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Effect of Dietary Organic Selenium Supplement on Growth and Reproductive Performance of Japanase Quail Breeders and Their Progeny and its Relation to Antioxidation and Thyroid Activity

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Abstract: This study was conducted to investigate the effect of dietary maternal Se supplementation on performance of Japanese quail breeders and some physiological traits of their progeny. A total of 240 Japanese quail breeders were used in this study, they divided into two ages, young (16 wk old) and old ages (40 wk old). Each age was distributed into 4 groups, 30 birds in each group, each one included two replicates of 15 birds (11 females and 4 males). All groups were fed the same diet supplemented with 0.0, 0.3, 0.5 or 1 mg selenium yeast (Sel-Plex)/kg feed. The experiment lasted 8 weeks. After hatching, all chicks were fed *ad libitum* on the basal diet during the whole period. Results indicated that the fertility and hatchability percentages were significantly increased by increasing dietary Se level, fertility and hatchability decreased for breeder hens when the age of birds increased. Se concentration in the egg yolk increased by increasing the dietary Se levels, but deposition of Se in egg yolk decreased in old hens. Concerning the progeny, the results showed that as Se level in maternal diets increased body weight gain (BWG) of their progeny increased, by the way BWG of chicks from young birds were higher than those from old age. Significant improvement in feed conversion for progeny was noted by adding Se in maternal diets especially young birds. Increasing Se in maternal diet significantly also increase triiodothyronine (T3), insulin-like Growth factor-1 (IGF-1) and Glutathione peroxidase (GPx) levels in young hens progeny. Plasma thyroxin (T4) levels were higher in chicks produced from control group compared to those of Se-treatment group. The ratios between plasma T4:T3 showed that Se-treatment facilitated the conversion of T4 to T3. It could be concluded that Japanese quail breeders, young age birds were more efficiently for using dietary selenium. Moreover, the maternal Se-supplementation improved performance and antioxidant status of their progeny for several days after hatching.

Key words: Organic selenium, age effect, maternal effect, Thyroid hormones, Glutathione peroxidase, insulin-like Growth factor-1

INTRODUCTION

Selenium (Se) has been recognized in laying hens as an essential nutrient required for normal growth, maintenance of health and physiological functions. Se is present in glutathione peroxidase (GPx) as a constituent of the amino acid selenocysteine, located at the active site of the enzyme where it plays a pivotal role in a redox reaction (Hatfield and Gladyshev, 2002). The GPx families of enzymes are crucial players in the integrated antioxidant system, neutralizing potential threats to the integrity of cellular macromolecules by eliminating hydrogen peroxide and detoxifying lipid hydroperoxides (Brigelius-Flohe, 1999). Se derived from the diet of the female bird is deposited in the egg and is distributed among the developing tissues during embryogenesis (Gaal *et al*., 1995; Surai, 2000; Patton *et al*., 2002). Consequently, GPx is expressed in the chicken embryo tissue and stage-specific manner (Surai, 1999). Supplementary Se in hen diet was shown to increase the concentration of this element in the egg and in the tissues of the chick at hatch and to elevate the expression of GPx, while reducing the generation of lipid peroxides in the liver of the day-old chick.

Chick embryo tissues contain a high proportion of highly polyunsaturated fatty acids in the lipid fraction and therefore need antioxidant defence. It is well accepted that maternal diet composition is a major determinant of antioxidant system development during embryogenesis and in early postnatal development (Surai, 2006). During embryonic development, antioxidants are absorbed from the yolk and also from the albumen in the case of Se and distributed among the differentiating tissues. However, the beneficial effects of egg derived antioxidants do not necessarily stop when the chick hatches since these compounds may be retained to varying extents in the tissues of the chick for several

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days after it emerges from its shell (Surai, 2000; Karadas *et al.*, 2005). Moreover, selenium has been implicated as a factor affecting male fertility of poultry. Selenium supplementation increases the hatchability of fertile eggs and number of hatched chicks (Davtyan *et al.*, 2006; 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.

