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RESPONSE OF PRODUCTIVE AND REPRODUCTIVE TRAITS TO DIETARY ELTROXINE ADDITION OF SINAI LAYING HENS

Dorra, Tork M. I.*; F. A. Agoor*; Kh. El. Sherif*; E.F. Abd El-Hameed and A. S. Hapeep****

*** Dept. of Poult. Prod., Fac. of Agric. Mansoura Univ.**

**** Anim. Prod. Res. Inst., Agric. Res. Center, Egypt**

ABSTRACT

Sinai laying hens at 22 or 42 weeks age were fed layer ration containing 0.00 (control), 40 , 60 or 80µg of Eltroxine /kg diet. This treatment was continued for 16 weeks (8 weeks of Elroxine addition and other 8 weeks without Eltroxine) within the summer and winter seasons.

Results showed that , absolute body weight change (ABWC) was significantly ($P<0.01$) reduced compared to the control during the Eltroxine addition at level of 80µg/kg diet, while it is significantly ($P<0.05$) increased compared to control at the same level during cessation of Eltroxine treatment. ABWC was significantly ($P<0.01$) decreased in the old compared to young hens during the Eltroxine addition and the whole experimental period. ABWC was significantly increased in the winter than summer season either during addition or cessation of Eltroxine and during the whole experimental period. Feed consumption was significantly decreased, and feed conversion was significantly improved by addition of Eltrorxin to diets of old than young hens, and in the winter than summer season .

Egg number egg weight and egg mass were insignificantly affected by Eltroxine addition, but after cessation of Eltroxine, egg number and egg mass were significantly ($P<0.01$) increased 5.6 and 5.03% for hens fed diets containing 40µg Eltroxine when compared to control, while, these traits were significantly decreased by 6.3 and 7.8%, respectively for hens fed diets with 80µg Eltroxine. Egg number was insignificantly affected between the young and old age, egg weight and egg mass were significantly higher with the old than young hens during addition of Eltroxine , when cessation of Eltroxine egg number and egg mass were significantly ($P<0.01$) lower with the old than young hens but egg weight was vice versa. Egg number, egg weight and egg mass were significantly ($P<0.01$) higher during the winter than summer season either during addition or cessation of Eltroxine period.

During addition of Eltroxine period means of yolk index and Haugh Units were significantly decreased by 5.9% and 7.1 % with the old than young hens , values of shall thickness and Haugh Units were significantly ($P<0.01$) higher by 7.3% and 8.5% within the winter than summer season. Mean of yolk index was significantly ($P<0.01$) lower when cessation of Eltroxine by 4% during the winter than summer season.

Shell, yolk and albumen weight percentage insignificantly affected with the Eltroxine addition either during addition or cessation of Eltroxine period. Shell and albumen weight percentage were significantly ($P<0.01$) increased with young than old hens while yolk percent was vice versa. Absolute chick weight was significantly ($P<0.01$) decreased compared with the control group by -3.4% at level of 80µg Eltroxine. Fertility and Hatchability percent were significantly ($P<0.01$) increased for young than old hens, but absolute chicks weight for old hens were significantly ($P<0.01$) increased by 9.8% compared with the young hens. Fertility, hatchability and relative chicks weight were significantly increased during the winter compared with the summer seasons.

General, the results indicated that 40mg Eltroxine /kg diet the optimal level for Sinai laying hens

INTRODUCTION

Eltroxine, is a commercial product having the properties of thyroxine and has marked stimulatory effect upon egg production in fowls. The optimum levels of circulating thyroid hormones are primary importance for normal female reproductive and productive functions. Changes in triiodothyronine T3 levels impaired fertility and altered pituitary genadotropin secretion (Shi and Barrell , 1992). Early studies on chickens stated that mild hyperthyroidism maintains egg production with advancing age (Turner and Kempster , 1948). Dempsey and Astwood (1943) showed that the thyroxine secretion rate is inversely related to environmental temperature. Egg production decline during summer and rise during winter season (Turner and Kempester 1947). This study aimed to determine the effect of thyroid hormones (Eltroxine) on productive and reproductive performance of Sinai laying hens at two different ages (22 or 42 weeks of age) during summer and winter seasons.

