Egypt. Poult. Sci. Vol (29) (IV): (1061-1084)

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

1-THE EFFECT OF ORGANIC SELENIUM (SEL-PLEX™) ON PRODUCTIVE, REPRODUCTIVE AND PHYSIOLOGICAL TRAITS OF BANDARAH LOCAL STRAIN

By

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Received: **18/11/2009** Accepted: **05/12/2009**

Abstract: *the effect of selenium yeast (Sel- Plex™) as dietary organic selenium supplementation on the productive, reproductive and physiological traits of Bandarah local chickens from 40 to 60 weeks of age was studied. One hundred and sixty females and forty males at 40 weeks of age were distributed randomly among four treatment groups (40 females and 10 males in each group). Females and males were fed on a basal diet supplemented with 0.0, 0.1, 0.2 or 0.3 mg Se / kg diet in the form of Sel-Plex™. The obtained results indicated that the live body weight was significantly increased in females and males fed Sel-Plex™ supplementation, while no significant effect on feed consumption. Live body weight of females was significantly increased with increase of hens age, but no significant effect on feed consumption as the age of birds increased. Egg production percentage, egg weight, egg quality (Haugh unit, egg yolk index and shell thickness) and selenium content in yolk and albumen were significantly increased for hens fed Sel-Plex™ supplementation compared with those in control group. All previous mentioned traits were significantly affected by hen's age. Semen ejaculate volume, advanced motility (%), alive sperm (%) and sperm concentration were significantly increased by Sel-Plex™ supplementation in cock's diet. These traits were not significantly affected by cock age except for sperm concentration which was increased ($P \leq 0.05$) at 56 and 60 weeks of age. Sel-Plex™ supplementation at 0.2 and 0.3 mg in females and males diet significantly increased the concentrations of total protein, globulin, glutathione peroxidase, selenium, triiodotherionine (T_3), hemoglobin(Hb), RBC's and WBC's while, no* *significant effect on serum albumin and thyroxin (T_4) concentration was observed. Fertility and hatchability percentages were significantly increased in treated groups but hatched chicks weight was increased ($P \leq 0.05$) especially with high level of Sel-Plex™ supplementation. Relative weights of ovary, testes, spleen, thymus and thyroid gland were significantly increased in selenium treated groups except relative weight of testes with low level of Sel-Plex™ supplementation. So, it can be concluded that selenium as (Sel- Plex) supplementation in the diets had improved the productive, reproductive and physiological traits in females and males of Bandarah local strain.*

INTRODUCTION

Selenium (Se) is an essential dietary nutrient for laying hens. The Se requirement for laying hens ranges from 0.05 to 0.08 ppm depending on daily feed intake **(NRC, 1994)**. However, Se content of feed grains widely varies from region to region **(NRC, 1994)**, and thus it is common practice in the poultry industry to supplement laying hen diets. The maximum allowed Se inclusion level in the United States is 0.30 ppm. Selenium is required for maintenance of health, growth, and physiological functions. Traditionally, Se has been added to poultry diets via inorganic sources, such as sodium selenite. Research has shown that organic Se such as selenocysteine, selenomethionine (SM), or Se-enriched yeast (SY), as supplemental sources of Se is more bioavailable than Se in sodium selenite **(Cantor *et al.*, 1982)**. Moreover, organic sources of Se have been explored as an alternative to inorganic supplementation **(Payne, *et al.*, 2005)**. The use of organic Se results in less Se being transferred to the environment through feces, and more Se is deposited into body tissues and eggs, therefore use of Se yeast in laying hen diets is very effective for increasing the Se content of eggs **(Cantor and Scott, 1974; Ort and Latshaw, 1978; Swanson, 1987; Davis *et al.*, 1996; Cantor *et al.*, 2000 Patton, 2000, Payne *et al.*, 2005 and Utterback, *et al.*, 2005)**. Low Se content of human diets has been correlated with higher incidences of cancer and other diseases **(Allan, *et al.*, 1999)**; therefore. Se yeast fed to laying hens may add value to market eggs **(Utterback, *et al.*, 2005)**. The enrichment of eggs with organic selenium represents a commercially valuable use for the future. The supplementation of hens' food with organic selenium not only improves their health and productivity, but can also be a natural way to produce functional food, respectively the production of eggs enriched with selenium **(Yaroshenko *et al.*, 2003 and Sara *et al.*, 2008)**. **Rotruck *et al.*, (1973), Wakebe (1998) and Dvorska *et al.*, (2003)** they reported that Se is required for proper function of the glutathione peroxidase enzymes, which are antioxidant enzymes that destroy free radicals produced during normal metabolic activity. In addition to the role as an antioxidant, Se has been shown to affect egg quality. For example, **Pappas *et al.*, (2005)** have shown that addition of organic Se to laying hen diets can ameliorate some of the adverse effects of storage on HU value of eggs.

Moreover, selenium has been implicated as a factor affecting male fertility of poultry (**Combs, 1994; Klecker *et al.*, 1999**). Selenium supplementation *increases the hatchability of fertile eggs and number of hatched chicks* (**Cantor and Scott, 1974; Davtyan *et al.*, 2006 and Petrosyan *et al.*, 2006**). As a result, Se has an important role in poultry fertility and embryonic development. However, there are currently no reports that quantify the movement of Se from the egg contents to the developing embryo.

Therefore, the present study was designed to investigate the effects of organic selenium (Sel- Plex) addition in local chicken diets on their productive, reproductive and physiological performances through the period from 40 to 60 wks of age in which a reduction in productive, reproductive and physiological indices can be recorded.

MATERIALS AND METHODS

The current experimental work was carried out at El-Sabahia Poultry Research Station (Alexandria). Animal production Research Institute. Agricultural Research Center. Ministry of Agriculture. One hundred and sixty females and forty males of Bandarah local chickens at 40 weeks of age were distributed randomly in four treatment groups (40 females and 10 males in each group). Females were housed in open system house with 8 pens measuring 3.0 × 2.5 × 3.5 m (each group in two replicates pens). Also. males were housed individually in single cages. All birds (females and males) were fed a basal diet of layers (Table 1) or basal diets supplemented with Se 0.1, 0.2 or 0.3 mg / kg diet in the form of selenium yeast (Sel-Plex™) during the experimental period (20 wks). Selenium yeast (Sel-Plex™ Alltech Inc.) contains 1000 ppm Se and produced by the fermentation of yeast (Saccharomyces cerevisiae) in a high Se medium. Diets and fresh water were provided ad libitum and lighting program of 16 hours a day was applied.

Females and males were individually weighed at the beginning of the trail then every four weeks. Feed intake was measured and calculated as g/ bird/ day. Egg number and egg weight were recorded daily and average egg weight and egg production (%) were calculated. At 50, 55 and 60 weeks of age, ten eggs were randomly taken from each group for egg quality measurements [egg shape index, Haugh units, yolk index, and egg shell thickness (mm)]. The concentration of selenium (ppm) in both the yolk and albumen was determined using atomic absorption spectrometry after hydrolysis of the sample by the methods of **Brown and Watkinson (1977).** Every four weeks, the cocks from each group were massaged and semen was collected to determine some semen physical properties such as ejaculate volume (ml), advanced motility (%), alive sperm (%) and sperm concentration (10^6 / mm^3) . From 57 to 60 wks of age, laying hens were inseminated once every three days with 0.05 mL undiluted semen from cocks that received the same treatment diets. Eggs were daily collected from each group every week during the last three weeks and incubated to determine fertility and hatchability percentages.