Jensen *et al.* (1986) observed that dietary Se affects thyroid hormone metabolism and it was then observed by Beckett *et al.* (1987) that plasma 3, 5, 3' - triiodothyronine (T3) is produced by 5'-deiodination of thyroxine (T4) in non-thyroidal tissues, particularly the liver and kidney. The reaction is catalyzed by type I iodothyronine deiodinase (5'-ID) (Beckett *et al.*, 1992), which was verified as being a selenoenzyme. It has been reported that Se deficiency alters both thyroid hormone synthesis in the thyroid gland and the activity of tissue specific 5'-ID in rats (Kohrle *et al.*, 1992). Hepatic 5'-ID activity in the Se deficient rat is 10-fold lower than that of the Se supplemented rat (Beckett *et al.*, 1992) and plasma T3 concentration is significantly lower than that of the normal rat (Beckett *et al.*, 1987). On the other hand, Arthur and Beckett (1994) reported that the 5'-ID activity in the thyroid of Se-deficient rats is four times greater than in Se-sufficient rats. It is well documented that the thyroid hormones play important roles in growth and protein turnover (Hayashi *et al.*, 1991; Hayashi, 1993), therefore, Se deficiency might affect protein turnover followed by growth retardation, as T3 production is impaired.

Therefore, the present study was designed to investigate the effects of organic selenium (Sel-Plex) supplementation in Japanese quail breeder diets on their productive and reproductive performance and transfer effect to the progeny.

MATERIALS AND METHODS

This study was carried out in Quail Production Unit, Agricultural Experiment and Research Station at Shalakan, Faculty of Agriculture, Ain Shams University. This work was designed to investigate the response of Japanese quail breeder and their progeny to dietary organic Se (Sel-Plex) supplements on some productive and reproductive performance and some physiological aspects.

A total of 240 Japanese quail breeders (Coturnix coturnix japonica) were used in this study, in which divided into two ages, young (16 weeks) and old ages (40 weeks). Each age was distributed into 4 groups, 30 birds in each group, each one included two replicates of 15 birds (11 females and 4 males). All groups were fed basal diet supplemented with 0.0, 0.3, 0.5 or 1 mg selenium yeast (Sel-Plex)/kg feed. The experiment lasted 8 weeks. The experimental groups were fed on one of the following diets:

T1: 0.0 mg/kg SY + Young age (control 1)
T2: 0.0 mg/kg SY + Old age (control 2)
T3: 0.3 mg/kg SY + Young age
T4: 0.3 mg/kg SY + Old age
T5: 0.5 mg/kg SY + Young age
T6: 0.5 mg/kg SY + Old age
T7: 1 mg/kg SY + Young age
T8: 1 mg/kg SY + Old age

Birds were kept in an individual wire cages system (18x18 cm) with a sloping floor for egg collection. All birds were kept in a windowed house and fed *ad libitum* on a diet which was formulated to meet the nutrient requirements of Japanese quail breeders according to NRC (1994) (Table 1). Drinking water was available all the time. Birds were exposed to a light cycle of 16 h light and 8 h dark throughout the experimental period. Individual egg weight and egg number were recorded daily through 8 wks of experimental period. After 8 weeks, three eggs from each treatment were collected for measure Se contents of the yolk to study the effects of maternal supplementation on the Se status of the progeny. Eggs collected from each treatment (120 eggs) at the end of the experiment for incubation at 37.5°C and 55% relative humidity in a commercial incubator with automatic egg turning. After hatching; percentages of fertility and hatchability (as a percent of fertile eggs) were recorded.

Selenium determination: Se was determined by Atomic Absorption Spectrometer (AAS)-Graphite system, Solaar $MQZ_{environmental}$, Thermo Electron Corporation, USA. 1000 mg/L selenium certified standard solution; Merck, Germany was used as stock solution for instrument calibration and the result is confirmed by Inductively Coupled Argon Plasma, iCAP 6500 Duo, Thermo Scientific, England. 1000 mg/L multi-element certified standard solution, Merck, Germany was used as stock solution for instrument standardization. Samples were digested by microwave digestion (1 gm sample+6 ml HNO_3+ H_2O_2 and diluted to 10 ml with deionized water). After hatching, all chicks produced were fed *ad libitum* on the basal diet yduring the whole period. The basal diet was formulated to cover the recommended requirements of Japanese quail birds during the growing period according to NRC (1994) (Table 2). Chicks were individually weighed at hatch and then weekly till five weeks of age. Live body weights (LBWs) were recorded to the nearest 0.1 g and the average body weight gain (BWG) was calculated by subtracting the average of initial body weight of the birds in a certain stage from the final one in the same stage. Feed conversion ratio (FCR) was calculated as feed

