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Thyroid Hormone and Hens Reproductive Performance of Two Local Strains

By

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Abstract: *The extent to which thyroxin can be beneficial in improving egg production in two local strains after peak of production was studied. Eighty Silver Montazah and 80 Gimmizah hens aged 48 weeks were randomly assigned for 4 treatments (20 birds each). Hens were individually subcutaneously (in the neck) weekly injected with 0.1 ml DL-Thyroxin solution to provide 50, 100, and 200 µg T4/Kg body weight, for 4-weeks treatment period. Birds of the 1st group served as control. DL-thyroxin administration caused increases in serum thyroid hormones in a dose dependent manner in both strains. These effects of treatments were sustained even after the 4-weeks recovery period maintaining the dose dependent manner. Estrogen has decreased significantly as a result of the treatments in a dose dependent manner. Serum progesterone on the other hand increased with the low doses of DL-thyroxin, and vice-versa. These effects of treatments were sustained even after the 4-weeks recovery period. During the treatment period egg number of Silver Montazah strain increased significantly with the 50 and 100 µgT_4/kg bwt. doses, respectively and vice-versa. Egg weight increased significantly with the different doses in a dose dependent manner. Similar effects of treatments on egg production was observed with the Gimmiza strain which was more sensitive to the treatments than the Silver Montazah. Egg quality characteristics after the treatment period did not differ significantly as compared with control. Serum calcium decreased in a dose dependent manner, inversely to serum. After the treatment period shell weight, shell thickness and shell calcium percentage did not differ significantly, although they showed tendency towards decreasing with treatments. Hatchability percentage improved in all thyroxin treatments meanwhile, dead embryos percentage was reduced and day old chick's weights was increased. It was concluded that inducing a mild hyperthyroidism can improve reproductive performance of the studied local strains past peak of production depending on the dose and the strain used.*

INTRODUCTION

In recent years it has become increasingly clear that adequate levels of circulating thyroid hormone are of primary importance for normal female reproductive functions. Changes in T_3 levels result in impaired fertility, and altered pituitary gonadotropin secretion (Erturth and Hedner, 1987; Longcope, 1991; Shi and Barrell, 1992). Evidence derived from experimental studies suggests that the hypothalamic-pituitary-thyroid axis and the hypothalamic-pitutitary-ovarian axis are physiologically related and act together as a unified system (Doufas and Mastorakos, 1981). In birds, thyroid hormones are important in several organismal level processes such as hatching, molt and reproduction. Concerning reproduction, thyroid hormones are necessary for reproductive system development and reproductive function, but high concentrations of thyroid hormones have antigonadal effects (Decuypere and Verheyen, 1986). Early studies on chickens stated that mild hyperthyroidism maintains egg production with advancing age (Turner and Kempster, 1948). Also, Ringer (1976) reported that feeding thyroprotein results in little or no stimulation of egg production. With these contradictions in hand, this study was conducted to evaluate the extent to which thyroxin can be beneficial in improving egg production in two local strains after peak of production.

MATERIALS AND METHODS

The present study was carried out at El-Sabahia Poultry Research Station, Animal Production Research Institute, Ministry of Agriculture.

***Birds*:** Eighty Silver Montazah and 80 Gimmizah hens aged 48 weeks were individually housed in wire cages. A photoperiod of 16L: 8D was provided during the laying period. Birds were fed on a basal diet (15.7% crude protein, 2753 Kcal/kg ME and 175.4 C/p ratio) formulated to meet NRC (1994) recommended nutrient requirements. Feed and water were provided *ad libitum*.

Treatments: Birds of each strain were randomly assigned for 4 treatments (20 birds each). Hens were individually subcutaneously (in the neck) weekly injected with 0.2 ml DL-Thyroxin solution (ethanol-saline) to provide 50, 100, and 200 μg T4/Kg body weight, for 4-weeks treatment period. Birds of the 1st group served as control sham treated in a like manner except that, the injected solution contained the ethanol-saline mixture only.

Blood Analysis: at the end of the 4-weeks treatment period, and after another 4-weeks (recovery period), blood was withdrawn from 5 birds

of each treatment. Blood was centrifuged for 20 minutes on 4000rpm and serum samples were stored at -20°C pending analysis. Thyroid hormones (T3 and T4), estradiol (E2) and progesterone (P4) were analyzed by RIA kits manufactured by Immunotech Beckman coulter Company. Serum calcium (mg/100ml) was determined by the O-cresolphthalein direct method (Tietz, 1970). Serum Phosphorous (mg/100ml) was determined by the Fiske-Subbarow direct method with molybdenum blue (Goodwin, 1970). Serum alkaline phosphatase activity (U/100ml) was determined according to the method of Amador *et. al.,* 1963.

Egg production: Egg production was recorded for each hen individually for a month (treatment period) then for another month after treatment (as a recovery period). Eggs were weighed individually and egg mass was calculated.

Egg quality: At the end of the treatment period 10 eggs of each treatment were used to determine egg quality. Eggs were weighed and then were broken out and yolk weight, height and diameter and albumin weight and height were recorded. Egg and yolk diameters were measured using a caliber. Yolk and albumin height were measured using a tripod micrometer reading to the nearest 0.01 mm. Yolk color was determined using Hoffmann La Roche yolk color fan.

Egg shell measurements: At the end of the 4-weeks treatment period, and after another 4-weeks (recovery period), 10 eggs from each treatment were broken to determine shell weight, shell thickness and for calcium analysis after dry ashing of the shell according to the method of A.O.A.C. (1985).

Fertility and hatchability: At the end of the treatment period hens were individually artificially inseminated twice a week using 100 x 10^6 sperm / insemination. Eggs were collected for incubation. Hatchability and hatched chicks weights were recorded.

Statistical analysis: Data were analyzed by analysis of variance using the general linear model procedure (Proc. GLM; SAS Institute, 1996). Differences among means were determined using Duncan test (Duncan, 1955).

