0.30 ppm **(AAFCO, 2003)**. The Se supplement that primarily has been used in poultry diets is the inorganic form, sodium selenite. Recently however, there has been interest in the use of organic forms of Se, such as selenocysteine, selenomethionine (SM), or Se-enriched yeast (SY), as supplemental sources of Se **(Payne and Southern, 2005)**.

The developing embryo and the hatched chick are completely dependent for their growth and development on nutrients deposited in the egg. Consequently the physiological status of the chick at hatching is greatly influenced by the nutrition of the breeder hen which will influence chick size, vigor and the immune status of the chick **(Kenny and Kemp, 2005)**. **Cantor and Scott (1974)** indicated that increasing the selenium content of hatching eggs is beneficial as it raises the selenium status of embryos and chicks. **Pappas *et al.*, (2006)** stated that the chicks from parents fed the selenium supplemented diets were heavier at hatch than those fed the low selenium diets. The organic selenium compounds in Sel-Plex™ allow contributing to a selenium reserve to be available for prevention of lipid peroxidation (through Glutathione Peroxidase GSH-Px) during stress conditions **(Surai, 2002)**. Therefore, increased antioxidant uptake in the hen due to the maternal diet is linked to increased antioxidant concentrations in the developing chick **(Surai, 1999)**.

Marsh *et al.*, (1986); Hegazy and Adachi (2000) and Hussain *et al.*, (2004) 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. 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 (**Koller, 1982**).Selenium supplementation of animals in diets enhances the immune status and ability of the immune system to respond to disease challenges. The parental administration of selenium has been reported to enhance humeral immune response as described by **Droke and Loerch (1989). 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 animals by increasing response of the organism to antigenic stimuli. **Arshad *et al.*, (2005)** indicated that selenium supplementation may help to increase post vaccination humeral immune response against IBDV in broiler chicks. Thus, the objective of the present study was to know the effect of organic selenium (Sel- Plex™) supplementation on productive, physiological and immunological traits in Bandarah local chicks from one day of hatch to 12 weeks of age.

MATERIALS AND METHODS

The present investigation was conducted at El-Sabahia Poultry Research Station (Alexandria), Animal production Research Institute, Agricultural Research Center, Ministry of Agriculture. All chicks were used in the present work produced from females and males fed diet with 0.0, 0.1, 0.2 and 0.3 mg Se/ kg diet. Two hundred unsexed one- day old chicks (50 chicks per parental treatment group) of Bandarah local chickens were placed in brooder at 4 pens measuring 2.5 × 3.4 × 3.5 m. All groups of chicks were fed a basal diet (Table 1) supplemented with 0.0, 0.1, 0.2 or 0.3 mg Se / kg diet in the form of selenium yeast (Sel-Plex™) as the same feed of their parents until 12 weeks of age. Selenium yeast (Sel-Plex™ Alltech Inc.) contains 1000 ppm Se and produced by the fermentation of yeast (*Saccharomyces cerevisiae*) in a high Se medium. All chicks were wing banded and individually weighed. The temperature of brooding was nearly 32 °C which decreased gradually down to 27°C at the end of the 4th week of age, after that it was gradually decreased according to usual brooding practices. All birds received continuous light for the first 3 weeks after hatching then 18 hr till 12 weeks of age. Experimental diets and water were offered *ad libitum* during the experimental period. All chicks in each group

were individually weighed every 4 weeks and daily number of dead chicks in each group was recorded to calculate mortality rate during the experimental period.

All birds were immunized using killed infectious bursal disease viruses (IBDV) after 8 wk of treatment. Four weeks after vaccination (12 wks of age), blood samples were collected in nonheparinized tubes from 12 birds (6 females and 6 males) in each treatment from the brachial vein. Blood samples were centrifuged at 3000 rpm for 15 minutes to separate clear serum to determine antibody responses against IBDV by ELISA technique using commercial kits, total protein, albumin and Glutathione Peroxidase (GSHPx) concentrations by spectrophotometer using available commercial Kits produced by Sentinel, Italy. Also, globulin was calculated in serum of the same samples. Serum selenium concentrations were determined using atomic absorption spectrometry. Triiodothyronine (T_3) and thyroxine (T_4) were determined in serum by using radioimmunoassay Kit. At 12 wks of age, another blood samples were obtained also in heparinized tubes from the brachial vein of randomly twelve birds (6 females and 6 males) from each group to determine hemoglobin concentration (Hb), red blood cells (RBC's) and white blood cells (WBC's) count. At the end of the feeding experiment, 6 random birds from each of females and males in each group were slaughtered. The relative weights of carcass, spleen, bursa of fabricius and thymus gland were calculated as percentages of body weight.