Table 1: Composition and calculated analyses of the basal diets for laying birds

Ingredients, (%)	Laying diet
Yellow corn	55.60
Soybean meal (48%)	25.20
Corn gluten meal (62%)	4.30
Sunflower oil	0.00
Wheat bran	5.50
Di-Ca-P	1.50
Limestone	7.00
Premix*	0.30
NaCl (salt)	0.25
L-lysine-HCL	0.10
DL-Methionine	0.15
Mold guard	0.10
Total	100
Calculated analyses**	
ME (kcal/kg)	29.60
Crude protein (%)	20.35
Crude fiber (%)	2.86
Ether extract (%)	2.75
Calcium (%)	3.07
Available P (%)	0.38
Lysine (%)	1.06
Methionine (%)	0.49
Methionine+cystine (%)	0.81

*Each 3 Kg contains: vit A 10000000 IU, vit D_3 2500000 IU, vit E 40000 mg, vit K_3 6000 mg, vit B_1 3000 mg, vit B_2 15000 mg, vit B_6 5000 mg, vit B_{12} 30 mg, Niacin 60000 mg, Folic 3000 mg, Biotin 3000 mg, Pantothenic acid 20000 mg, Copper 20 g, Iodine 2 g, Selenium 0.00 g, Iron 80 g, Manganese 120 g, Zinc 70 g, Cobalt 0.25 g. **Calculated from NRC (1994)

Table 2: Composition and calculated analyses of the basal diets for growing quail

Ingredients, (%)	Growing diet
Yellow corn	53.20
Soybean meal (48%)	33.50
Corn gluten meal (62%)	4.50
Sunflower oil	0.90
Wheat bran	4.50
Di-Ca-P	1.44
Limestone	1.00
Premix*	0.30
NaCl (salt)	0.25
L-lysine-HCL	0.19
DL-Methionine	0.12
Mold guard	0.10
Total	100
Calculated analyses**	
ME (kcal/kg)	29.05
Crude protein (%)	24.10
Crude fiber (%)	3.03
Ether extract (%)	3.16
Calcium (%)	0.81
Available P (%)	0.42
Lysine (%)	1.30
Methionine (%)	0.50
Methionine+cystine (%)	0.89

*Each 1.5 kg contains: vit A 15000000 IU, vit D_3 3000000 IU, vit E 35000 mg, vit K_3 3000 mg, vit B_1 2000 mg, vit B_2 5000 mg, vit B_6 3000 mg, vit B_{12} 20 mg, Niacin 60000 mg, Folic 3000 mg, Biotin 300 mg, Pantothenic acid 15000 mg, Copper 20 g, Iodine 2 g, Selenium 0.3 g, Iron 80 g, Manganese 120 g, Zinc 70 g, Cobalt 0.25 g. **Calculated from NRC (1994)

consumption (g) to body weight gain (g). At 10 and 18 day old, a total of 48 blood samples were collected from the chicks, into heparinized tubes. The tubes were gently mixed, centrifuged at the speed of 4000 r.p.m. for 15 min. and Plasma samples were decanted into Ependorf tubes (1.5 ml) stopped tightly and stored in a deep freezer at -20°C until hormonal analyses were done. Triiodothyronine (T3) and thyroxine (T4) were determined in plasma by using Enzyme-linked Immunosorbent Assay (ELISA) Kit. But insulin-like Growth factor-1 (IGF-1) determined in plasma by using Radio Immune Assay (RIA) Kit. Glutathione Peroxidase (GSHPx) concentrations by spectrophotometer using available commercial Kits produced by bio-diagnostic.