At the end of the experiment, blood samples were obtained in heparinized tubes from the brachial vein of randomly twelve birds (6 females and 6 males) in each group. Hemoglobin concentration (Hb), red blood cells (RBC's) count and white blood cells (WBC's) count were determined. Another equal number of blood samples from females and males were centrifuged at 3000 rpm for 15 minutes to separate clear serum which was stored at – 20 °C for determination of 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 the age of 60 weeks, 4 females and 4 males were taken at random from each group and slaughtered. The relative weights of ovary, testes, spleen, thymus and thyroid 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 and Feed Consumption

Results are presented in Table 2 indicated that overall means of live body weight was significantly ($P \leq 0.05$) increased in females and males of Bandarah chickens fed selenium (Sel-Plex™) supplementation compared with the control group. Regardless of Sel-Plex™ supplementation, overall means of live body weight was significantly ($P \leq 0.05$) increased with the increase of hens age, while live body weight of males was insignificantly increased with the increased of males age. Our results are in agreement with **Arpasova *et al.*, (2009)** who indicated that the supplementation of selenium into the diet significantly ($P \leq 0.05$) influenced the laying hens body weight for a breeding period. The highest body weight increase of birds was in the groups with the addition of Se-yeast at a dose of 0.4 mg/kg and 0.9 mg/kg, Many results indicated that the body weight was increased with organic selenium supplementation in the diets of broiler chickens (**Skrivan *et al.*, 2008, Sevcikova *et al.*, 2006 and Srimongkol 2003**), quails (**Sahin *et al.*, 2008**) and turkey poults (**Cantor *et al.*, 1982**).

No significant effects of Sel-Plex™ supplementation on feed consumption were observed throughout all studied ages for both females and males (Table 2). Therefore, overall mean of feed consumption was not significantly affected with the increase of bird's age or Sel-Plex™ supplementation. These results are supported by **Richter *et al.*, (2006)** who indicated that the organic Se supplementation did not take affect feed intake in laying hens. **Payne *et al.*, (2005) and Utterback *et al.*, (2005)** indicated that feed intake was not affected by organic Se ($P \leq 0.05$), but it was increased in hens fed the basal diet compared with organic Se. Also, in broiler chickens **Niu *et al.*, (2009), Spears *et al.*, (2003) and Edens *et al.*, (2001)** found that non significant influence on feed intake by dietary organic Se.

Egg Production and Egg Weight

Overall mean of egg production percentage and egg weight were significantly ($P \leq 0.05$) increased for hens fed Sel-Plex™ supplementation compared with the control group (Table 3). Regardless of Sel-Plex™ supplementation, overall mean of egg production was significantly ($P \leq 0.05$) increased at 56 and 60 weeks of age compared to those at 44, 48 and 52 weeks of age. Also, overall mean of egg weight was significantly ($P \leq 0.05$) increased at 48, 52, 56 and 60 weeks of age compared to those at 44 weeks of age. These results are in harmony with those reported by **Renema (2004)** who indicated that the use of organic selenium source can improve egg production and egg weight, where, the hen-housed rate of lay was 68% in Sel-Plex™ birds compared to 61% and 60% in the selenite and non supplemented treatments, respectively during the late lay period (49-58 weeks). **Sara *et al.*, (2008)** indicated that addition of organic Se (Sel-Plex™) in laying hen diets within the second laying stage (aged between 48 – 62 weeks) improved egg production and egg weight. **Simon (2004)** showed that broiler breeders fed diet supplemented with Sel-Plex™ had superior egg production compared to control or other groups fed inorganic selenium. **Stanley *et al.*, (2004)** found that hen-day egg production and egg weight from the Sel-Plex™ fed hens were significantly higher ($P \leq 0.05$) than the control group. Also, **Cantor and Scott (1974)** reported an increase in percentage hen-day production for hens fed 0.10 ppm of selenomethionine (SM) relative to no supplementation.

Egg Quality

Table 4 shows that the additions of Sel-Plex™ in laying hen diets improve egg shape index, Haugh unit, yolk index, shell thickness and selenium content of yolk and albumen through all studied ages. Also, overall means of Haugh unit, yolk index, shell thickness and selenium content of yolk and albumen were significantly increased in Sel-Plex™ treated groups compared to the control group. While, no significant effect on egg shape index was observed. Irrespective of Sel-Plex™ supplementation, overall means of egg shape index were not significantly ($P \leq 0.05$) affected by hen's age. While, overall means of Haugh unit, yolk index, shell thickness and selenium content of yolk and albumen were significantly ($P \leq 0.05$) affected by hen's age. The results obtained for the egg shape index in the present study are in agreement with the finding published by **Renema (2004)** who found that during the late lay period (49-58 wk), the Sel-Plex™ hens produced significantly fewer unsettable eggs. Also, Haugh unit data support the results reported by **Rutz *et al.*, (2005)** who noted an improvement in albumen height with organic selenium by indirect mode of action of organic selenium which enhanced function of the selenium-dependent GSH-Px antioxidant system. **Wakebe (1998)** reported that selenium yeast reduced deterioration of the albumen, which results in slower carbon dioxide loss and thus maintains albumen quality after the egg is laid. Improves egg yolk index in the present study are in agreement with those reported by **Rutz *et al.*, (2003)** who found that the addition of organic selenium in laying hen diets led to the improvement of the egg components (egg shell, yolk and white). The results of shell thickness are in agreement with a previous report by **Renema (2006)** indicated that shell thickness was higher in the Sel-Plex™ group than in the control group after 9 weeks of treatment, while shell thickness in the group given inorganic selenium was intermediate. **Klecker *et al.*, (2001) and Sara *et al.*, (2008)** indicated that the administration of organic selenium in laying hen diets increased egg shell thickness and reduced the number of eggs with shell abnormalities, consequently improved eggshell quality. **Spring (2006)** showed that organic selenium supplementation in broiler breeders and layers improve egg quality and antioxidative properties. Many reports, **Cantor and Scott**

(1974), Ort and Latshaw (1978), Swanson (1987), Davis *et al.*, (1996), Cantor *et al.*, (2000), and Patton (2000) reported that dietary organic Se resulted in a greater increase in egg Se concentration content than inorganic Se. **Surai and Sparks (2001) and Combs and Combs (1986)** reported that supplemented organic Se to broiler breeders and layers were actively absorbed and can be directly incorporated into protein. **Kenyon *et al.*, (2003)** reported that supplementation with Sel-Plex™ led to a significant increase in selenium concentrations of both the yolk and the albumen compared to the Na-selenite treatment.

Semen Physical Properties

Data presented in Table 5 indicated that overall means of ejaculate volume (ml), advanced motility (%), a live sperm (%) and sperm concentration (10^6 /mm^3) were significantly ($P \leq 0.05$) increased for males fed Sel-Plex™ supplementation compared with the control group. Regardless of Sel-Plex™ supplementation, overall mean of sperm concentration was significantly ($P \leq 0.05$) increased at 56 and 60 weeks of age compared to those at 44, 48 and 52 weeks of age. While, overall mean of ejaculate volume, advanced motility and a live sperm were not significantly influenced as males advanced in age. These results are in agreement with that reported by **Simon (2004)** who showed that broiler breeders fed diets supplemented with Sel-Plex™ improve sperm morphology and activity. Also, **Surai *et al.*, (1998)** indicated that the need for defense against oxidative damage is clear in the male, where antioxidant enzymes play a key role in maintaining the sperm cells. Sperm cells contain large amounts of polyunsaturated fatty acids, which allow them to maintain flexibility relating to motility **(Surai, 2002)**. However, this means they are also a target for lipid peroxidation. Cellular integrity is maintained by GSH-Px and other selenoenzymes which protect the cell membranes from oxidative damage **(Flohe and Zimmermann, 1970)**. Similar results of a live sperm were obtained by **Davtyan *et al.*, (2006)** who indicated that the number of spermatozoa was also increased significantly by the use of Sel-Plex™. **Sefton and Edens (2004)** found that the sperm quality index was greater in semen samples collected from males fed Sel-Plex™ , Also, normal sperm number was significantly increased while abnormal number was significantly decreased compared with group fed sodium selenite. **Edens, (2002)** found that the inclusion of selenium in poultry diets enhances sperm numbers, and using an organic source (Sel-Plex™) reduces production of defective sperm, thereby having a positive effect on the fertilizing potential of the male. Our results in sperm concentration are supported by **Renema (2006)** who found that feeding broiler breeder males (between 45- 65 weeks of age) 0.2 mg / kg Sel-Plex™ increased semen concentration. Also, **Spring (2006)** indicated significant improvements in spermatozoa concentration and activity, when fed diets were supplemented with Se yeast in comparison to selenite.