RESULTS AND DISCUSSION

Experimentally Induced Hyperthyroidism:

Data presented in Table (1) proves the induction of hyperthyroidism by the end of the 4-weeks treatment period, as a result of the treatments. DL-thyroxin administration caused increases in serum thyroid hormones in a dose dependent manner in both strains. In Silver Montazah strain, serum T_4 increased by 50.86, 59.57 and 77.39% ($p=0.0094$) and T_3 increased by 1.96, 16.67 and 17.65% ($p=0.0339$) while in Gimmiza strain serum T_4 increased by 19.55, 31.41 and 52.24% ($p=0.0325$) and T_3 increased by 10.75, 16.13 and 18.28% ($p=0.0166$) in compare with control, with the 50, 100, and 200 μgT4/Kg body weight treatments, respectively. These effects of treatments were sustained even after the 4-weeks recovery period (Table 1) maintaining the dose dependent manner. In Silver Montazah strain, serum T_4 remained higher than the control by 26.44, 66.67 and 95.40% ($p=0.0170$) and T_3 by 30.53, 42.11 and 78.95% ($p=0.0610$) while in Gimmiza strain serum T_4 remained higher than the control by 10.42, 15.28 and 94.44% ($p=0.0042$) and T_3 by 27.06, 27.06 and 41.18% ($p=0.0003$) after the recovery period of the 50, 100, and 200 μgT4/Kg body weight treatments, respectively.

These symptom of hyperthyroidism condition is typical to that reported by other workers. Thyroid hormones supplementation was shown to increase circulating levels of T_3 and T_4 (Harvey, 1983; Nakaya *et al*., 1985; Samar Elnagar *et.al.,* 2001 and Azza El-Sebai *et. al.,* 2002).

The hyperthyroid condition resulted from the different treatments was not accompanied with any disorders in the T_4 conversion to T_3 system as evidenced by the insignificant changes in T_3/T_4 ratio either after the 4-weeks treatment period ($p=0.5658$ and 0.2079) or after the 4-weeks recovery period ($p=0.4300$ and 01061) in Silver Montazah and Gimmiza strains respectively.

Estrogen, Progesterone and Estrogen/Progesterone Ratio

Data presented in Table (2) shows a marked effect of hyperthyroidism on the reproductive hormones measured in both strains after both treatment and recovery periods. After the 4-weeks treatment period, serum estrogen of the Silver Montazah strain was reduced significantly ($p=0.0009$) in a dose dependent manner, the reduction was by 11.11, 11.33 and 21.33% in compare with control. Serum progesterone on the other hand increased by 71.48 and 128.51% in compare with control

with the first two doses of DL-thyroxin, respectively and decreased by 10.93% in compare with control with the highest dose of DL-thyroxin (p=0.0001). Meanwhile, estrogen /progesterone ratio had a trend opposite to that of progesterone as it decreased by 47.89 and 61.43% in compare with control with the first two doses of DL-thyroxin, respectively then it rose again without reaching the control's value and remained less than control by 11.26% with the highest dose of DL-thyroxin (p=0.0001). Similar trend was observed with the Gimmiza strain after the 4-weeks treatment period. As estrogen has decreased significantly as a result of the treatments in a dose dependent manner (p=0.0023) and the reduction was by 9.97, 34.90 and 45.14% in compare with control. Serum progesterone on the other hand increased by 55.10% in compare with control with the lowest dose of DL-thyroxin, and decreased by 4.59 and 31.63% in compare with control with the 100 and 200 μgT_4/kg bwt. doses, respectively (p=0.0019). Estrogen/progesterone ratio decreased in a dose reverse manner as the reduction was by 41.24, 31.00 and 19.22% in compare with control (p=0.0067).

These effects of treatments were sustained even after the 4-weeks recovery period (Table 2). In Silver Montazah strain, estrogen was reduced significantly (p=0.0188) in a dose dependent manner, the reduction was by 12.93, 34.05 and 33.83% in compare with control. Serum progesterone on the other hand increased by 45.78 and 78.48% in compare with control with the first two doses of DL-thyroxin, respectively and decreased by 13.59% in compare with control with the highest dose of DL-thyroxin (p=0.0037). Meanwhile, estrogen /progesterone ratio had a trend opposite to that of progesterone as it decreased by 39.62 and 63.27% in compare with control with the first two doses of DL-thyroxin, respectively then it rose again without reaching the control's value and remained less than control by 22.64% with the highest dose of DL-thyroxin (p=0.0001). Again, similar trend was observed with the Gimmiza strain after the 4-weeks recovery period. As estrogen has decreased significantly as a result of the treatments in a dose dependent manner (p=0.0377) and the reduction was by 8.87, 16.12 and 20.96% in compare with control. Serum progesterone on the other hand increased by 69.58% in compare with control with the lowest dose of DL-thyroxin, and decreased by 22.14 and 27.00% in compare with control with the 100 and 200 μgT_4/kg bwt. doses, respectively (p=0.0391). Estrogen/progesterone ratio decreased by 45.68, 67.10 and 64.78% in compare with control (p=0.0106).

Results of the effect of hyperthyroidism on estrogen in both strains and after either the treatment or the recovery period, are consistent with the

findings of Sekimoto *et. al.,* (1987) who found that when laying hens were injected with 500 g thyroxin/kg bwt. daily for 4 weeks, serum estradiol concentrations fall from 226 ± 12 pg/ml to 80 ± 9.4 pg / ml. Meanwhile, results obtained concerning the response of progesterone to the DL-thyroxin treatments show that in the Silver Montazah strain, it raises with the 50 and 100 μgT_4/kg bwt. doses and decreases with the 200 μgT_4/kg bwt. dose, and in the Gimmiza strain it raises with the 50 μgT_4/kg bwt. dose and decrease with the 100 and 200 μgT_4/kg bwt. doses. This response can be explained by the findings of Liu YangQiang and Han Zhengkang (1998) who reported that hyperthyroid laying hens had higher progesterone levels compared to control hens and the findings of Sekimoto *et. al.,* (1987) who found that when laying hens were injected with 500 g thyroxin/kg bwt daily for 4 weeks, serum progesterone concentration fall from 3.9 ±0.2 ng / ml to 1.1±0.1 ng/ml. Which shows that progesterone's response to thyroxin treatments depends on the dose used and/or the strain treated.