MATERIALS AND METHODS

This research was carried out at El-Serw Poultry Research Farm, belonging to Animal Production Research Institute. Two hundred and forty female and twenty four male of Sinai birds at 22 weeks of age and the same number of these birds at 42 weeks of age were used in this study during summer and winter seasons. The birds were reared in flooer pens and fed a commercial layer diet. Birds at start of study have nearly equal live weights . They were randomly distributed into four experimental groups either at 22 or 42 weeks of age. The first group was fed the basal diet and considered as control, while the other three groups were fed the basal diet supplemented with 40 , 60 or 80µg Eltroxine /kg diet, respectively. The experiment was continued for eight weeks with Eltroxin addition and other eight weeks without Eltroxine in the diets.

Individual body weights (BW) were recorded at the beginning, and the body weight change (BWC) was calculated. Feed consumption and feed conversion ratio (as g feed/g egg mass) were calculated.

Egg production parameters (egg number , weight and mass) were recorded daily and calculated during the whole experimental period.

Fifteen freshly laid eggs were taken from each group to measure egg quality characteristics. Egg shape index was determined according to Reddy *et al.* (1979). Shell thickness (without shell membranes) was estimated by a micrometer to the nearest 0.01 mm. Yolk index was estimated as a ratio between yolk height (mm) and it is width (mm). Haugh Units was measured according to the following equation presented by (Haugh, 1937**)** .

H.U. = 100 log (H-1.7 X W 0.37 X7.6) . Where : H= the observed height of the thick albumin in millimeters and W =weight of egg (g).

Relative weights of egg components were also calculated. Fertility was calculated as a percentage of fertile eggs out of the number of total eggs. Hatchability was calculated as a percentage of healthy chicks hatched

out of fertile eggs set. Absolute and relative chicks weight were calculated for each treatment at hatch.

Statistical analysis:

Data were subjected to factorial analysis of variance with treatments effect using general linear model (GLM) procedure of SAS Guide, (SAS, 1998).

RESULTS AND DISCUSSION

Effect of Eltroxine (E), age and season on body weights of Sinai laying hens.

As shown in Table 1 the higher does (80µg) of E significantly ($P<0.05$) decreased Bw by -6.6gm compared to the control group during addition of Eltroxine period, while after treatment cessation Bw increased significantly by 96.5gm.This increase was 89.9 for the whole period. These results are in agreement with that obtained by El-Nagar *et al.* (2001), who found that E treatment increased body weight and weight gain of broiler chicks.

As shown in Table (1) ABWC was significantly ($P<0.01$) reduced by about 31 gm in 42 weeks treated hens when compared with those young hens during Eltroxine treatment period. Also it is significantly lower in old hens compared to young during the experimental period . These results are in agreement with those reported by Soliman (1982).

Absolute body weight change was significantly higher during the winter than in summer seasons either during Eltroxine treatment or after cessation of Eltroxine. These results are in agreement with those found by Akinci and Baydram (2004).

Effect of Eltroxine (E) , age and season on feed consumption and feed conversion:

As shown in Table 2 averages of feed consumption and feed conversion were insignificantly affected with the Eltroxine addition compared to the control either during addition or cessation of Eltroxine treatment and during the whole experimental period. This result agree with those reported by Butt *et al.* (2001).

As shown in Table 2 feed consumption was significantly ($P<0.01$) decreased in the old than young hens either during addition or cessation of Eltroxine treatment and during total experimental period. These results agree with that found by Roland *et al.*(1978). Feed conversion was significantly ($P<0.01$) improved in old than young hens either during addition of Eltroxine or during the total experimental period, while it was insignificantly affected during cessation of Eltroxine period as previously found by Simsek *et al.* (2006).

Mean of feed consumption was significantly lower during the winter than summer seasons during addition of Eltroxine . These results are in agreement with that obtained by Queen (1997). Feed conversion was significantly improved within winter than summer season either during addition or cessation of Eltroxine treatment and during total experimental period. These result is agree with that found by Kocaman *et al.* (2006).