Blood Hematological and Biochemical Parameters in Laying Hens

Selenium supplementation at 0.2 and 0.3 to Bandarah females and males chicken diets increased ($P\leq0.05$) serum total protein and globulin, while no significant effects on serum albumin concentration were observed (Table 6). Organic Se had more pronounced effect on total protein, **Sunde (1997)** reported that SM could be incorporated into protein at a rate similar to methionine, because Se and sulphur have very similar atomic properties. The ability of Se to be treated like sulphur, and the ability of SM to replace methionine so that it can be incorporated into protein when metabolized. **Kim and Mahan (2003)** indicated that selenium is biochemically similar to sulphur, Se replaces the sulphur molecule in the normal biosynthetic pathways of the yeast cell and is absorbed actively across the intestine by the same amino acid carrier. **Combs and Combs (1986)** reported that supplemented organic Se to broiler breeders and layers was actively absorbed and can be directly incorporated into protein.

Table 6 shows that there were significant increase in serum glutathione peroxidase, selenium and triiodothyrionine concentrations due to selenium supplementation in females and males diet, whereas, no significant effect on serum thyroxine concentration in both females and males. The use of Sel-Plex™ as a source of supplemental dietary Se provides a more efficiently utilized form of organic selenium and facilitates a greater antioxidant enzyme presence in glutathione peroxidase, which more readily reduce peroxides and other free radicals that compromise cell membranes **(Edens and Gowdy, 2005)**. Also, **Atlavin and Apsite (2001)** found that selenium metabolites in the body are closely linked with activities of glutamine peroxides which eliminate lipid hydroxyl peroxides in cellular structures. Similar results were reported by **Srimongkol (2003) and Mahmoud and Edens (2003)** who indicated that selenium supplemented to broiler chicks had significantly ($P\leq0.05$) elevated glutathione peroxidase than the control group. Our results of Se concentration agreed with those of **Cantor *et al.*, 1975[a,b], 1982; Echevarria *et al.*, 1988 and Spears *et al.*, 2003** in which Se supplementation increased plasma Se concentrations in turkey poults or broilers. Our results of serum T_3 concentration are agree with **Srimongkol (2003)** who reported that selenium supplemented in broiler diets had significantly ($P\leq0.05$) increased triiodothyrionine (T_3) levels than fasted chicks and control. Additionally, Se supplementation facilitated the conversion of T_4 to T_3. This observation suggested that the extra-thyroidal conversion of T_4 to T_3 was mediated by the hepatic Se- dependent type 1, 5'-iodothyronine deiodinase enzyme **(Edens, 2001)**.

Results of blood hematological parameters for females and males are presented in Table 6. Means of Hb, RBC's and WBC's were significantly ($P \leq 0.05$) increased in selenium treated groups compared with those in the control group. Organic selenium supplementation in the diets is important for increase number of lymphocytes **(Blood *et al.*, 1995)** and for proper development and function of immune system **(Hussain *et al.*, 2004 and Khan *et al.*, 1993)**.

Fertility and Hatchability and Hatched Chick Weight

Fertility, hatchability and hatched chick weights as affected by feeding different levels of selenium to Bandarah chickens strain are presented in Table 7. There was significant ($P \leq 0.05$) increase in fertility and hatchability percentages in all groups fed selenium as Sel-Plex™ supplementation compared with the control group. The use of Sel-Plex™ to improve fertility acts by two ways. A primary effect is on the breeder performance by a higher number of viable chicks produced and lower mortality of embryos during incubation, while the second effect on the males by effecting of Se on maintaining sperm quality long time when stored in sperm storage tubules after mating and quantity is of major interest **(Davtyan *et al.*, 2006; Petrosyan *et al.*, 2006)**. **Agate *et al.*, (2000)** showed that selenium (Sel-Plex™) supplementation in laying hen diets improved the environment of the sperm storage tubules in the hen's oviduct, allowing sperm to live longer, increasing the length of time sperm can be stored and increasing the average number of sperm holes in the yolk layer. **Rotruck *et al.*, (1973)** reported that Se is required for proper function of the glutathione peroxidase enzymes, which are antioxidant enzymes that destroy free radicals produced during normal metabolic activity. Therefore, increased hatchability in treated groups may be due to improved anti-oxidant status. During embryo development, oxidative metabolism increases substantially over the incubation period and especially in the last few days before hatch **(Freeman and Vince, 1974)**. This normal respiration related to embryo growth results in the production of free radicals, which can cause tissue damage through lipid peroxidation. The protective effects of organic selenium are especially apparent during the highly oxidative state of late incubation and the first few days after hatch. **(Surai, 1999; Surai, 2000)**.

Hatched chicks produced from hens fed high dose of selenium were significantly ($P \leq 0.05$) heavier than those of the group fed low dose of selenium or the group fed the basal diet. Similar results were reported by **Pappas *et al.*, (2006) and Sefton and Edens (2004)** who found that the chick weights from parents fed diets high in Se were heavier at hatch than those hatched from parents fed diets low in Se.

Organ Relative Weights

Relative weights of ovary, testes, spleen, thymus and thyroid gland in females and males (as a percentage of live body weight) of Bandarah chickens were significantly ($P \leq 0.05$) affected by Sel-Plex™ supplementation (Table 8). Relative weights of ovary and testes of females and males were significantly ($P \leq 0.05$) increased in Sel-Plex™ treated groups except relative weight of testes with low level of Sel-Plex™ compared with the control group. Improved relative weight of ovary due to the significant increase of egg production Table 5. These results are in agreement with those reported by **Renema (2004)** who indicated that the testes weight was greatest in broiler breeder males fed 0.2 mg selenium as Sel-Plex™ supplementation in the diets at 65 weeks of age.

Results presented in Table 8 showed that Sel-Plex™ supplementation in the diets significantly ($P \leq 0.05$) increased relative weight of spleen, thymus and thyroid gland in females and males chickens. Nutrition plays a significant role in the development and function of the immune system **(Khan *et al.*, 1993). Hussain *et al.*, (2004) and Blood *et al.*, (1995)** found that selenium is an essential mineral, which is necessary for vital activities inducing immune response of birds. Our results in the present study are agreement with **Hussain *et al.*, (2004)** who reported that the relative weight of lymphoid organs (spleen and thymus) of birds fed on diet containing organic Se was significantly greater than that for the control group. **Hegazy and Adachi (2000)** indicated that the relative weight of spleen was significantly higher in organic Se supplemented birds compared with those in birds fed inorganic Se. **Chang *et al.*, (1990)** and **March *et al.*, (1987)** indicated that the histopathological slides of spleen and thymus glands in groups receiving organic selenium appeared normal, whereas control group showed mild depletion of lymphocytes in these organs. Also, **March *et al.*, (1986)** reported 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.