Data were subjected to ANOVA using the SAS general linear model procedure (**SAS, 1996**). Significant differences between treatment mean values were compared using Duncan multiple rang test (**Duncan, 1955**).

RESULTS AND DISCUSSION

Live Body Weight

Regardless of sex, overall means of live body weight were significantly ($P \leq 0.05$) increased in Bandarah chicks fed selenium (Sel-Plex™) supplementation compared with the control group except low dose of selenium (0.1 mg) at 8 and 12 weeks of age (Table 2). Regardless of Sel-Plex™ supplementation, overall means of live body weight were significantly ($P \leq 0.05$) heavier in males compared to females. In accordance with these results, **Cantor *et al.*, (1982)** who reported that body weights were increased in turkey poults fed organic or inorganic selenium (0.04 to 0.12 ppm Se) compared with those fed a basal diet. **Upton *et al.*, (2008)** indicated that the body weight of broiler chickens at 42 days was increased

in Sel-Plex™ treatment groups as compared to those in the control group. Also, **Srimongkol (2003), El-Sheikh and Ahmed (2006) and Sevcikova *et al.*, (2006)** found that organic selenium supplemented in broiler chicken diets had better growth performance than inorganic selenium or the control group. Whereas, **Edens *et al.*, (2001)** reported that there were no differences in body weight when broiler chickens fed diets containing 0.2 ppm Se from selenium yeast or selenium selenite.

Also, table 2 shows that there were no significant differences in mortality rate between experimented groups throughout the experimental period. These results are in agreement with the findings of other authors **(Spears *et al.*, 2003; Payne and Southern, 2005; Ryu *et al.*, 2005)**.

Blood Parameters

Results presented in Table 3 showed that regardless of sex, overall means of blood Hb, RBC's, WBC's, antibody responses against IBDV and T_3 were significantly ($P \leq 0.05$) increased in all selenium treated groups compared with the control group. While addition of different concentrations of selenium had not any significant effect on serum T_4. Irrespective of Sel-Plex™ supplementation, overall means of all previous mentioned traits were not significantly ($P \leq 0.05$) affected by sex, except, WBC's in females which was significantly ($P \leq 0.05$) higher than those for males. Concerning the results of selenium addition, **Latshaw, (1991); El-Sebai, (2000) and Abaza, (2002)** found that the selenium singly or combining with vitamin E supplementation to the broiler chickens and Japanese quail diets caused a significant ($P<0.05$) rise in WBC's or RBC's counts. **Huang *et al.*, (1999)** found that selenium improved markedly hematological parameters. **Arshad *et al.*, (2005)** indicated that selenium supplementation helps to increase post vaccination humeral immune response against IBDV in broiler chickens. Also, **Blood *et al.*, (1995), Hegazy and Adachi (2000), Schrauzer (2000) and DengHua *et al.*, (2001)** who found an increase in humoral antibody titers when selenium was used in feed, the perceptible reason for enhanced antibody production is increase number of lymphocytes with increased selenium supplementation. Moreover, **Calnago *et al.*, (1984) and Madron and Vrzgulova (1988)** reported that selenium supplementation enhanced the immune system and increased the natural resistant of animals by increasing response of the organism to antigenic stimuli.

Our results on serum T_3 and T_4 concentrations could be related to the conversion of T_4 to T_3 was more efficient when organic selenium was supplemented. This observation suggested that the extra-thyroidal

conversion of T_4 to T_3 was mediated by the hepatic Se- dependent type I, 5'-iodothyronine deiodinase enzyme **(Edens, 2001)**. Similar results were found by **Upton *et al* ., (2008)** who reported that serum T_3 concentration was higher in broiler chickens supplemented with Sel-Plex™ compared to those in birds fed a basal diet. **Srimongkol (2003)** indicated that Se supplementation in broiler diets significantly ($P \leq 0.05$) increased T_3 levels than the control group.