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Effect of Eltroxine (E) age, season, on egg number, egg weight and egg mass:

As shown in Table 3, during addition of Eltroxine to laying hens diets egg number, egg weight and egg mass were insignificantly affected. However, but during cessation of Eltroxine treatment, egg number and egg mass were significantly increased with the 40µg/level by 5.6% and 5.03% respectively compared to the control groups when compared with the control group. Similar result were previously found by Butte *et al.* (2001)..

The same parameters were significantly decreased by -6.3% and -7.7%, respectively with the 80µg level when compared with the control groups. Also during the whole experimental period, egg number and egg mass were significantly ($P<0.01$) lower with the 80µg/level compared to the 40µg level while it is insignificantly affected compared to control groups.

During addition of Eltroxine egg number was insignificantly affected with hens age. These results disagree with that reported by Chen *et al.* (2001), perhaps due to the interaction between age and season, which subsequently lead to maske the decrease in egg number with age, but egg weight and egg mass were significantly ($P<0.01$) increased with the old than young hens by about 18.4% and 16% respectively . The same observation was found by Seker *et al.*, (2005) and Negm *et al.*, (1984), but after cessation of Eltroxine treatment egg number was significantly ($P<0.01$) increased with the young than old hens by 21.6% and during the total experimental period by 11.7%. Egg weight was continued significantly higher with old than young hens either during cessation of Eltroxine or during total experimental period. Egg mass became significantly higher with the young than old hens during cessation of Eltroxine and it is insignificantly affected during total experimental period.

Egg number was significantly ($P<0.01$) higher during the winter than summer season either during addition or cessation of Eltroxine by about 14.6% and 9.6% respectively and during total experimental period by about 12%.

Either during addition or cessation of Eltroxine period and within total experimental period egg weight and egg mass were significantly ($P<0.01$) higher during the winter than summer season.

These results are in agreement with those previously reported by Akinici and Boyaram (2004) , Younis and Abd El-Ghany (2003) and Bordas and Minvielle (1997).

Effect of Eltroxine (E) age and season on egg shape index , shell thickness , yolk index and Haugh units:

As shown in Table (4) during the period of Eltroxine additon egg shape index, shell thickness, yolk index and Haugh units were insignificantly affected with the Eltroxine addition at any level. The same result was found by El-Nagar *et al.* (2005 and 2007), while during cessation of Eltroxine egg shape index significantly ($P<0.01$) decreased with the 80µg level but Haugh Units significantly decreased with the 60µg level when compared to control. Shell thickness was significantly ($P<0.05$) decreased with the 40µg level compared to control during total experimental period.

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Results in Table (4) indicate that egg shape index and shell thickness insignificantly affected between two ages 22 and 42 weeks of age during either addition or cessation of Eltroxine period and during total experimental period. These results are in agreement with those found by Nofal and Hassan (2001). Yolk index and Haugh Units values were significantly ($P<0.01$) higher with the young birds by about 6.2% and 8.2%, respectively as compared with the old birds during addition of Eltroxine period but it is insignificantly affected between two ages during cessation, while these traits were significantly ($P<0.01$) higher with the young than old birds during the whole experimental period.

During addition of Eltroxine egg shape index and yolk index were insignificantly affected between the winter and summer season, but shell thickness and Haugh Unit values were significantly ($P<0.01$) higher during the winter than summer season by about 7.3 and 8.5%, respectively. These results agree with that previously reported by El-Sagheer (2007) and Skrbic *et al.* (2004) when the diets changed without Eltroxine, egg shape index, shell thickness and Haugh Units insignificantly affected between the summer and winter season, while yolk index was significantly ($P<0.01$) higher during the summer than winter season by about 4.1%.

Effect of Eltroxine (E) age and season on shell, yolk and albumen weight percentage :

As shown in Table 5 shell, yolk and albumen weight percentage were insignificantly affected by the different levels of Eltroxine either during addition or cessation of Eltroxine period and during total experimental period. These results agree with those found by Sedarose (2006).