The results from our experiment indicate that organic selenium (Sel-Plex™) especially at 0.2 and 0.3 mg/kg diet can be used to supplement the diet for laying hens and cockerels to improve productive, reproductive and physiological traits during the period from 40 to 60 weeks of age.

Table 1: Composition and calculated analysis of basal diet.

Ingredients	%
Yellow corn	64.00
Soybean meal 44%	24.78
Wheat bran	1.00
Di-calcium phosphate	1.61
Limestone	7.91
DL-Methionine	0.10
Sodium chloride	0.30
Vit. & Min. Mixture*	0.30
Total	100.00
Calculated analysis:	
Metabolizable energy (Kcal/Kg)	2718.00
Crude protein %	16.02
Crude fiber %	3.46
Crude fat %	2.96
Calcium %	3.34
Available phosphorous %	0.42
Lysine %	0.89
Methionine %	0.39
Met+cystine %	0.66

*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™) supplementation on body weights (kg) and feed consumption (g/hen/day) at different ages (Means ± SE).

Sex	Age (wks)	control	Se 0.1	Se 0.2	Se 0.3	Overall mean
Females	Body weight (kg)					
	44	1.316±0.20	1.395±0.01	1.409±0.01	1.430±0.01	1.387±0.01^{E}
	48	1.384±0.02	1.433±0.021	1.431±0.02	1.477±0.01	1.424±0.02^{D}
	52	1.413±0.01	1.474±0.01	1.489±0.02	1.491±0.02	1.467±0.01^{C}
	56	1.450±0.02	1.503±0.02	1.497±0.03	1.523±0.03	1.493±0.02^{B}
	60	1.496±0.03	1.542±0.02	1.553±0.02	1.565±0.02	1.539±0.02^{A}
	Overall mean	1.412±0.01^{d}	1.468±0.02^{c}	1.477±0.02^{b}	1.491±0.02^{a}	
	Feed consumption (g/hen/day)					
	44	114.65±0.48	114.30±0.35	114.13±0.65	114.20±0.71	114.32±0.56
	48	114.90±0.75	114.65±0.85	114.45±0.56	114.36±0.66	114.59±0.41
	52	115.10±0.88	114.74±0.41	114.55±0.73	114.60±0.53	114.75±0.65
	56	115.00±1.10	114.88±0.95	114.80±0.90	114.70±0.85	114.85±0.75
	60	115.31±0.95	114.95±1.22	114.79±0.55	114.80±0.74	114.96±0.66
	Overall mean	114.99±0.79	114.70±0.59	114.54±0.46	114.53±0.50	
Males	Body weight (kg)					
	44	1.687±0.05	2.182±0.08	2.354±0.13	2.360±0.11	2.146±0.09
	48	1.724±0.11	2.264±0.18	2.383±0.12	2.417±0.13	2.197±0.11
	52	1.782±0.14	2.309±0.12	2.392±0.15	2.431±0.14	2.229±0.12
	56	1.806±0.13	2.352±0.10	2.403±0.09	2.463±0.11	2.256±0.07
	60	1.835±0.10	2.359±0.17	2.422±0.13	2.485±0.11	2.275±0.10
	Overall mean	1.767±0.10^{b}	2.293±0.13^{a}	2.391±0.12^{a}	2.431±0.10^{a}	
	Feed consumption (g/cock/day)					
	44	115.49±0.38	115.33±0.78	115.22±0.68	115.09±0.66	115.28±0.65
	48	116.30±1.29	114.31±0.43	114.39±0.68	115.28±0.93	115.07±0.85
	52	115.91±0.79	114.71±1.30	114.71±0.51	114.62±0.70	114.99±0.61
	56	115.98±0.88	115.72±0.97	115.45±0.55	115.50±0.44	115.66±0.48
	60	116.06±0.58	115.10±0.78	116.05±0.36	116.68±0.78	115.97±0.49
	Overall mean	115.95±0.51	115.03±0.74	115.16±0.45	115.43±0.66	

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

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

Table 3: Effect of organic selenium (Sel-Plex™) supplementation on egg production and egg weight at different ages (Means ± SE).

Age (wks)	control	Se 0.1	Se 0.2	Se 0.3	Overall mean
Egg production (%)					
44	46.52±1.73	49.11±1.83	51.16±1.57	52.05±2.01	49.71±0.85B
48	44.73±1.79	45.80±2.16	53.04±1.95	54.11±1.62	49.42±1.00B
52	43.84±2.51	48.11±2.35	49.38±1.99	51.88±1.92	48.30±1.45B
56	57.68±2.17	59.02±1.68	61.88±2.21	67.23±1.94	61.45±2.01A
60	53.84±1.43	59.02±1.88	59.29±2.22	63.13±1.86	58.82±1.35A
Overall mean	49.45±1.80d	52.21±1.95c	54.95±1.65b	57.68±1.41a	
Egg weight (g)					
44	47.10±0.39	50.03±0.34	50.31±0.43	50.34±0.32	49.65±0.20C
48	49.10±0.34	51.17±0.34	51.87±0.36	52.10±0.37	51.06±0.25B
52	49.44±0.44	51.59±0.34	52.89±0.37	53.58±0.32	51.88±0.30A
56	51.08±0.37	51.56±0.35	52.62±0.37	53.02±0.38	52.07±0..29A
60	50.02±0.35	52.26±0.40	52.91±0.36	53.67±0.37	52.21±0.22A
Overall mean	49.51±0.23c	51.32±0.29b	52.12±0.32a	52.54±0.26a	

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

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

Table 4: Effect of organic selenium (Sel-Plex™) supplementation on some egg quality and selenium content of egg yolk and albumen at different ages (Means ± SE).

Age (wks)	control	Se 0.1	Se 0.2	Se 0.3	Overall mean
Egg shape index					
50	75.51±1.11	75.61±1.22	75.95±1.65	76.01±1.40	75.77±0.85
55	76.55±0.89	76.70±0.79	76.90±1.00	77.01±0.95	76.77±0.74
60	75.31±1.02	75.32±1.55	75.56±1.23	75.55±1.33	75.44±0.65
Overall mean	75.79±1.09	75.88±1.60	76.14±0.93	76.19±1.20	
Haugh unit					
50	85.85±1.57	87.62±0.62	87.75±0.51	89.42±0.65	87.66±0.50^{B}
55	86.00±2.46	90.56±1.98	91.18±1.63	92.35±1.82	90.02±1.40^{A}
60	87.96±1.63	90.57±1.16	91.33±0.74	92.54±0.86	90.60±0.68^{A}
Overall mean	86.60±1.20^{b}	89.58±1.44^{a}	90.09±0.80^{a}	91.44±0.79^{a}	
Egg yolk index					
50	47.25±1.31	48.91±0.70	49.38±0.82	49.86±1.15	48.97±0.85^{A}
55	44.99±0.75	46.41±0.59	47.45±0.63	48.91±0.98	46.94±0.65^{B}
60	47.95±1.19	49.05±0.78	49.84±0.85	50.02±0.87	49.21±0.91^{A}
Overall mean	46.73±1.12^{c}	48.12±0.43^{b}	48.89±0.56^{ab}	49.59±0.95^{a}	
Shell thickness (mm)					
50	0.353±0.008	0.393±0.008	0.387±0.007	0.408±0.009	0.385±0.008^{B}
55	0.372±0.006	0.394±0.003	0.417±0.009	0.427±0.006	0.403±0.005^{A}
60	0.365±0.005	0.390±0.005	0.405±0.007	0.429±0.007	0.397±0.006^{AB}
Overall mean	0.363±0.005^{c}	0.392±0.006^{b}	0.403±0.007^{b}	0.421±0.007^{a}	
Yolk selenium (ppm)					
50	0.210±0.037	0.348±0.055	0.302±0.021	0.385±0.062	0.311±0.025^{B}
55	0.276±0.052	0.450±0.018	0.426±0.017	0.554±0.045	0.426±0.037^{A}
60	0.279±0.035	0.467±0.035	0.441±0.025	0.534±0.047	0.430±0.020^{A}
Overall mean	0.255±0.033^{c}	0.390±0.025^{b}	0.421±0.019^{b}	0.491±0.030^{a}	
Albumen selenium (ppm)					
50	0.101±0.009	0.180±0.014	0.181±0.007	0.185±0.004	0.162±0.006^{B}
55	0.096±0.005	0.194±0.007	0.197±0.006	0.202±0.007	0.172±0.006^{AB}
60	0.105±0.014	0.195±0.007	0.197±0.005	0.211±0.010	0.177±0.009^{A}
Overall mean	0.101±0.008^{b}	0.190±0.006^{a}	0.192±0.004^{a}	0.199±0.003^{a}	