Results presented in Table 4 showed that regardless of sex, overall means of serum total protein, globulin and glutathione peroxidase concentrations significantly ($P \leq 0.05$) increased for groups fed 0.2 and 0.3 selenium compared with the control group. While, selenium (Sel-Plex™) supplementation had no significant effect on serum albumin concentrations. Overall means of serum selenium concentrations significantly ($P \leq 0.05$) increased for groups fed Sel-Plex™ compared with the control group (Table 4). Irrespective of Sel-Plex™ supplementation, overall means of all previous mentioned traits were not significantly ($P \leq 0.05$) affected by sex, except, serum selenium concentration in females was significantly ($P \leq 0.05$) higher than males. Our results of serum total protein are supported with the finding of **Sunde (1997) and Kim and Mahan (2003)** who reported that selenomethionine could be incorporated into protein at a rate similar to methionine, because Se and sulphur have very similar atomic properties, therefore, selenium can absorb actively across the intestine by the same amino acid carrier.

Our results of serum Se concentration agree with those reported by **Cantor *et al.*, (1975[a,b], 1982); Echevarria *et al.*, (1988) and Spears *et al.*, (2003)** who found that Se supplementation increased plasma Se concentrations in turkey poults or broiler chickens. Moreover, **Payne and Southern (2005)** reported that plasma Se concentrations were significantly ($P \leq 0.05$) higher in broiler chickens fed organic selenium than birds given inorganic selenium. **Mahmoud and Edens (2003) and Srimongkol (2003)** indicated that selenium supplemented to broiler chicks had significantly ($P \leq 0.05$) higher blood glutathione peroxidase concentration than those in the control group.

Slaughter Traits

Results in Table 5 indicated that regardless of sex, overall means of carcass percentage was significantly ($P \leq 0.05$) increased in Bandarah chicks fed Sel-Plex™ compared with the control group. Irrespective of selenium (Sel-Plex™) supplementation, overall means of carcass percentage of males significantly ($P \leq 0.05$) higher than females. These results are in agreement

with those reported by **Upton *et al.*, (2008)** who indicated that the carcass percentage of broiler chickens was higher in Sel-Plex™ treated groups compared with the control group. Also, **Choct *et al.*, (2004)** found that broiler chickens receiving organic selenium in their diets had improved breast yield. While, **Payne and Southern (2005) and Sevcikova *et al.*, (2006)** reported that addition of organic or inorganic selenium in diets did not have a significant influence on dressed weight.

Overall means of relative weights of lymphoid organs (spleen, bursa of fabricius, and thymus gland) were significantly ($P \leq 0.05$) increased for groups fed selenium (Sel-Plex™) compared with the control group (Table 5). While, regardless of Sel-Plex™ supplementation, overall means of spleen, bursa of fabricius, and thymus gland percentage in females were significantly ($P \leq 0.05$) higher than those for males. These results are in harmony with those reported by **Hegazy and Adachi (2000) and Hussain *et al.*, (2004)** Also, **March *et al.*, (1986)** found that selenium deficiency had adverse effects on the development of lymphoid organs (especially spleen and thymus) and also resulted in impaired function of these organs. Moreover, **March *et al.*, (1987) and Chang *et al.*, (1990)** indicated that the histopathological slides of bursa of fabricius, spleen and thymus in groups receiving organic selenium or inorganic Se appeared normal, whereas control group showed mild depletion of lymphocytes in these organs.

From the results of this study, it can be concluded that the organic selenium (Sel-Plex™) supplementation in the diets especially 0.3 mg/ kg diet of Bandarah local chicks from one day of hatch to 12 weeks of age improved productive, physiological and immunological traits including parameters such as live body weight, relative weights of carcass, blood hematological and biochemical measurements, antibody responses against IBDV and relative weights of lymphoid organs (spleen, bursa of fabricius, and thymus gland). Therefore, selenium in (Sel-Plex™) could be an essential form of selenium supplementation in dietary chicks.

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Table 1: Composition and calculated analysis of basal diet.

Ingredients	Starter (0- 8)	Grower (9-12)
Yellow corn	64.00	67.00
Soybean meal 44%	27.00	15.50
Wheat bran	4.50	13.70
Di-calcium phosphate	2.00	1.35
Limestone	1.85	1.80
Dl.-Methionine	0.10	0.10
Sodium chloride	0.30	0.30
Vit. & Min. Mixture*	0.25	0.25
Total	100.00	100.00
Calculated analysis:		
Metabolizable energy	2855.00	2783.00
(Kcal/Kg)	18.15	14.64
Crude protein %	3.37	3.64
Crude fiber %	2.92	3.30
Crude fat %	1.19	1.00
Calcium %	0.52	0.40
Available phosphorous %	0.91	1.02
Lysine %	0.36	0.49
Methionine %	0.54	0.76
Met+cystine %		

*Supplied per kg diet: Vit A, 10000IU; Vit D_3, 2000 IU; Vit E, 10 mg; Vit K_3, 1 mg; Vit B_1, 1 mg; Vit B_2, 5mg; Vit B_6, 1.5 mg; Vit B_{12}, 10 mcg; Niacin, 30 mg; Pantothenic acid, 10 mg; Folic acid, 1 mg; Biotin, 50mcg; Choline, 260 mg; Copper,4 mg; Iron, 30 mg; manganese, 60 mg;Zinc, 50 mg; Iodine, 1.3 mg; Selenium, 0.1mg; Cobalt,0.1mg.