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

Effect of supplementing quail laying hens diets with organic Se and age effect on fertility, hatchability, are shown in Table 3. The results showed that adding organic selenium to Japanese quail breeder significantly increased fertility and hatchability percent. It can be seen that fed diets containing (1 mg Se/kg feed) had higher fertility and hatchability percent than the control diets. Our results agree with those of Agate *et al.* (2000) who showed that Se as 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. These results agree with the findings of Davtyan *et al.* (2006); Petrosyan *et al.* (2006); Hanafy *et al.* (2009) who reported that Se as Sel-Plex™ supplementation increased the hatchability of fertile eggs and number of hatched for laying hen. Our results agree also with those of Rotruck *et al.* (1973) who reported that Se is required for proper function of the glutathione peroxidase enzymes, (antioxidant enzymes) that destroy free radicals produced during normal metabolic activity. So, increased hatchability in treated groups may be due to improved anti-oxidant status.

Regarding to age of hen, fertility and hatchability percent decreased significantly by age, might be due to the older hen's inability to hold sperm in the sperm storage tubules (SST) this result agrees with those of Fasenko *et al.* (1992). A significant interaction was observed between Se-supplemented and age effect on fertility and hatchability percent.

Table 3: Effect of selenium supplementation and Japanese quail breeder's age on percentage of fertility and hatchability

	Selenium level (mg/kg feed) (S)					Significance		
Age (A)	0	0.3 mg	0.5 mg	1 mg	Overall mean	S	A	S*A
Fertility (%)								
Young	84.7±1.29	89.3±1.6	85.9±1.2	91.0±1.24	87.7[a]			
old	76.2±0.26	83.9±2.2	84.2±3.3	81.6±6.06	81.5[b]			
Overall mean	80.50[c]	86.60[a]	85.05[b]	86.30[a]	-	*	*	*
Hatchability (%)								
young	79.2±0.46	80.36±0.95	81.03±1.12	85.5±0.08	81.5[a]			
old	77.6±0.5	78.5±0.54	79.4±0.23	80.5±0.40	79.0[b]			
Overall mean	78.4[c]	79.45[bc]	80.2[b]	83.01[a]	-	*	*	*

1-16 weeks old. 2-40 weeks old

Table 4: Effect of selenium supplementation and Japanese quail breeder's age on selenium concentration in egg yolk

	Selenium level (mg/ kg feed) (S)					Significance		
Age	0	0.3 mg	0.5 mg	1 mg	Overall mean	S	A	S*A
Selenium concentration (µg/l) in egg yolk								
young	16.33±0.88	31.66±1.8	35.33±0.96	39.33±2.6	30.6[a]			
old	15.66±0.66	27.00±1.15	31.66±0.88	35.00±1.0	27.3[b]			
Overall mean	16.0[d]	29.3[c]	33.5[b]	37.16[a]	-	**	**	NS

Table 5: Effect of selenium supplementation and Japanese quail breeder's age on performance of their progeny

		Selenium level (mg/kg feed) (S)					Significance		
Period	Age (A)	0	0.3 mg	0.5 mg	1 mg	Overall mean	S	A	S*A
Body gain (g)									
0-3 weeks	Young	78.6±3.3	96.3±2.8	99±3.2	115±3.0	97.2[a]			
	Old	71.0±1.1	95±4.1	94.3±2.8	113±4.5	93.3[b]			
	Overall mean	74.8[c]	95.6[b]	96.6[b]	114.0[a]	-	**	**	NS
3-5 weeks	Young	105±6.1	115.3±3.8	117.6±1.3	124±1.5	115.5[a]			
	Old	102±3.57	112±2.2	116.3±1.45	119.3±2.8	112.4[b]			
	Overall mean	103.5[d]	113.6[c]	117.0[b]	121.6[a]	-	**	**	NS
0-5 weeks	Young	183±5.8	212±4.5	217±3.5	239±8.5	212.9[a]			
	Old	173±7.57	207±2.3	211±5.5	232±3.4	205.7[b]			
	Overall mean	178.3[d]	209.5[c]	214.0[b]	235.5[a]	-	**	*	NS
Feed conversion									
0-5	Young	2.8±0.03	2.3±0.03	2.3±0.08	2.23±0.08	2.42[b]			
	Old	3.0±0.24	2.4±0.08	2.4±0.05	2.3±0.06	2.54[a]			
	Overall mean	2.9[a]	2.4[b]	2.35[bc]	2.2[c]	-	**	*	NS

Feed conversion: feed consummating/ b.w. gain (g)

The results (Table 4) showed that dietary supplementation of the hen diets with Sel-Plex readily elevates Se concentration in egg. Se concentration in the yolk increased significantly with increasing level of Sel-Plex addition (Table 4). Fisinin *et al.* (2008), Sara *et al.* (2008) and Hanafy *et al.* (2009) reported that the supplementation of hens' diet with organic Se not only improves their health and productivity but also be a natural way to produce eggs enriched with Se.