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 5: Effect of organic selenium (Sel-Plex™) supplementation on semen physical properties at different ages (Means ± SE).

Age (wks)	control	Se 0.1	Se 0.2	Se 0.3	Overall mean
Ejaculate volume (ml)					
44	0.196±0.023	.392±0.200	0.403±0.035	0.429±0.025	0.355±0.021
48	0.199±0.014	0.400±0.028	0.399±0.30	0.426±0.024	0.356±0.030
52	0.202±0.022	0.389±0.025	0.393±0.027	0.408±0.031	0.348±0.035
56	0.198±0.021	0.385±0.027	0.381±0.038	0.400±0.025	0.341±0.031
60	0.230±0.021	0.393±0.037	0.395±0.034	0.392±0.034	0.346±0.029
Overall mean	0.200±0.020^{c}	0.392±0.035^{b}	0.394±0.029^{b}	0.411±0.022^{a}	
Advanced motility (%)					
44	85.0±1.29	88.5±1.67	92.0±1.11	93.0±1.10	89.6±2.00
48	84.5±1.57	88.5±1.83	91.5±1.67	93.0±1.11	89.4±1.33
52	82.5±1.57	88.5±1.50	91.0±1.45	92.0±1.33	88.5±1.61
56	82.0±2.00	87.5±2.01	90.7±1.61	92.0±1.33	88.1±1.07
60	81.5±1.83	90.0±1.29	90.0±1.29	91.5±1.07	87.6±2.01
Overall mean	83.1±1.57^{c}	88.3±1.67^{b}	91.0±1.11^{a}	92.0±1.33^{a}	
Alive sperm (%)					
44	87.5±1.44	90.5±1.41	92.0±1.02	92.1±0.92	89.3±1.00
48	86.8±1.00	90.0±0.87	91.3±0.36	92.1±0.46	90.0±0.80
52	85.4±0.79	89.7±0.91	91.1±0.50	91.9±0.84	89.5±0.64
56	84.1±0.74	89.3±0.91	90.9±0.43	91.6±0.50	89.0±0.53
60	85.2±0.51	88.7±0.60	90.4±0.43	91.7±1.10	89.0±0.60
Overall mean	84.8±0.50^{c}	89.6±0.65^{b}	91.3±0.75^{a}	91.9±0.71^{a}	
Sperm concentration($10^{6}/mm^{3}$)					
44	1.88±0.11	2.04±0.06	2.66±0.16	2.73±0.10	2.33±0.11^{B}
48	1.93±0.04	2.08±0.07	2.63±0.18	2.77±0.13	2.36±0.09^{B}
52	1.99±0.17	2.56±0.17	2.26±0.21	2.89±0.25	2.43±0.17^{B}
56	2.03±0.08	2.83±0.10	2.92±0.04	3.02±0.09	2.70±0.07^{A}
60	2.07±0.05	2.92±0.07	2.98±0.04	3.12±0.16	2.77±0.04^{A}
Overall mean	1.98±0.05^{d}	2.49±0.09^{c}	2.69±0.11^{b}	2.91±0.09^{a}	

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 6: Blood biochemical and hematological parameters at 60 weeks of age of Bandarah local chickens fed organic selenium (Sel-Plex™) (Means ± SE).

Items	control	Se 0.1	Se 0.2	Se 0.3
		females		
Total protein (g/dl)	3.73±0.14^{b}	4.24±0.30^{ab}	4.84±0.31^{a}	4.93±0.30^{a}
Albumin (g/dl)	1.49±0.08	1.96±0.17	1.77±0.15	1.60±0.24
Globulin (g/dl)	2.24±0.17^{b}	2.28±0.27^{b}	3.07±0.28^{a}	3.33±0.29^{a}
Glutathione peroxidase (mu/ml)	8.64±2.16^{b}	15.98±2.16^{a}	17.29±2.16^{a}	25.94±3.74^{a}
Selenium (mg / l)	0.055±0.006^{b}	0.078±0.007^{a}	0.076±0.005^{a}	0.086±0.003^{a}
Triiodotherionine (ng /dl)	131.61±6.16^{b}	145.32±9.11^{a}	147.90±8.23^{a}	148.80±7.32^{a}
Thyroxine (µg /dl)	1.72±0.34	1.75±0.42	1.79±0.41	1.83±0.52
Hb (g /dl)	11.17±0.33^{b}	13.67±0.55^{a}	13.28±0.75^{a}	13.77±0.53^{a}
WBC (10^3/ ml)	9.93±0.84^{b}	14.43±1.37^{a}	14.83±0.95^{a}	14.90±1.46^{a}
RBC 10^6/ml)	2.05±0.35^{b}	3.68±0.29^{a}	3.75±0.36^{a}	3.88±0.38^{a}
		males		
Total protein (g/dl)	3.96±0.16^{b}	4.06±0.15^{b}	4.66±0.16^{a}	4.86±0.13^{a}
Albumin (g/dl)	1.79±0.19	1.96±0.13	1.72±0.06	1.79±0.20
Globulin (g/dl)	2.16±0.16^{b}	2.10±0.18^{b}	2.95±0.19^{a}	3.07±0.09^{a}
Glutathione peroxidase (mu/ml)	10.13±2.16^{c}	17.29±5.72^{b}	21.61±5.71^{ab}	34.58±10.81^{a}
Selenium (mg / l)	0.052±0.006^{b}	0.076±0.005^{a}	0.079±0.005^{a}	0.081±0.005^{a}
Triiodotherionine (ng /dl)	132.21±5.36^{b}	146.62±8.12^{a}	148.13±7.61^{a}	149.25±8.33^{a}
Thyroxine (µg /dl)	1.83±0.52	1.84±0.49	1.85±0.62	1.88±0.59
Hb (g /dl)	11.65±0.59^{b}	13.87±0.51^{a}	13.53±0.60^{a}	13.72±0.36^{a}
WBC (10^3/ ml)	11.25±0.74^{b}	14.72±0.81^{a}	14.72±0.81^{a}	15.85±1.05^{a}
RBC 10^6/ml)	2.41±0.33^{b}	3.80±0.33^{a}	3.78±0.40^{a}	3.93±0.39^{a}

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

Table 7: Fertility and hatchability percentages and hatched chick weight of Bandarah chickens fed diets supplemented with organic selenium (Sel-Plex™) (Means ± SE).