Egg Production

Results presented in Table (3) indicates a profound effect of DL-thyroxin treatments on egg production during both treatment and recovery periods in both strains. During the treatment period egg number of Silver Montazah strain increased significantly by 2.34 and 8.77% in compare with control with the 50 and 100 μgT_4/kg bwt. doses, respectively and decreased by 6.14% in compare with control with the 200 μgT_4/kg bwt dose ($p=0.0044$). Egg weight increased significantly ($p=0.0056$) with the different doses in a dose dependent manner as it increased by 0.47, 0.71, and 2.90% in compare with control with the three DL-Thyroxin treatments respectively. Egg mass followed the trend of egg number as it increased significantly by 2.72 and 9.69% in compare with control with the 50 and 100 μgT_4/kg bwt. doses, respectively and decreased by 3.16% in compare with control with the 200 μgT_4/kg bwt dose ($p=0.0067$). Similar effects of treatments on egg production was observed with the Gimmiza strain during the 4-weeks treatment period (Table 3). As egg number increased by 4.67% in compare with control with the 50 μgT_4/kg bwt. dose and decreased by 2.82 and 10.36% in compare with control with the 100 and 200 μgT_4/kg bwt doses, respectively ($p=0.0075$). Egg weight increased significantly ($p=0.0040$) with the different doses in a dose dependent manner as it increased by 1.70, 3.06, and 5.65% in compare with control with the three DL-Thyroxin treatments respectively. Egg mass followed the trend of egg number as it increased significantly by 6.48% in compare with control with the 50μgT_4/kg bwt. dose and decreased by 0.10 and 4.86% in compare with control with the 100 and 200 μgT_4/kg bwt doses, respectively ($p=0.0080$).

These effects of treatments were sustained during the 4-weeks recovery period (Table 3). In Silver Montazah strain, egg number remained significantly higher by 5.85 and 13.5% in compare with control with the 50 and 100 μgT_4/kg bwt. doses, respectively and remained lower by 5.25% in compare with control with the 200 μgT_4/kg bwt dose ($p=0.0056$). Egg weight increased significantly ($p=0.0004$) with the different doses in a dose dependent manner as it increased by 0.35, 1.28 and 2.76% in compare with control with the three DL-Thyroxin treatments respectively. Egg mass followed the trend of egg number as it increased significantly by 6.07 and 14.81% in compare with control with the 50 and 100 μgT_4/kg bwt. doses, respectively and decreased by 2.64% in compare with control with the 200 μgT_4/kg bwt dose ($p=0.0018$). Again, similar trend was observed with the Gimmiza strain during the 4-weeks recovery period (Table 3). As egg number increased by 4.03% in compare with control with the 50 μgT_4/kg bwt. dose and decreased by 0.46 and 8.42% in compare with control with the 100 and 200 μgT_4/kg bwt doses, respectively ($p=0.0031$). Egg weight increased significantly ($p=0.0025$) with the different doses in a dose dependent manner as it increased by 3.29, 4.29 and 6.48% in compare with control with the three DL-Thyroxin treatments respectively. Egg mass increased significantly by 7.35 and 3.90% in compare with control with the 50 and 100 μgT_4/kg bwt. doses, respectively and decreased by 2.36% in compare with control with the 200 μgT_4/kg bwt dose ($p=0.0036$).

Results obtained are in good agreement with the findings of Gado *et. al.,* (1982) who reported that when Japanese quail hens were subcutaneously injected daily for 2 weeks with L-thyroxin, egg weight has significantly increased, whereas egg number and egg mass have significantly decreased. Khalifa *et. al.,* (1983) also indicated that hyperthyroid Fayomi hens' egg weight was significantly higher but egg number and egg mass were significantly lower compared to control. Also, Sekimoto *et. al*., (1987) found that when laying hens were injected with 20, 100 or 500 g thyroxin/kg bwt daily for 4-weeks, egg production of the hens given 500 g thyroxin/kg bwt. decreased, meanwhile the other groups did not show any effect. Moreover, Liu YangQiang and Han Zhengkang (1998) reported that hyperthyroid laying hens had higher laying rates and egg weight than controls. Also, Hamdy and El-Latif (1999) found that supplementation of Japanese quail water with iodine as KI at levels of 300 or 600 ppm improved egg number and egg weight, whereas the use of KI at level of 900 ppm showed the opposite trend. Accordingly, it appears that low doses of thyroxin can improve egg production whereas high doses have an opposite effect, highest egg production was also correlated with the lowest

estrogen/progesterone ratio which is a better parameter for estimating egg production than estrogen or progesterone alone (Leszczynski *et al.,* 1985) and as Nagwa *et al.,* (1998) found that the higher E_2/P_4 ratio in Fayoumi hens is associated with their lower egg production (70 egg/hen/100 days) compared to the lower E_2/P_4 ratio found in LSL hens which was associated with their higher egg production (90 egg/hen/100 days). Effects of thyroxin treatments on egg production appears to be affected by the strain beside the thyroxin dose, it was observed that the Gimmiza strain was more sensitive to the treatments than the Silver Montazah as egg production in the Gimmiza strain increased with the 50 μgT_4/kg bwt dose whereas, egg production in Silver Montazah strain increased with the 100 μgT_4/kg bwt dose which may be due to the findings of Samar Elnagar *et al.,* (2002) who reported that Gimmiza strain is a better egg producer than the Silver Montazah strain.