Table 2: Effect of organic selenium (Sel-Plex™) supplementations (mg / kg diet) on live body weights and mortality rate of Bandarah local chicks during different periods (Means ± SE).

Age (wks)	Sex	control	Se 0.1	Se 0.2	Se 0.3	Overall means
		Live body weight (g)				
4	Females	494.56±18.80	550.46±19.95	555.67±23.73	561.15±11.44	$540.46±12.41^{B}$
	Males	537.43±27.48	629.32±19.04	639.20±31.07	642.21±23.51	$612.04±21.27^{A}$
	Overall means	$507.52±16.20^{b}$	$574.32±17.90^{a}$	$580.21±22.43^{a}$	$585.66±13.65^{a}$	
8	Females	542.53±16.98	573.08±13.20	582.04±21.26	631.85±9.91	$582.38±11.10^{B}$
	Males	690.62±33.13	728.23±28.04	755.31±39.48	865.39±19.61	$759.89±15.20^{A}$
	Overall means	$587.30±25.22^{c}$	$619.99±21.02^{bc}$	$634.42±33.31^{b}$	$702.46±13.36^{a}$	
12	Females	677.16±15.53	686.37±21.04	725.02±22.71	803.77±12.51	$723.08±9.53^{B}$
	Males	889.29±30.90	892.96±27.66	951.26±40.66	1079.88±30.51	$953.35±20.0^{A}$
	Overall means	$741.29±18.19^{c}$	$750.50±17.27^{bc}$	$793.42±23.34^{b}$	$887.24±21.15^{a}$	
0-12		mortality rate				
		6±1.00	6±1.00	6±1.00	5±1.00	

a, b, c = Means having different letters exponents within each row are significantly different at $P \leq 0.05$.
A, B = Means having different letters exponents within each column are significantly different at $P \leq 0.05$.

Table 3: Effect of organic selenium (Sel-Plex™) supplementations (mg / kg diet) on blood hematological, infectious bursal disease virus antibody titers (IBDVAb), Triiodotherionine (T_3) and Thyroxine (T_4) of Bandarah local chicks at 12 weeks of age (Means ± SE).

Items	Sex	control	Se 0.1	Se 0.2	Se 0.3	Overall means
Hb (g /dl)	Females	11.02±0.73	13.15±0.65	13.05±0.71	13.30±0.86	12.63±0.38
	Males	11.43±0.76	13.40±0.59	13.35±0.56	13.66±0.77	12.96±0.59
	Overall means	11.23±0.56^{b}	13.28±0.45^{a}	13.20±0.61^{a}	13.48±0.48^{a}	
RBC (10^6/ml)	Females	1.64±0.22	2.15±0.35	2.70±0.33	3.03±0.21	2.38±0.16
	Males	1.74±0.19	2.13±0.11	2.94±0.23	3.27±0.21	2.52±0.18
	Overall means	1.69±0.15^{d}	2.14±0.25^{c}	2.82±0.20^{b}	3.15±0.15^{a}	
WBC (10^3/ ml)	Females	7.26±0.21	8.36±0.20	9.36±0.29	9.97±0.16	8.74±0.15^{A}
	Males	6.81±0.32	7.16±0.50	7.82±0.37	8.40±0.31	7.54±0.33^{B}
	Overall means	7.03±0.19^{c}	7.76±0.31^{b}	8.59±0.30^{a}	9.18±0.29^{a}	
IBDVAb	Females	13197±211	16785±176	18560±118	20694±183	17309±105
	Males	14075±307	19777±203	18396±389	21834±168	18520±124
	Overall means	13636±163^{b}	18281±140^{a}	18478±201^{a}	21264±119^{a}	
T_3 (ng /dl)	Females	151.68±25.72	201.87±30.77	252.49±47.71	269.28±23.96	218.83±16.07
	Males	169.51±29.50	219.92±14.81	247.74±48.16	251.80±25.01	222.24±21.52
	Overall means	160.59±18.43^{b}	210.89±16.17^{a}	250.11±38.24^{a}	260.54±12.18^{a}	
T_4 (µg /dl)	Females	0.957±0.07	0.999±0.15	0.132±0.19	1.143±0.06	1.058±0.11
	Males	0.968±0.04	0.842±0.14	1.239±0.14	1.305±0.20	1.113±0.12
	Overall means	0.962±0.03	0.971±0.10	1.186±0.09	1.224±0.11	

a, b, c, d = Means having different letters exponents within each row are significantly different at $P \leq 0.05$.