Items	control	Se 0.1	Se 0.2	Se 0.3
Fertility (%)	86.20±0.30^{b}	91.40±0.60^{a}	92.65±0.85^{a}	94.40±1.10^{a}
Hatchability (%)	88.90±1.00^{b}	93.15±0.25^{a}	94.65±0.55^{a}	94.90±0.30^{a}
Hatched chick weight (g)	34.27±0.30^{b}	34.70±0.25^{b}	34.99±0.29^{ab}	35.63±0.28^{a}

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

Table 8: Relative weight of some organs at 60 weeks of age in Bandarah chickens fed diets supplemented with organic selenium (Sel-Plex™) (Means ± SE).

Relative weight (%)	control	Se 0.1	Se 0.2	Se 0.3
Females				
Ovary	0.204± 0.017[b]	0.405± 0.054[a]	0.342±0.022[a]	0.355±0.010[a]
Spleen	0.109± 0.006[b]	0.165± 0.013[a]	0.148±0.007[a]	0.139±0.006[a]
Thymus	0.091± 0.003[b]	0.129± 0.009[a]	0.130±0.006[a]	0.144±0.004[a]
thyroid	0.029± 0.005[b]	0.046± 0.004[a]	0.048±0.004[a]	0.053±0.004[a]
Males				
Testes	0.93± 0.084[c]	1.07± 0.019[bc]	1.31± 0.083[b]	1.63± 0.203[a]
Spleen	0.107± 0.017[b]	0.151± 0.007[a]	0.145± 0.003[a]	0.161± 0.014[a]
Thymus	0.099± 0.005[b]	0.129± 0.007[a]	0.130± 0.008[a]	0.135± 0.007[a]
throid	0.032± 0.004[b]	0.045± 0.003[a]	0.046± 0.004[a]	0.054± 0.004[a]

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

REFERENCES

Agate, D.D.; O'Dea, E.E. and Rustad, M.E. 2000. *Effects of dietary selenium on laying hen fertility as assessed by the periviteline sperm hole assay. Proceedings of the Poultry Research and Production Symposium, Alberta Poultry Research Centre, pp. 1-4.*

Allan,C.B., Lacourciere, G. M. and Stadtman, T. C. 1999. *Responsivenessof selenoproteins to dietary selenium. Annu. Rev. Nutr. 19:1–16.*

Atlavin, A.B. and Apsite, M. R.2001. *Biological role of selenium in poultry nutrition. Poult. Sci. 80:744.*

Arpasova, H.; Weis, J.; Hascik, P. and Kacaniova, M. 2009. *The effects of sodium selenite and selenized yeast supplementation into diet for laying hens on selected qualitative parameters of table eggs. Lucrări ştiinţifice Zootehnie şi Biotehnologii, vol. 42:408-414.*

Blood, D. C.; Radostits, O. M. and Gay, C. C. 1995. *Veterinary Medicine, A textbook of the diseases of cattle, sheep, pigs, goats and horses. 8 th Ed. ELBS., pp:1412-1416.*

Brown, M. W., and Watkinson, J. H. 1977. *An automated fluorimetric method for the determination of nanogram quantities of selenium. Anal. Chim. Acta 89:29–35.*

Cantor, A. H. and Scott, M. L. 1974. *The effect of selenium in the hen's diet on egg production, hatchability, performance of progeny and selenium concentration in eggs. Poult. Sci. 53:1870–1880.*

Cantor, A. H.; Moorehead, P. D. and Musser, M. A. 1982. *Comparative effects of sodium selenite and selenomethionine upon nutritional muscular dystrophy, selenium-dependent glutathione peroxidase, and tissue selenium concentrations of turkey poults. Poult. Sci. 61:478–484.*

Cantor, A. H.; Scott, M. L. and Noguchi, T. 1975a. *Biological availability of selenium in feedstuffs and selenium compounds for prevention of exudative diathesis in chicks. J. Nutr. 105:96–105.*

Cantor, A. H.; Scott, M. L. and Noguchi T. 1975b. *Efficacy of selenium in selenium compounds and feedstuffs for prevention of pancreatic fibrosis in chicks. J. Nutr. 105:106–111.*

Cantor, A. H.; Straw, M. L.; Ford, M. J.; Pescatore, A. J. and Dunlap, M. K. 2000. *Effect of feeding organic selenium in diets of laying hens on egg selenium content. Page 473 in Egg Nutrition and Biotechnology. J. S. Sim, S. Nakai, and W. Guenter, ed. CABI Publishing, New York, NY.*

Chang, W. P.; Marsh, J. A.; Dietert, R. R. and Combs, G. H. 1990. *The effect of dietary vitamin E and selenium deficiencies on chicken lymphocyte surface marker expression and proliferation. Proc.5 th Intl.Conf. Avian Immunol., Philadelphia, USA., pp:238:333-334.*

Combs, G. F. Jr. 1994. *Clinical implications of selenium and vitamin E in poultry nutrition. Vet. Clin. Nutr. 1:133–140.*

Combs, G. F. Jr. and Combs, S. B. 1986. *The Role of Selenium Combs, G. F., Jr. 1994. Clinical implications of selenium and vitamin E in poultry nutrition. Vet. Clin. Nutr. 1:133–140.*

Davis, R. H.; Fear, J. and Winton, A. C. 1996. *Interactions between dietary selenium, copper, and sodium nitroprusside, a source of cyanide in growing chicks and laying hens. Br. Poult. Sci. 37:87–94.*

Davtyan, D.; Papazyan, T. and Nollet, L. 2006. *Dose response of Se added as sodiumselenite or Sel-Plex on male sperm quality and breeder productivity. XII European Poultry Conference, Verona, Italy, 10-14 September.*

Duncan, D. B. 1955. *Multiple range and multiple F- test, Biometrics 11:1-42.*

Dvorska, J. E.; Yaroshenko, F. A.; Surai, P. F. and Sparks, N. H. C. 2003. *Selenium-enriched eggs: Quality evaluation. Pages 23–24 in Proc. 14th European Symp. Poult. Nutr. World's Poultry Science Association, Lillehammer, Norway.*

Echevarria, M. G.; Henry, P. R.; Ammerman, C. B.; Rao, P. V. and Miles, R. D. 1988. *Estimation of the relative bioavailability of inorganic selenium sources for poultry. 2. Tissue uptake of selenium from high dietary selenium concentrations. Poult. Sci. 67:1585–1592.*

Edens, F.W., 2001. *Involvement of Sel-Plex in physiological stability and performance of broiler chickens. In: T.P. Lyons and K.A. Jacques (Eds.), Science and Technology in the Feed Industry. Nottingham University Press, Nottingham NG 110 AX, United Kingdom. Proc. 17th Alltech Ann. Sympos., 17: 349-376.*

Edens, F.W. 2002. *Practical applications for selenomethionine: broiler breeder reproduction. In: Nutritional Biochemistry in the Feed and Food Industries, Proceedings of Alltech's 18th Annual Symposium (K.A. Jacques and T.P. Lyons, eds). Nottingham University Press, UK, pp. 29-42.*

Edens, F.W. and Gowdy, K.M. 2005. *Involvement of the thioredoxin reductase system in the maintenance of cellular redox status. In: T.P. Lyons and K.A. Jacques (Eds.), Nutritional Biotechnology in the Food and Feed Industry. Nottingham University Press, Nottingham, United Kingdom. Proc. 20th Alltech Ann. Sympos., 20: 369-382.*