Egg Quality

Although, different DL-Thyroxin doses had profound effects on egg production, egg quality characteristics after the treatment period did not differ significantly in compare with control (Table 4). As, egg shape index, yolk index, hugh unit, and yolk color did not differ significantly (p=0.7452, 0.7268, 0.8581 and 0.6476 respectively) neither in Silver Montazah strain nor in Gimmiza strain (p=0.3138, 0.0819, 0.6332 and 0.6476 respectively).

Serum Calcium, Phosphorous and Alkaline Phosphatase

Data illustrated in Table (5) shows a dose dependent effect of DL-thyroxin treatments on serum calcium and phosphorous during both treatment and recovery periods in both strains. During the treatment period serum calcium of Silver Montazah strain decreased (p=0.2746) in a dose dependent manner as it decreased by 9.04, 11.49 and 18.92% in compare with control with the three thyroxin doses respectively. Serum phosphorous on the other hand increased (p=0.0033) in a dose dependent manner as it increased by 14.47, 72.13 and 120.85% in compare with control with the three thyroxin doses respectively. Serum alkaline phosphatase increased (p=0.0035) by 2.96, 23.61 and 24.46% in compare with control with the three thyroxin doses respectively. The effect of treatments on serum calcium and phosphorous was also observed in Gimmiza strain (Table 5). As serum calcium showed a reduction (p=0.6408) associated with thyroxin doses, it decreased by 6.36, 13.43 and 19.71% in compare with control with the three thyroxin doses respectively. As observed with the Silver Montazah strain, serum phosphorous increased (p=0.0005) in a dose dependent manner by 16.51, 137.8, and 175.12% in compare with control with the three thyroxin

doses respectively. Serum alkaline phosphatase increased (p=0.4352) by 1.35, 7.38 and 8.04% in compare with control.

Similar trends were observed after the recovery period (Table 5). In Silver Montazah strain, serum calcium were lower (p=0.0329) in the treated groups in compare with control by 11.12, 16.99 and 26.78% respectively. Serum phosphorous increased (p=0.0130) by 28.12, 127.89 and 135.15% respectively. Serum alkaline phosphatase remained higher in treated groups when compared to control by 33.74, 41.09 and 53.58% respectively. As with the Silver Montazah strain, Gimmiza strain's blood analysis after the recovery period showed that serum calcium remained lower (p=0.2110) in the treated groups in compare with control by 1.77, 13.39 and 31.95% respectively. Serum phosphorous was higher (p=0.0078) in the treated groups in compare with control by 29.36, 31.62 and 52.16% respectively. Serum alkaline phosphatase remained higher (p=0.0152) than the control in the three treated groups by 4.92, 5.08 and 19.56% respectively.

These findings are in good agreement with the findings of Manicourt *et al.,* (1979) who found that among 72 patients with hyperthyroidism, there was an increased inorganic phosphorus in 30% and increased alkaline phosphatase in 44%, and Simsek *et. al.,* (1997) who reported that adding L-thyroxin to rats diet for 3 weeks caused a significant decrease in blood calcium. Also, Serakides *et. al.,* (2000) in rats, who found that hyperphosphataemia and hypocalcaemia were induced by hyperthyroidism. This effect of hyperthyroidism on calcium can be explained by the findings of Haldimann et al., (1980) and Popelier *et al.,* (1990) who reported that in hyperthyroid patients, the intestinal absorption of calcium was reduced. And can also be attributed to the reduction in circulating estrogen observed with the treatments (Table 2) as estrogen increases total plasma calcium, primarily by stimulating the production of blood calcium-binding proteins (Bacon *et al.,* 1980)

Egg Shell Quality

Results presented in Table (6) shows hyperthyroidism effects on egg shell quality. After the treatment period, of the Silver Montazah strain, shell weight, shell thickness and calcium percentage in the shell did not differ significantly (p= 0.7099, 0.3171, and 0.0965, respectively) in compare with control, although they showed tendency towards decreasing with treatments. Same trends were observed after the treatment period of the Gimmiza strain (p=0.4472, 0.0677 and 0.3066, respectively).

Same effects were sustained after the recovery period, as shell weight and shell thickness were not significantly affected by treatments in both Silver Montazah (p=0.4461 and 0.6469) and Gimmiza (p=0.4870 and 0.6789) strains. As for shell calcium, it was reduced significantly in a dose dependent manner in Silver Montazah strain by 0.83, 8.27 and 9.92% and in Gimmiza strain by 0.83, 9.05 and 13.99% in compare with control with the three thyroxin doses respectively.

The observed reduction in shell calcium content and the tendency of shell weight and thickness to decline with treatments can be the reflection of serum calcium reduction observed in table (5).

Hatchability, Dead in Shell Percentage and One Day Old Chicks' Weights

Results presented in table (7) illustrate the beneficial effects of thyroxin treatments on hatchability, dead embryos percentage and one day old chick weight. In Silver Montazah strain, after the 4-weeks treatment period, hatchability percentage improved (p=0.0001) in all thyroxin treatments by 14.5, 25.50 and 15.31% meanwhile, dead embryos percentage was reduced (p=0.0001) by 13.54, 69.79 and 32.29% and one day old chick's weights increased (p=0.0243) by 0.26, 1.27 and 3.00% in compare with control with the three thyroxin doses, respectively. Similar trends were observed with the Gimmiza strain after the treatment period (Table 7). As hatchability percentage improved (p=0.0017) in the first two thyroxin treatments by 1.79 and 3.57% and declined with the highest thyroxin dose by 4.05% meanwhile, dead embryos percentage was reduced (p=0.0001) by 8.11, 54.05 and 44.59% and one day old chick's weights increased (p=0.0001) by 0.89, 7.14 and 3.32% in compare with control with the three thyroxin doses, respectively.