Regarding to age of hens, as the age of hen increased, deposition of Se into egg yolk decreased significantly, these results agree with Pappas *et al.* (2005) who reported that the concentration of Se in the egg decreased as the age of the bird increased. They suggested that this decrease of egg Se was not explained by the increased egg mass with older birds but by the less efficient mechanism by which Se was absorbed and deposited with age.

Productive performance of growing quails: The results concerning the effects of parental Se Supplementation and age on performance of progeny are shown in Table 5. The results concerning BWG indicated that birds originate from parent flocks fed with diets containing Se for young age had BWG higher than birds originate from parent flocks fed with diets don't contain Se for old age, but the best group that originates from parent flocks fed 1 mg se/kg feed for young age. Our results agree in general with the results of Chun *et al.* (2009) who reported that supplementation of different levels of selenium (0.1 or 0.4 mg/kg) improved daily gains. Also, Sefton and Edens, (2004); Pappas *et al.* (2006) 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. However, Zhou and Wang (2011) revealed that improved daily weight gain (DWG) were observed in the groups supplemented with Nano-Se at (0.10, 0.30 and 0.50 mg/kg) as compared with the control groups after 90 d of feeding.

In contrast, several reports have shown that dietary supplementation with organic Se, does not affect the DWG of chickens. Biswas *et al.* (2006) suggested that

Table 6: Effect of selenium supplementation and Japanese quail breeder's age on the concentration of thyroid hormones of their progeny

		Selenium level (S)					Significance		
Period	Age (A)	0	0.3 mg	0.5 mg	1 mg	Overall mean	S	A	S*A
Triiodothyrionine (T3) (ng/ml)									
10 days	Young	1.96±0.03	2.73±0.14	3.00 ±0.11	4.23±0.12	2.98[a]			
	Old	1.73±0.12	2.50±0.11	2.83 ±0.08	3.50±0.15	2.64[b]			
	Overall mean	1.85[d]	2.61[c]	2.91[b]	3.86[a]	-	**	*	NS
18 days	Young	4.90±0.05	6.26±0.14	7.46±0.26	8.23±0.23	6.71[a]			
	Old	4.53±0.14	5.70±0.15	7.23±0.18	7.76±0.18	6.30[b]			
	Overall mean	4.71[d]	5.98[c]	7.35[b]	8.00[a]	-	**	*	NS
Thyroxin (T4) (ng/ml)									
10 day	Young	27.66±1.45	19.66±0.33	17.00±0.57	18.00±0.57	20.58[b]			
	Old	29.00±0.57	20.33±0.88	19.66±0.33	18.66±0.88	21.91[a]			
	Overall mean	28.33[a]	20.00[b]	18.33[b]	18.33[b]	-	**	*	NS
18 day	Young	38.33±0.88	28.00±1.15	26.33±0.88	23.33±0.66	29.00[b]			
	Old	43.33±2.40	29.33±0.66	27.33±1.45	25.66±0.66	31.41[a]			
	Overall mean	40.83[a]	28.66[b]	26.83[bc]	24.50[c]	-	**	*	NS

Table 7: Effect of selenium supplementation and Japanese quail breeder's age on some blood parameters of their progeny