Edens, F. W.; Parkhurst, C. R.; Havenstein,G. B. and Sefton, A. E. 2001. *Housing and selenium influences on feathering on broilers. J. Appl. Poult. Res. 10:128–134.*

Flohe, L. and Zimmermann, R. 1970. *The role of GSH peroxidase in protecting the membrane of rate liver mitochondria. Biochim. Bio. Acta 223:210- 213.*

Freeman, B. M. and Vince, M. A. 1974. *In: Development of the avian embryo. Champman and Hall, London, UK, pp. 249-260.*

Hegazy S. M. and Adachi, Y. 2000. *Comparison of the effects of dietary selenium, zinc, and selenium and zinc supplementation on growth and immune response between chick groups that were inoculated with Salmonella and aflatoxin or Salmonella. Poult. Sci. 78:331-335.*

Hussain, M. I.; Khan, S. A.; Chaudhary, Z. I.; Aslam, A.; Ashraf, K. and Rai, M. F. 2004. *Effect of organic and inorganic selenium with and without vitamin E on immune system of broilers. Pakistan Vet. J. 24: 1-4.*

Kenyon, S.; Spring, P. and Tucker, L. 2003. *Egg selenium Concentrations in breeder hens fed diets with selenium derived from different sources. pp 1060-1063 in Proc. 16th Eur. Symp. on the Quality of Egg Poultry Meat and 10th Eur. Symp. on the Quality of Egg and Egg Products, Saint Brieuc, France.*

Khan, S. A.; Iqbal, M. and Ashraf, S. K. 1993. *Poultry industry in Pakistan. Agro. Vet. News, 5: 9.*

Kim Y.Y. and Mahan D.C. 2003. *Biological aspects of selenium in farm animals. Asian-Australas. J. Anim. Sci., 16, 435–444.*

Klecker D.; Zantlokaul, M. and Zeaman, L. 2001. *Effect of organic selenium, zink and manganese on reproductive traits of laying hens and cockerels on the quality parameters of eggs. Proceedings of the 13th European Symposiumon Poultry Nutrition, Blankenberge, Belgium, October 2001.*

Klecker, D.; Zeman, L.; Bunesˇovaˊ, A. and isˇke, V. Sˇ. 1999. *Effect of organic selenium, zinc, and manganese on reproductive traits of laying hens and cockerels. Pages 183-185 in: Eggs and Egg Products Quality. Proceedings of 8th European Symposium on the Quality of Eggs and Egg Products. World's Poult. Sci. Assoc., Bologna, Italy.*

Mahmoud, K. Z. and Edens, F.W. 2003. *Influence of selenium sources on agerelated and mild heat stress-related changes of blood and liver glutathione redox cycle in broiler chickens (Gallus domesticus). Comp Biochem Physiol B Biochem Mol Biol. 136: 921-34.*

March, I. A.; Combs, G.H; Whitacre, M. E. and Dietert, R. R. 1986. *Effect of selenium and vitamin E dietary deficiencies on chick lymphoid organ development.Proc.Soc.Exp. Biol. Med. 182:425-436.*

March, I. A.; Dietert, R. R. and Combs, G. H. 1987. *Effects of dietary selenium and vitamin E deficiencies in the chicken. Proc.2 nd Intl.Conf. Avian Immunol., Philadelphia, USA., pp:238:333-345.*

National Research Council. 1994. *Nutrient Requirements of Poultry. 9th rev. ed. National Academy Press, Washington, DC.*

Niu, Z.,Y.; Liu, F. Z.; Yan, Q. L. and Li, L. 2009. *Effects of different levels of selenium on growth performance and immunocompetence of broilers under heat stress. Archives of Animal Nutrition 63: 56-65.*

Ort, J. F., and Latshaw, J. D. 1978. *The toxic level of sodium selenite in the diet of laying chickens. J. Nutr. 108:1114–1120.*

Pappas, A. C.; Acamovic, T.; Sparks, N. H. C.; Surai, P. F. and McDevitt, R. M. 2005. *Effects of Supplementing Broiler Breeder Diets with Organic Selenium and Polyunsaturated Fatty Acids on Egg Quality During Storage. Poult. Sci. 84:865–874.*

Pappas, A. C.; Acamovic, T.; Sparks, N. H. C.; Surai, P. F. and McDevitt, R. M. 2006. *Maternal organo-selenium compounds and polyunsaturated fatty acids affect progeny performance and levels of selenium and docosahexaenoic acid in the chick tissues. Poult. Sci. 84:1610-1620.*

Patton, N. D. 2000. *Organic selenium in the nutrition of laying hens: Effects on egg selenium content, egg quality and transfer to developing chick embryos. Ph. D. Diss., Univ. Kentucky, Lexington, KY.*

Payne, R. L.; Lavergne, T. K. and Southern, L. L. 2005. *Effect of inorganic versus organic selenium on hen production and selenium concentration. Poult. Sci. 84:232–237.*

Petrosyan, A.; Papazyan, T. and Nollet, L. 2006. *Administration of Se as Sel-Plex on top of Sodiumselenite still improves fertility of hatchability Of a broiler breeder flock. XII European Poultry Conference, Verona, Italy, 10-14 September.*

Renema, R.A. 2004. *Reproductive responses to Sel-Plex® organic selenium in male and female broiler breeders: impact on production traits and hatchability. In: Bnutritional Biotechnology in the Feed and Food Industries. Proceedings of 20th Alltech's Annual Symposium, Edited by Lyons, T.P. and. Jacques, K.A., 'Nottingham University Press, Nottingham, UK, pp. 81-91.*

Renema, R. A. 2006. *Creating the ideal hatching egg: quality, efficiency and fertility. Nutritional biotechnology in the feed and food industries: Proceedings of Alltech's 22nd Annual Symposium, Lexington, Kentucky, USA, 23-26 April 2006.*

Richter, G.; Leiterer, M.; Kirmse, R.; Ochrimenko, W. I. and Arnhold W. 2006. *Comparative investigation of dietary supplements of organic and inorganic bounded selenium in laying hens. Tieraerztliche Umschau 61: 155.*

Rotruck, J. T.; Pope, A. L.; Ganther, H. E.; Swanson, A. B.; Hafeman, D. G. and Hoekstra, W. G. 1973. *Selenium: biochemical role as a component of glutathione peroxidase. Science 179:588–590.*

Rutz, F.; Pan, E. A.; Xavier, G. B. and Anciuti, M. A. 2003. *Meeting selenium demands of modern poultry: responses to Sel-Plex™ organic selenium in broiler and breeder diets, Nutritional Biotechnology in the Feed and Food Industries. Proceedings of 19th Alltech's Annual Symposium, Nottingham University Press, Nottingham, UK, p.147 – 161.*

Rutz, F.; Anciuti, M. A.; Rech, J. L. and Xavier, E. G. 2005. *Following response to Sel-Plex® and other organic minerals through the broiler breeder maze: case studies in Brazil. In: Nutritional Biotechnology in the Feed and Food Industries: Proceedings of Alltech's 21st Annual Symposium (T.P. Lyons and K.A. Jacques, eds). Nottingham University Press, UK, pp. 55-66.*

Sahin, N.; Onderci, M.; Sahin, K. and Kucuk., O. 2008. *Supplementation with organic or inorganic selenium in heat-distressed quail. Biological Trace Element Research 122:229-237.*

Sara, A.; Bennea, M.; Odagiu, A. and Pantă, L. 2008. *Effects of the organic selenium (Sel-Plex) administered in laying hens' feed in second laying phase on production performances and the eggs quality. Bulletin UASVM Animal Science and Biotechnologies, 65:1-2.*