Findings concerning hatchability, supports the findings of Decyupere *et al.,* (1991) who stated that high prehatch thyroid hormone concentrations appear to be stimulating a variety of developmental and metabolic processes necessary for successful hatching. Also with the findings of Christensen (1985) in turkeys, who reported that physiological doses of thyroxine and triiodothyronine of 50 and 25 ng, respectively, injected at 25 days of incubation significantly improved hatchability. Meanwhile, the increased one-day-old chicks weights with thyroxin treatments can be due to the increased egg weight observed with treatments (Table 3).

It can be concluded that hyperthyroidism can be beneficial in improving productive and reproductive performance of the studied local strains after peak of production depending on the level of hyperthyroidism and the strain used. The most pronounced beneficial effects was obtained using the 100 ug Tμ dose (Table 3,7).

Table (1): DL-Thyroxin treatments effects on thyroid hormones of "Silver Montazah" and "Gimmiza" strains after 4-weeks of treatment and 4-weeks of recovery (mean ± SE).

Treatment Period		T3 (ng/ml)	T4 (ng/ml)	T3/T4 ratio
Silver Montazah	Control	0.102 ± 0.005 ^{B}	2.30 ± 0.300 ^{B}	0.052 ± 0.008
	50 μgT$_4$/kg bwt	0.104 ± 0.004 ^{AB}	3.47 ± 0.340 ^{AB}	0.035 ± 0.007
	100 μgT$_4$/kg bwt	0.119 ± 0.010 ^{A}	3.67 ± 0.540 ^{AB}	0.045 ± 0.010
	200 μgT$_4$/kg bwt	0.120 ± 0.002 ^{A}	4.08 ± 0.590 ^{A}	0.039 ± 0.007
	p	**0.0339**	**0.0094**	**0.5658**
Gimmiza	Control	0.093 ± 0.008 ^{B}	3.12 ± 0.244 ^{C}	0.033 ± 0.0032
	50 μgT$_4$/kg bwt	0.103 ± 0.018 ^{AB}	3.73 ± 0.645 ^{B}	0.039 ± 0.0210
	100 μgT$_4$/kg bwt	0.108 ± 0.005 ^{A}	4.10 ± 0.750 ^{AB}	0.039 ± 0.0160
	200 μgT$_4$/kg bwt	0.110 ± 0.006 ^{A}	4.75 ± 0.479 ^{A}	0.026 ± 0.0050
	p	**0.0166**	**0.0325**	**0.2079**
Recovery Period				
Silver Montazah	Control	0.095 ± 0.010 ^{B}	1.74 ± 0.39 ^{B}	0.059 ± 0.012
	50 μgT$_4$/kg bwt	0.124 ± 0.005 ^{AB}	2.20 ± 0.13 ^{AB}	0.060 ± 0.129
	100 μgT$_4$/kg bwt	0.135 ± 0.021 ^{AB}	2.90 ± 0.69 ^{AB}	0.051 ± 0.008
	200 μgT$_4$/kg bwt	0.170 ± 0.025 ^{A}	3.40 ± 0.59 ^{A}	0.054 ± 0.011
	p	**0.0610**	**0.0170**	**0.4300**
Gimmiza	Control	0.085 ± 0.004 ^{B}	2.88 ± 0.09 ^{C}	0.032 ± 0.004
	50 μgT$_4$/kg bwt	0.108 ± 0.006 ^{A}	3.18 ± 0.44 ^{B}	0.036 ± 0.006
	100 μgT$_4$/kg bwt	0.108 ± 0.009 ^{A}	3.32 ± 0.76 ^{B}	0.034 ± 0.008
	200 μgT$_4$/kg bwt	0.120 ± 0.008 ^{A}	5.60 ± 0.51 ^{A}	0.024 ± 0.008
	p	**0.0003**	**0.0042**	**0.1061**

^{A,B,C} Means having different letters within a column are significantly different at P≤ 0.05.

Table (2): DL-Thyroxin treatments effects on reproductive hormones of "Silver Montazah" and "Gimmiza" strains after 4-weeks of treatment and 4-weeks of recovery (mean ± SE).

Treatment Period		E2 (pg/ml)	P4 (ng/ml)	E2/P4 ratio
Silver Montazah	Control	450 ± 29.85 ^{A}	0.512 ± 0.027 ^{C}	0.879 ± 0.080 ^{A}
	50 µgT_4/kg bwt	400 ± 17.69 ^{B}	0.878 ± 0.091 ^{B}	0.458 ± 0.055 ^{C}
	100 µgT_4/kg bwt	399 ± 22.44 ^{B}	1.170 ± 0.185 ^{A}	0.339 ± 0.059 ^{D}
	200 µgT_4/kg bwt	354 ± 14.49 ^{C}	0.456 ± 0.259 ^{D}	0.780 ± 0.017 ^{B}
	p	**0.0009**	**0.0001**	**0.0001**
Gimmiza	Control	381 ± 19.20 ^{A}	0.588 ± 0.035 ^{B}	0.645 ± 0.084 ^{A}
	50 µgT_4/kg bwt	343 ± 16.66 ^{B}	0.912 ± 0.022 ^{A}	0.379 ± 0.053 ^{D}
	100 µgT_4/kg bwt	248 ± 23.95 ^{C}	0.561 ± 0.048 ^{C}	0.445 ± 0.039 ^{C}
	200 µgT_4/kg bwt	209 ± 10.42 ^{D}	0.402 ± 0.028 ^{D}	0.521 ± 0.020 ^{B}
	p	**0.0023**	**0.0019**	**0.0067**
Recovery Period				
Silver Montazah	Control	464 ± 13.27 ^{A}	0.581 ± 0.014 ^{C}	0.795 ± 0.021 ^{A}
	50 µgT_4/kg bwt	404 ± 27.13 ^{B}	0.847 ± 0.233 ^{B}	0.480 ± 0.042 ^{C}
	100 µgT_4/kg bwt	306 ± 31.37 ^{C}	1.037 ± 0.021 ^{A}	0.292 ± 0.058 ^{D}
	200 µgT_4/kg bwt	307 ± 15.73 ^{C}	0.502 ± 0.019 ^{D}	0.615 ± 0.018 ^{B}
	p	**0.0188**	**0.0037**	**0.0001**
Gimmiza	Control	248 ± 20.81 ^{A}	0.411 ± 0.024 ^{B}	0.602 ± 0.024 ^{A}
	50 µgT_4/kg bwt	226 ± 18.50 ^{AB}	0.697 ± 0.026 ^{A}	0.327 ± 0.098 ^{B}
	100 µgT_4/kg bwt	208 ± 22.73 ^{BC}	0.320 ± 0.026 ^{C}	0.198 ± 0.031 ^{C}
	200 µgT_4/kg bwt	196 ± 14.40 ^{C}	0.300 ± 0.025 ^{C}	0.212 ± 0.024 ^{C}
	p	**0.0377**	**0.0391**	**0.0106**