		Selenium level (mg/kg feed) (S)					Significance		
Period	Age (A)	0	0.3 mg	0.5 mg	1 mg	Overall mean	S	A	S*A
T4/T3 ratio									
10 days	Young	14.06±0.78	7.23±0.27	5.66±0.23	4.26±0.14	7.80[b]			
	Old	16.90±0.98	8.13±0.08	6.93±0.12	5.36±0.48	9.33[a]			
	Overall mean	15.48[a]	7.68[b]	6.30[c]	4.81[d]	-	**	*	NS
18 days	Young	7.83±0.23	4.46±0.27	3.53±0.16	2.86±0.06	4.67[b]			
	Old	9.60±0.85	5.16±0.12	3.80±0.26	3.30±0.10	5.46[a]			
	Overall mean	8.71[a]	4.81[b]	3.66[c]	3.08[c]	-	**	*	NS
IGF-1 (ng/ml)									
10 days	Young	14.20±0.43	18.27±0.34	21.34±0.35	24.66±0.35	19.62[a]			
	Old	13.05±0.10	17.05±0.10	20.01±0.12	23.10±0.20	18.30[b]			
	Overall mean	13.62[d]	17.66[c]	20.67[b]	23.88[a]	-	**	*	NS
18 days	Young	14.06±0.38	16.14±0.19	18.70±0.24	21.71±0.24	17.65[a]			
	Old	13.01±0.10	15.29±0.31	17.13±0.18	20.38±0.29	16.45[b]			
	Overall mean	13.54[d]	15.71[c]	17.92[b]	21.04[a]	-	**	*	N.S

Table 8: Effect of selenium supplementation and Japanese quail breeder's age on the concentration of plasma glutathione peroxidase of their progeny

		Selenium level (S)					Significance		
Period	Age (A)	0	0.3 mg	0.5 mg	1 mg	Overall mean	S	A	S*A
GSH-Px (Mu/Ml)									
10 days	Young	38.75±0.30	52.04±0.38	59.06±1.12	66.76±0.86	54.15[A]			
	Old	36.79±0.76	49.87±0.68	56.44±1.37	63.11±0.79	51.55[B]			
	Overall mean	37.77[d]	50.96[c]	57.75[b]	64.93[a]	-	**	**	NS
18 days	Young	35.64±1.07	45.16±0.47	46.08±0.23	48.24±0.20	43.78[A]			
	Old	35.30±0.70	44.83±0.75	45.60±1.50	47.22±0.68	43.23[A]			
	Overall mean	35.47[c]	44.99[b]	45.84[b]	47.73[a]	-	**	NS	NS

BWG was not affected by Se supplementation in Japanese quails. Also, Payne *et al.* (2005) showed that daily gain of broilers was not affected by Se-yeast supplementation. This result might be associated with the high dietary background levels of Se and the fact that the levels of Se in the control diet could have masked the effect of supplemental Se in previous experiments conducted by Zhou and Wang (2011). Besides, statistical analysis did not reveal any significant interaction between Se treatment and age for BWG of birds.

Concerning FCR, the results presented in Table 6 indicated that there were significant effects of parental Se Supplementation and age on FCR of progeny, since we found that birds originate from hens fed high level of Se for young age had improved FCR compared with birds originate from hens fed free Se for old age, but the best group was that chicks originated from parent flocks fed with diets containing 1 mg Se/kg feed. These results agree with Sahin *et al.* (2008) who found improvement in feed efficiency in Se-supplemented quail (either 0.15 or 0.30 mg/kg of diet) reared under heat stress conditions. Also, Deniz *et al.* (2005) who reported that supplementation of broiler diets with organic Se (0.3 ppm) improved feed conversion ratio. Moreover, Chun *et al.* (2009) confirmed that supplementation of different levels of selenium (0.1 or 0.4 mg/kg) improved feed conversion ratio in broilers and the effect of 0.4 mg/kg Yeast-Se was the best. These results were observed in several other studies (Naylor *et al*., 2000; Rutz *et al*., 2003; Mahmoud and Edens, 2005) in which improved FCR was reported, Moreover, Jianhua *et al*. (2000) reported that dietary Se improves the growth of broilers because Se is needed to synthesize iodothyronine deiodinase which catalyses the conversion of T4 to T3. But our results disagree with Payne *et al*. (2005) who showed that feed ratio of broilers was not affected by Se-yeast supplementation. Edens *et al*. (2001); Spears *et al*. (2003) reported no differences in feed efficiency when broilers were fed diets containing Se from SY. Besides, statistical analysis did not reveal any significant interaction between Se treatment and age for FCR of birds.