SAS Institute. 1996. *SAS User's Guide. Release 6.12 Edition: SAS institute Inc., Cary, NC.*

Sefton, A.E. and Edens, F.W. 2004. *Sel-Plex improves broiler breeder performance. Book of Abstracts XXII World's Poultry Congress, 8-13 June, 2004, Istanbul, Turkey, p.257.*

Sevcikova, S.; Skrivan, M.; Dlouha, G. and Koucky, M. 2006. *The effect of selenium source on the performance and meat quality of broiler chickens. Czech J. Anim. Sci. 51: 449–457.*

Simon, S. 2004. *Alltech symposium highlights .World Poult. 20 :12-13.*

Skrivan, M.; Dlouha, G.; Masata, O. and Sevcikova, S. 2008. *Effect of dietary selenium on lipid oxidation, selenium and vitamin E content in the meat of broiler chickens. Czech Journal of Animal Science 53: 306-311.*

Spears, J. W.; Grimes, J.; Lloyd, K. and Ward, T. L. 2003. *Efficacy of a novel organic selenium compound (zinc-l-selenomethionine, Availa Se) in broiler chicks. Pages 197–198 in Proceedings of the 1st Latin American Congress of Animal Nutrition, .Mexico ‹Cancun.*

Srimongkol, C. 2003. *Effects of Selenium Supplementation on Growth Performance, Thyroid Hormone (T_3) Levels, antioxidant Enzyme and disaccharidase activities in broiler chicks. Thesis M.Sc. Chulalongkorn University.*

Spring, P .2006. *Poultry health through nutrition. World Poultry 22:26-29.*

Stanley, V. G.; Krueger, W. F. and Sefton, A. E. 2004. *Single and combined effects of yeast cell wall residue and Sel-Plex® on production and egg quality of laying hens. Poult. Sci. 83:200.*

Sunde, R.A. 1997. *Selenium. Page 493 in Handbook of Nutritionally Essential Mineral Elements. B. L.O'Dell and R. A. Sunde, ed. Marcel Dekker, Inc., New York.*

Surai, P.F. 1999. *Tissue-specific changes in the activities of antioxidant enzymes during the development of the chicken embryo. Brit. Poult. Sci.40:397-405.*

Surai, P.F. 2000. *Organic selenium: benefits to animals and humans, a biochemist's view. In: Biotechnology in the Feed Industry, Proceedings of Alltech's 16th Annual Symposium (K.A. Jacques and T.P. Lyons, eds). Nottingham University Press, UK, pp. 205-260.*

Surai, P.F. 2002. *Selenium in poultry nutrition 2. Reproduction, egg and meat quality and practical applications. World's Poult. Sci. 58:431-450.*

Surai, P.F. and Sparks, N.H.C. 2001. *Comparative evaluation of the effect of two maternal diets on fatty acid, vitamin E and carotenoid in the chick embryo. Brit. Poult. Sci. 42:252-259.*

Surai, P.F.; Ionov, I.; Kuklenko, T.; Kostjuk, I.; MacPherson, A.; Speake, B.; Noble, R. and Sparks, N.H.C.. 1998. *Effect of supplementing the hen's diet with vitamin A on the accumulation of vitamins A and E, ascorbic acid and carotenoids in the egg yolk and in the embryonic liver. Brit. Poult. Sci. 39:257-263.*

Swanson, C. A. 1987. *Comparative utilization of selenite, selenomethionine, and selenized yeast by the laying hen. Nutr. Res. 7:529–537.*

Utterback, P. L.; Parsons, C. M.; Yoon, I. and Butler, J. 2005. *Effect of supplementing selenium yeast in diets of laying hens on egg selenium content, Poult. Sci., 84: 1900-1901.*

Wakebe, M. 1998. *Feed for chicken and for hen. Japanese Patent Office, Patent number JP10023864A2. Jan 27.*

Yaroshenko F.A.; Dvorska, J. E.; Surai, P. F. and Sparks, N.H.C. 2003. *Selenium/ vitamin E enriched eggs: nutritional quality and stability during storage. Poster presented at Alltech's 19th Annual Symposium on Nutritional Biotechnology in the Feed and Food Industries, Lexington, Ky, May 12- 14,.ROM -CD.*

الملخص العر بى

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

١- تأثير أضافة السيلنيوم العضوى(سلبلكس) على الصفات الانتاجية و التناسلية و الفسيولوجية لسلالة البندرة المحلية

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أجريت هذه التجربة لدراسة تأثير أضافة السيلنيوم العضوى (سلبلكس) فى الغذاءعلى الصفات الانتاجية و التناسلية و الفسيولوجية لدجاج البندرة المحلى من عمر ٤٠ حتى ٦٠ أسبوع . حيث أستخدم ١٦٠ أنثى و ٤٠ ديك عمر ٤٠ أسبوع قسمت عشوائيا إلى أربعة مجموعات متساوية (٤٠ أنثى و ١٠ ديوك فى كل مجموعة). غذيت كل من الاناث والذكور على الغذاء الاساسى مضاف اليه صفر ، ١، ٢، ٣، ملجم سيلنيوم / كجم غذاء فى شكل السلبلكس. و أوضحت النتائج التى تم الحصول عليها بان وزن الجسم الحى أزداد معنويا فى اناث و ذكور البندرة المغذاه على السيلنيوم بينما لا يوجد تأثير معنوى على الغذاء المستهلك. و أن وزن الجسم فى الاناث ازداد معنويا مع زيادة عمر الدجاج بينما لا يوجد تأثير معنوى على الغذاء المستهلك بزيادة عمر الطيور.و وجد أن النسبة المنوية لانتاج البيض ووزن البيضة و صفات جودة البيض(التى تتضمن وحدة هيو و معامل الصفار و سمك القشرة) ومحتوى السيلنيوم فى الصفار و البياض أزدادت معنويا فى الاناث المغذاة على السيلنيوم مقارنة بمجموعة المقارنة ، و أن كل الصفات السابقة تأثرت معنويا بعمر الدجاج. كما أزدادت معنويا حجم القذفة للسائل المنوى و الحركة التقدمية و عدد الحيوانات المنوية الحية و تركيز الحيوانات المنوية فى الديوك المغذاه على السيلنيوم و ان هذه الصفات لم تتأثر معنويا بزيادة عمر الديوك باستثناء تركيز الحيوانات المنوية فى الديوك الذى أزداد معنويا عند عمر ٥٦ و ٦٠ أسبوع. كما وجد أن أضافة السيلنيوم بالمستويين ٢ ، ٣ , ملجم فى غذاء الاناث و الذكور أدت إلى زيادة معنوية لتركيز البروتين الكلى و الجلوبيولين و الجلوتاثيون بيروكسيديز و السيلنيوم والتراىايودوثريونين و الهيموجلوبين و كرات الدم الحمراء و البيضاء بينما لم يلاحظ أى تأثير معنوى على تركيز الألبيومين وهرمون الثيروكسين فى السيرم. كما وجد أن النسبة المنوية للخصوبة و الفقس أزدادت معنويا أيضا فى المجموعات المغذاه على السيلنيوم بينما وزن الكتاكيت الفاقسة أزداد معنويا مع المستوى لعالى من السيلنيوم.

و بذلك توضح هذه النتائج أن أضافة السيلنيوم العضوى (سلبلكس) فى الغذاء يحسن الصفات لانتاجية و التناسلية و الفسيولوجية فى أناث و ذكور سلالة البندرة المحلية.