A, B= Means having different letters exponents within each column are significantly different at $P \leq 0.05$.

Table 4: Effect of organic selenium (Sel-Plex™) supplementations (mg / kg diet) on serum biochemical parameters of Bandarah local chicks at 12 weeks of age (Means ± SE).

Items	Sex	Control	Se 0.1	Se 0.2	Se 0.3	Overall means
Total protein (g/dl)	Females	3.75±0.12	4.11±0.24	4.44±0.21	4.58±0.44	4.22±0.15
	Males	3.77±0.19	4.09±0.24	4.50±0.19	4.68±0.42	4.26±0.24
	Overall means	3.76±0.11^{b}	4.10±0.14^{ab}	4.47±0.13^{a}	4.64±0.29^{a}	
Albumin (g/dl)	Females	1.44±0.12	1.60±0.16	1.64±0.10	1.69±0.13	1.59±0.09
	Males	1.36±0.10	1.63±0.14	1.68±0.14	1.70±0.18	1.59±0.11
	Overall means	1.40±0.07	1.62±0.11	1.66±0.08	1.70±0.12	
Globulin (g/dl)	Females	2.31±0.29	2.51±0.22	2.80±0.20	2.89±0.09	2.63±0.18
	Males	2.41±0.25	2.46±0.27	2.82±0.24	2.94±0.15	2.67±0.11
	Overall means	2.36±0.20^{b}	2.49±0.16^{ab}	2.81±0.13^{a}	2.94±0.07^{a}	
Selenium (mg / l)	Females	0.055±0.003	0.077±0.004	0.075±0.004	0.083±0.004	0.073±0.002^{A}
	Males	0.056±0.002	0.066±0.003	0.069±0.006	0.072±0.002	0.066±0.004^{B}
	Overall means	0.056±0.002^{b}	0.072±0.004^{a}	0.072±004^{a}	0.077±0.003^{a}	
Glutathione peroxidase (mu/ml)	Females	12.97±3.74	15.13±2.16	19.94±5.72	23.78±2.16	19.95±2.03
	Males	15.13±2.16	15.85±2.01	28.26±5.79	28.10±5.72	21.84±3.15
	Overall means	14.05±1.99^{b}	15.49±1.30^{b}	24.10±3.95^{a}	25.94±2.90^{a}	

a, b = Means having different letters exponents within each row are significantly different at P ≤0.05.

A, B = Means having different letters exponents within each column are significantly different at P ≤0.05.

Table 5: Effect of organic selenium (Sel-Plex™) supplementations (mg / kg diet) on relative weight of carcass and lymphoid organs of Bandarah local chicks at 12 weeks of age (Means ± SE).

Relative weights	Sex	control	Se 0.1	Se 0.2	Se 0.3	Overall means
Carcass	Females	60.33±0.58	62.08±0.39	62.92±0.34	64.06±0.43	62.35 ± 0.28^{B}
	Males	63.90±0.48	65.02±0.32	66.29±0.38	68.53±0.36	65.94 ± 0.30^{A}
	Overall means	62.12 ± 0.25^{d}	63.55 ± 0.21^{c}	64.60 ± 0.29^{b}	66.29 ± 0.19^{a}	
Spleen	Females	0.177±0.009	0.205±0.008	0.220±0.010	0.243±0.013	0.211 ± 0.008^{A}
	Males	0.137±0.005	0.160±0.006	0.187±0.007	0.207±0.009	0.173 ± 0.005^{B}
	Overall means	0.157 ± 0.006^{d}	0.183 ± 0.005^{c}	0.203 ± 0.008^{b}	0.225 ± 0.010^{a}	
Bursa of fabricius	Females	0.260 ± 0.006^{d}	0.280 ± 0.005^{c}	0.310 ± 0.007^{b}	0.338 ± 0.005^{a}	0.297 ± 0.006^{A}
	Males	0.242 ± 0.005^{e}	0.255 ± 0.004^{d}	0.278 ± 0.005^{c}	0.313 ± 0.006^{b}	0.272 ± 0.003^{B}
	Overall means	0.251 ± 0.003^{d}	0.268 ± 0.005^{c}	0.294 ± 0.005^{b}	0.326 ± 0.004^{a}	
Thymus gland	Females	0.572 ± 0.006^{c}	0.612 ± 0.005^{b}	0.658 ± 0.009^{a}	0.648 ± 0.0008^{a}	0.623 ± 0.007^{A}
	Males	0.525 ± 0.010^{d}	0.555 ± 0.006^{cd}	0.570 ± 0.004^{c}	0.628 ± 0.014^{ab}	0.570 ± 0.009^{B}
	Overall means	0.548 ± 0.008^{d}	0.583 ± 0.004^{c}	0.614 ± 0.006^{b}	0.638 ± 0.009^{a}	