Plasma thyroid hormones: Results presented in Table 6 indicated that, plasma tri-idothyronine (T3) levels were significantly higher in chicks produced from hens fed high level of Se (young and old age) than than those of control during the two periods (10 and 18 day old). Likewise, the chicks produced from young hens (16 wks) had significantly higher level of T3 than the old age (40 wks), but no significant interaction was noted between Se-supplement and age effect. The results showed that the chicks produced from the young hens fed 1 mg Se/kg feed was the best. Conversely, the results of plasma thyroxin (T4) levels were significant lower for chicks produced from hens fed Se treatment compared to the control.

Regarding to T3:T4 ratio, the results in (Table 7) followed the same trend of T4. These results may be due to that supplemental Se is necessary for the increased conversion of plasma T4 to T3 for Japanese quails. These results supported by those of Srimongkol (2003) who reported that selenium supplemented in broiler diets had significantly increased T3 levels than fasted chicks and control. Also, Upton *et al*. (2008) reported that the serum thyroxin levels were higher in birds within the no Se treatment when compared to those supplemented with seleno-yeast and Serum T3 levels were lower in broilers given no Se compared to broilers supplemented with seleno-yeast. Chang *et al*. (2005) found that the dietary Se deficiency resulted in significantly decreased plasma T3 levels, conversely, plasma T4 levels were elevated in those animals fed the Se-deficient diets. Additionally, the ratios between the hormones strongly suggest that organic Se supplementation facilitated the conversion of T4 to T3. This observation suggested that the extra-thyroidal conversion of T4 to T3 was mediated by the hepatic Se-dependent type I, 5'-iodothyronine deiodinase enzyme (Edens *et al*., 2001).

Insulin-like Growth factor-1 (IGF-1): The results of (IGF-I) level showed that (Table 7) chicks produced from hens fed high level of Se (young and old age) had higher level of IGF-1 than chicks produced from control group, but the levels of IGF-1 of chicks produced from the young age were significantly higher than those produced from the old age. However, no significant interaction was observed between Se-supplement and age effect. This disagree with Harvey *et al*. (1978) who reported that In mammals, T4 is stimulatory to GH production due to interactions with gene response elements, whereas in chickens, thyroid hormones (at least T3) decrease GH due to negative feedback on thyrotropic releasing hormone (TRH) production, Elevations in plasma T3 depress GH concentrations in a dose-dependent manner while hypothyroidism in the chicken is associated with elevated GH concentrations. This is thought to be largely due to the negative feedback of the thyroid hormones on the hypothalamus, decreasing the production and release of TRH, a known potent GH secretagogue.

Glutathione peroxidase: The results of the present study (Table 8) showed that higher GSH-Px activity in plasma of chicks produced from hens (young and old age) fed high levels of Se compared to the control during two periods (10 and 18 day old), however, the chicks produced from young age were significantly higher activity of GPx than those produced from old age (only at 10 day). The results did not reveal any significant interaction between Se-supplement and age effect. In this respect, the results of increasing glutathione peroxidase activity in serum by organic Se in this experiment were in agreement with previous reports of Jiang *et al*. (2009). Also, dietary supplementation with Se-Met raised activities of GSH-Px. These results were consistent with those of Spears *et al*. (2003) and Wang and Xu (2008). These findings suggested that Se-Met improved antioxidative status of male broilers by elevating activity of antioxidant enzymes and reducing peroxidation products and also implicated that Se-Met supplementation may have a beneficial effect on oxidative stability and shelf life of chick meat. Previous work has also shown that maternal Se supplementation increases the activity of GPX in the tissues of the offspring at hatch (Surai, 2000).

Spears *et al*. (2003) reported that Se supplementation increased GPx activity over that of birds fed unsupplemented diets. Mahmoud and Edens (2005) observed an enhanced GSH-GPx antioxidant system in organic Se-fed chickens than inorganic Se group's.

It could be concluded that, dietary Se supplement could be used more efficiently for reproductive performance in Japanese quail breeders; however, the young age birds were more efficiently for using dietary Se. Moreover, the maternal Se-supplementation improved performance and antioxidant status of their progeny for several days after hatching.

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