^{A,B,C} Means having different letters within a column are significantly different at $P \leq 0.05$.

Table (3): DL-Thyroxin treatments effects on egg number (egg/hen/month), egg weight (g/egg) and egg mass of "Silver Montazah" and "Gimmiza" strains for 4-weeks of treatment and 4-weeks of recovery (mean ± SE).

Treatment Period		Egg number	Egg wt.	Egg mass
Silver Montazah	Control	17.10 ± 0.10 ^{C}	53.40 ± 0.17 ^{B}	918 ± 11.86 ^{C}
	50 µgT$_4$/kg bwt	17.50 ± 0.29 ^{B}	53.65 ± 0.18 ^{B}	943 ± 16.70 ^{B}
	100 µgT$_4$/kg bwt	18.60 ± 0.23 ^{A}	53.78 ± 0.15 ^{B}	1007 ± 17.70 ^{A}
	200 µgT$_4$/kg bwt	16.05 ± 0.35 ^{D}	54.95 ± 0.08 ^{A}	889 ± 12.26 ^{D}
	p	**0.0044**	**0.0056**	**0.0067**
Gimmiza	Control	19.50 ± 0.03 ^{B}	50.61 ± 0.16 ^{D}	987 ± 16.60 ^{B}
	50 µgT$_4$/kg bwt	20.41 ± 0.14 ^{A}	51.47 ± 0.27 ^{C}	1051 ± 14.65 ^{A}
	100 µgT$_4$/kg bwt	18.95 ± 0.05 ^{C}	52.16 ± 0.13 ^{B}	988 ± 15.38 ^{B}
	200 µgT$_4$/kg bwt	17.48 ± 0.13 ^{D}	53.47 ± 0.22 ^{A}	940 ± 16.99 ^{C}
	p	**0.0075**	**0.0040**	**0.0080**
Recovery Period				
Silver Montazah	Control	20.00 ± 0.07 ^{C}	54.06 ± 0.80 ^{B}	1087 ± 15.00 ^{C}
	50 µgT$_4$/kg bwt	21.17 ± 0.17 ^{B}	54.25 ± 0.82 ^{B}	1153 ± 16.63 ^{B}
	100 µgT$_4$/kg bwt	22.70 ± 0.12 ^{A}	54.75 ± 0.91 ^{B}	1248 ± 18.11 ^{A}
	200 µgT$_4$/kg bwt	18.95 ± 0.17 ^{D}	55.55 ± 0.83 ^{A}	1059 ± 10.84 ^{D}
	p	**0.0056**	**0.0004**	**0.0018**
Gimmiza	Control	21.84 ± 0.09 ^{B}	50.17 ± 0.12 ^{C}	1102 ± 14.19 ^{C}
	50 µgT$_4$/kg bwt	22.72 ± 0.69 ^{A}	51.82 ± 0.39 ^{B}	1183 ± 11.07 ^{A}
	100 µgT$_4$/kg bwt	21.74 ± 0.85 ^{B}	52.32 ± 0.43 ^{B}	1145 ± 15.27 ^{B}
	200 µgT$_4$/kg bwt	20.00 ± 0.51 ^{C}	53.42 ± 0.21 ^{A}	1076 ± 12.96 ^{D}
	p	**0.0031**	**0.0025**	**0.0036**

^{A,B,C} Means having different letters within a column are significantly different at P≤ 0.05.

Table (4): DL-Thyroxin treatments effects on egg shape index, yolk index, hugh unit and yolk color of "Silver Montazah" and "Gimmiza" strains after 4-weeks of treatment (mean ± SE).

Treatment Period		Shape index	Yolk index	Hugh unit	Yolk color
Silver Montazah	Control	77.88 ± 1.89	0.438 ± 0.007	84.06 ± 1.69	5.7 ± 0.213
	50 µgT$_4$/kg bwt	78.19 ± 0.62	0.447 ± 0.012	84.02 ± 1.04	5.4 ± 0.179
	100 µgT$_4$/kg bwt	77.14 ± 0.66	0.435 ± 0.005	82.52 ± 1.70	5.6 ± 0.200
	200 µgT$_4$/kg bwt	77.02 ± 0.83	0.435 ± 0.007	84.45 ± 2.02	5.7 ± 0.153
	p	**0.7452**	**0.7268**	**0.8581**	**0.0772**
Gimmiza	Control	78.01 ± 1.04	0.467 ± 0.007	82.42 ± 2.73	6.4 ± 0.306
	50 µgT$_4$/kg bwt	80.01 ± 0.94	0.457 ± 0.007	80.13 ± 3.51	6.0 ± 0.333
	100 µgT$_4$/kg bwt	78.05 ± 1.00	0.454 ± 0.006	82.45 ± 2.10	5.9 ± 0.230
	200 µgT$_4$/kg bwt	78.06 ± 0.84	0.453 ± 0.009	77.92 ± 1.51	6.1 ± 0.314
	p	**0.3138**	**0.0819**	**0.6332**	**0.6476**

Table (5): DL-Thyroxin treatments effects on serum calcium , serum phosphorous and serum Alkaline phosphatase (U/100ml) of "Silver Montazah" and "Gimmiza" strains for 4-weeks of treatment and 4-weeks of recovery(mean ± SE).