a, b, c, d, e = Means having different letters exponents within each row are significantly different at $P \leq 0.05$.
A, B = Means having different letters exponents within each column are significantly different at $P \leq 0.05$.

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الملخص العربى

تأثير اضافة السلينيوم العضوى على الأداء الأنتاجى والفسيولوجى فى سلالة محلية من الدجاج.

٢- النظام المناعى وبعض الصفات الفسيولوجية لكتاكيت البندرة وتأثرها بالسيلنيوم العضوى

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أجريت هذه التجربة لدراسة المقاييس الانتاجية و المناعية و الفسيولوجية فى كتاكيت البندرة المحلية كنتيجة لأضافة السيلنيوم العضوى (سلبلكس) فى الغذاء. كل الكتاكيت المستخدمة فى هذه التجربة أنتجت من اناث وذكور مغذاة على علائق تحتوى على صفر ، ١، ، ٢، ٣، ملجم سيلنيوم / كجم غذاء فى شكل السلبلكس. أستخدمت مائتان كتكوت غير مجنس عمر يوم (٥٠ كتكوت لكل مجموعة من الأمهات و الأباء و المعاملة بنفس الجرعة) سكنت فى حضانة فى عشوش و غذيت على الغذاء الاساسى مضاف اليه صفر ، ١، ، ٢، ٣، ملجم سيلنيوم / كجم غذاء فى شكل السلبلكس مثل الأباء و الأمهات حتى عمر ١٢ أسبوع. و أوضحت النتائج التالى :

١- أدى أضافة السيلنيوم خاصة المستويات ٢، ٣، ملجم فى علائق كتاكيت البندرة إلى زيادة معنوية لوزن الجسم الحى خلال الفترة التجريبية و أن وزن الجسم للذكور كان أعلى معنويا من الاناث.

٢- وجد أن تركيز الهيموجلوبين و كرات الدم الحمراء و البيضاء و أستجابة الأجسام المضادة للتحصين بمرض الجمبورو و التراي ايودوثريونين أزداد معنويا فى كل المجموعات المغذاة على السيلنيوم (السلبلكس) مقارنة بمجموعة الكنترول بينما لم يلاحظ أى تأثير معنوى على نركيز هرمون الثيروكسين فى سيرم الدم. و أن كل الصفات السابقة لم تتأثر معنويا بالجنس باستثناء كرات الدم البيضاء فى الاناث و التى أزدادت معنويا مقارنة بالذكور.

لوحظ أن تركيز البروتين الكلى و الجلوبيولين و الجلوتاثيون بيروكسيديز فى السيرم أزداد معنويا فى المجموعات المغذاه على ٢ , ، ٣ , ملجم سلينيوم مقارنة بمجموعة الكنترول بينما لم يلاحظ أى تأثير معنوى لنركيز الألبيومين فى السيرم. ووجد أيضا أن تركيز السيلنيوم فى السيرم أزداد معنويا فى كل المجموعات المغذاة على السيلنيوم (السلبلكس) مقارنة بمجموعة الكنترول. وأن كل الصفات السابقة لم تتأثر معنويا بالجنس باستثناء تركيز السيلنيوم فى السيرم للاناث و الذى أرتفع معنوبا مقارنة بالذكور.

٣- وجد أن الوزن النسبى للذبيحة و الأعضاء الليمفاوية (الطحال و البرسا و الغدة التيموسية) لكتاكيت البندرة أزدادت معنويا بأضافة السيلنيوم العضوى (السلبلكس) مقارنة بمجموعة الكنترول. و أن جميع تلك الصفات السابقة كانت أعلى معنويا فى الاناث مقارنة بالذكور باستثناء الوزن النسبى للذبيحة فى الذكور كان معنويا أعلى من الاناث.