Treatment Period		Calcium	Phosphorous	Alkaline Phosphatase
Silver Montazah	Control	11.84 ± 1.03	4.70 ± 0.40 ^{C}	74.34 ± 6.52 ^{B}
	50 µgT_4/kg bwt	10.77 ± 1.96	5.38 ± 0.25 ^{C}	76.54 ± 4.96 ^{B}
	100 µgT_4/kg bwt	10.48 ± 1.22	8.09 ± 0.15 ^{B}	91.89 ± 8.11 ^{A}
	200 µgT_4/kg bwt	9.60 ± 0.67	10.38 ± 1.37 ^{A}	92.52 ± 9.37 ^{A}
	p	**0.2746**	**0.0033**	**0.0035**
Gimmiza	Control	14.00 ± 1.99	4.18 ± 0.88 ^{B}	73.88 ± 8.98
	50 µgT_4/kg bwt	13.11 ± 1.22	4.87 ± 0.10 ^{B}	74.88 ± 8.62
	100 µgT_4/kg bwt	12.12 ± 1.68	9.94 ± 0.66 ^{A}	79.33 ± 6.33
	200 µgT_4/kg bwt	11.24 ± 1.36	11.5 ± 1.19 ^{A}	79.82 ± 6.21
	p	**0.6408**	**0.0005**	**0.4352**
Recovery Period				
Silver Montazah	Control	11.24 ± 1.04 ^{A}	4.41 ± 0.63 ^{B}	64.56 ± 2.45 ^{B}
	50 µgT_4/kg bwt	9.99 ± 0.19 ^{AB}	5.65 ± 0.85 ^{B}	86.34 ± 5.15 ^{A}
	100 µgT_4/kg bwt	9.33 ± 0.92 ^{AB}	10.05 ± 1.76 ^{A}	91.09 ± 8.98 ^{A}
	200 µgT_4/kg bwt	8.23 ± 0.39 ^{B}	10.37 ± 0.78 ^{A}	99.15 ± 6.02 ^{A}
	p	**0.0329**	**0.0130**	**0.0235**
Gimmiza	Control	12.99 ± 0.22	4.87 ± 0.01 ^{C}	67.69 ± 2.37 ^{C}
	50 µgT_4/kg bwt	12.76 ± 0.30	6.30 ± 0.46 ^{B}	71.02 ± 1.44 ^{B}
	100 µgT_4/kg bwt	11.25 ± 1.66	6.41 ± 0.46 ^{B}	71.13 ± 3.69 ^{B}
	200 µgT_4/kg bwt	8.84 ± 0.61	7.41 ± 0.45 ^{A}	80.93 ± 4.81 ^{A}
	p	**0.2110**	**0.0078**	**0.0152**

^{A,B,C} Means having different letters within a column are significantly different at P≤ 0.05.

Table (6): DL-Thyroxin treatments effects on shell weight (g) , shell thickness(mm) and calcium in shell (%) of "Silver Montazah" and "Gimmiza" strains for 4-weeks of treatment and 4-weeks of recovery(mean ± SE).

Treatment Period		Shell weight	Shell thickness	Ca% in shell
Silver Montazah	Control	7.27 ± 0.276	0.362 ± 0.009	81.67 ± 0.881
	50 μgT$_4$/kg bwt	7.17 ± 0.267	0.356 ± 0.006	80.00 ± 1.155
	100 μgT$_4$/kg bwt	6.97 ± 0.155	0.357 ± 0.009	78.67 ± 1.763
	200 μgT$_4$/kg bwt	6.95 ± 0.216	0.342 ± 0.009	74.33 ± 2.333
	p	***0.7099***	***0.3171***	***0.0965***
Gimmiza	Control	7.83 ± 0.286	0.374 ± 0.016	79.33 ± 0.882
	50 μgT$_4$/kg bwt	7.49 ± 0.323	0.369 ± 0.019	77.00 ± 1.528
	100 μgT$_4$/kg bwt	7.43 ± 0.221	0.350 ± 0.005	76.00 ± 1.154
	200 μgT$_4$/kg bwt	7.32 ± 0.280	0.340 ± 0.017	75.67 ± 1.453
	p	***0.4472***	***0.0677***	***0.3066***
Recovery Period				
Silver Montazah	Control	5.80 ± 0.359	0.302 ± 0.009	80.67 ± 2.731 ^{A}
	50 μgT$_4$/kg bwt	5.31 ± 0.289	0.300 ± 0.017	80.00 ± 1.152 ^{A}
	100 μgT$_4$/kg bwt	5.18 ± 0.282	0.291 ± 0.010	74.00 ± 0.581 ^{B}
	200 μgT$_4$/kg bwt	5.15 ± 0.257	0.282 ± 0.013	72.67 ± 2.402 ^{B}
	p	***0.4461***	***0.6469***	***0.0350***
Gimmiza	Control	6.22 ± 0.101	0.330 ± 0.012	81.00 ± 2.082 ^{A}
	50 μgT$_4$/kg bwt	6.00 ± 0.490	0.318 ± 0.012	80.33 ± 3.281 ^{AB}
	100 μgT$_4$/kg bwt	5.60 ± 0.267	0.317 ± 0.018	73.67 ± 0.883 ^{BC}
	200 μgT$_4$/kg bwt	5.68 ± 0.281	0.303 ± 0.019	69.67 ± 0.333 ^{C}
	p	***0.4870***	***0.6789***	***0.0166***

^{A,B,C} Means having different letters within a column are significantly different at P≤ 0.05.

Table (7): DL-Thyroxin treatments effects on hatchability (%), dead in shell (%) and chick weight (g) of "Silver Montazah" and "Gimmiza" strains after 4-weeks of treatment (mean ± SE). **Literature Cited**

Treatment Period	Hatchability	Dead in shell	Chick weight
Control	71.65 ± 0.94 ^{C}	9.6 ± 0.12 ^{A}	33.98 ± 0.32 ^{B}
50 μgT$_4$/kg bwt	82.05 ± 0.58 ^{B}	8.3 ± 0.23 ^{B}	34.07 ± 0.31 ^{B}
100 μgT$_4$/kg bwt	89.92 ± 0.68 ^{A}	2.9 ± 0.12 ^{D}	34.41 ± 0.38 ^{AB}
200 μgT$_4$/kg bwt	82.62 ± 0.51 ^{B}	6.5 ± 0.17 ^{C}	35.00 ± 0.26 ^{A}
p	***0.0001***	***0.0001***	***0.0243***
Control	83.65 ± 1.65 ^{B}	7.4 ± 0.20 ^{A}	35.85 ± 0.30 ^{C}
50 μgT$_4$/kg bwt	85.15 ± 0.39 ^{AB}	6.8 ± 0.09 ^{B}	36.17 ± 0.28 ^{C}
100 μgT$_4$/kg bwt	86.64 ±0.60 ^{A}	3.4 ± 0.24 ^{D}	38.41 ± 0.28 ^{A}
200 μgT$_4$/kg bwt	80.26 ± 0.43 ^{C}	4.1 ± 0.08 ^{C}	37.04 ± 0.31 ^{B}
p	***0.0017***	***0.0001***	***0.0001***

^{A,B,C} Means having different letters within a column are significantly different at P≤ 0.05.

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الملخص العربي

هرمون الثيروكسين و الأداء التناسلي لدجاجات سلالتين محليتين

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تمت دراسة إمكانية استخدام هرمون الدرقية (الثيروكسين) لتحسين خواص انتاج البيض في سلالتين محليتين في مرحلة انتاجية متاخرة (بعد قمة الانتاج). تم استخدام عدد 80 دجاجة من كل من سلالتي المنتزة الفضى والجميزة عمر 48 اسبوع ووزعت كل سلالة عشوائياً الي 4 مجاميع. حقنت الدجاجات تحت الجلد اسبوعياً بأحد ثلاث جرعات من الثيروكسين 50 ، 100 ، 200 ميكروجرام/كجم وزن جسم لمدة 4 اسابيع كفترة معاملة و استمرت الدراسة لمدة 4 اسابيع اخري كفترة استرجاع واستخدمت المجموعة الرابعة كمجموعة مقارنه. وقد اوضحت النتائج أن:

المعاملة بالثيروكسين ادت الي زيادة هرمون الثيروكسين بدم الدجاجات و كانت الزيادة مرتبطة بالجرعة المقدمة وذلك في كل من السلالتين واستمر هذا التأثير خلال فترة الاسترجاع بعد المعاملة.

ادي الثيروكسين الي انخفاض معنوي في مستوي هرمون الاستروجين بالدم تبعاً للجرعة المستخدمة. ارتفع مستوي هرمون البروجيسترون بالدم مع الجرعة المنخفضة من الثيروكسين واخفض مع الجرعة المرتفعة من الثيروكسين و استمر التأثير لفترة الاسترجاع. ارتفع عدد البيض معنوياً في سلالة المنتزة الفضي مع جرعتي 50 ، 100 ميكروجرام/كجم وزن جسم بينما انخفض العدد مع الجرعة المرتفعة من الثيروكسين. ارتفع وزن البيض معنوياً مع المعاملة بالثيروكسين وكان الارتفاع تابع للجرعة المستخدمة من الهرمون. حدثت نفس النتائج مع سلالة الجميزة التي وضح انها اكثر حساسية للمعاملة بالمقارنة بسلالة المنتزة الفضي. حيث ارتفع انتاج البيض في سلالة الجميزة مع المعاملة بالجرعة المنخفضة من الثيروكسين (50 ميكروجرام/كجم وزن جسم) بينما حدث هذا الارتفاع في انتاج البيض في سلالة المنتزة الفضي مع المعاملة بالجرعة المتوسطة من الهرمون (100 ميكروجرام/كجم وزن جسم) و قد اسنمر تأثير المعاملة حتى نهاية فترة الاسترجاع. خواص جودة البيض لم تختلف مع المعاملة بالثيروكسين عنها في الكنترول. ادت المعاملة بالثيروكسين الي انخفاض مستوي كالسيوم الدم بينما ارتفع مستوي كل من فسفور الدم و كذلك انزيم ال Alkaline phosphatase طردياً مع الجرعات المستخدمة في كل من السلالتين و ذلك خلال فترتي المعاملة والاسترجاع. لم تؤدي المعاملة بالثيروكسين الي أي اختلاف معنوي في

كل من وزن القشرة و سمك القشرة و كذلك كالسبوم القشرة و ذلك لقلة هرمون الاستروجين. تحسنت نسبة التفريخ بالمعاملة و انخفضت نسبة الاجنة النافقة مع المعاملة بالثيروكسين. بينما ارتفع وزن جسم الكتكوت عمر يوم. و يمكن استنتاج ان الارتفاع المتوسط في مستوي هرمون الثيروكسين في دم دجاجات السلالات المحلية تحت الدراسة ادي الي تحسين اداء الدجاجات في مرحلة بعد قمة الإنتاج وهذا يعتمد علي كل من الجرعة المستخدمة وكذلك سلالة الدجاجات.