During addition of Eltroxine in the diets shell and albumen weights percentage were significantly ($P<0.01$) increased with the young birds by about 6.9 and 4.5% as compared to the old birds, while yolk weight percentage was significantly ($P<0.01$) increased with the old birds than young birds by about 11.02% . These results are inagreement with those previously reported by Nofal *et al.* (2000) and Rossi and Pompci (1995). After cessation of Eltroxine, both yolk and albumen weight percentage were insignificantly affected, between two ages while shell weight percentage was continued significantly ($P<0.05$) higher with the young than old birds by about 6.2%. Shell and albumen percentage were significantly ($P<0.01$) higher with the young than old birds by about 6.8 and 4.4%, respectively during total experimental period while yolk percentage was significantly higher by about 11.02% with the old than young hens. Shell, yolk and albumen weight percentage were insignificantly affected between the summer and winter seasons either during addition or cessation of Eltroxine and during total experimental period. The same observation was reported by El-Sagheer *et al.* (2007).

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Effect of Eltroxine on fertility (F1%) and hatchability (HI%) and absolute and relative chicks weights:

As shown in Table 6 , after 2 months of Eltroxine addition in the diets, FI% , HI% and relative chicks weights were insignificantly affected among different levels of Eltroxine when compared with the control group, while absolute chicks weight was significantly (P<0.01) decreased by about -34% at level of 80µg Eltroxine as compared to control and it is insignificantly affected at levels of 40 and 60µg Eltroxine /kg diets. These results are in agreement with those found by Mc Cartney and Shaffner (1950) and Sedaros (2006).

After 2 months of Eltroxine addition in the diets of Sinai laying hens both FI% and HI% were significantly increased with the young (22 weeks) than old birds (42weeks) by 6% and 4.6% respectively, while absolute chick weight was significantly (P<0.01) increased with old than young hens by about 9.8% but the relative increased with old than young hens by about 9.8% but relative chick weight was insignificantly affected between the two ages. These results agreed with Chen *et al.* (2001) and Shahein *et al.* (2007), while FI%, HI% and absolute and relative chick weight were significantly (P<0.01) increased during the winter than summer season by about 7.7, 6.7, 15.2 and 5.5% respectively. The same observation was found by Younis and Abd El-Ghany (2003).

Table (6): Effect of Eltroxine, age, season and their interaction on fertility , hatchability and absolute and relative chick weight at hatch during addition of Eltroxine in the diets of Sinai laying hens.

Items	FI%	HI%	Absolute chick weight	Relative chick weight
1. Eltroxine level µg/kg diet (E)				
Control	88.60±0.86	86.30±2.2	29.30±0.86a	66.11±0.70
40	88.98±2.28	86.98±2.5	29.03±0.89ab	66.00±0.95
60	91.50±2.27	86.70±2.4	29.77±0.75a	66.76±0.84
80	88.17±2.54	83.35±2.05	28.31±1.02b	65.42±1.08
Significance level	NS	NS	**	NS
2. Age of birds (A)				
22 weeks	91.86±1.17[a]	87.79±1.52[a]	27.79±0.28[b]	66.67±0.35
42 weeks	86.70±1.73[b]	83.90±1.68[b]	30.50±0.75[a]	65.48±0.82
Significance level	**	*	**	NS
3. seasons (S)				
Summer	86.09±1.74b	83.17±1.73b	27.10±0.20b	64.35±0.56b
Winter	92.72±0.93a	88.72±1.31a	31.22±0.59a	67.91±0.42a
Significance level	**	**	**	**
Interactions				
E x A	NS	NS	NS	NS
E x S	NS	NS	NS	NS
A x S	NS	**	**	**
E x A x S	NS	NS	NS	NS

Means within columns in each treat having smaller superscripts are not significantly different

NS: not significant ; * significant at P<0.05; ** significant at P<0.01

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استجابة بعض الصفات الإنتاجية والتناسلية لإضافة الالتروكسين فى عليقة دجاج السينا البياضة

تـرك محمـد إبـراهيم درة*، فـؤاد عبدالواحـد عجـور*، خليـل الشـحات شـريف*، عصـام فـؤاد عبدالحميد و عرفات عبدالهادى حبيب****

*** قسم إنتاج الدواجن – كلية الزراعة – جامعة المنصورة**

**** معهد بحوث الإنتاج الحيوانى – الدقى – الجيزة – مصر**

أجريت هذه الدراسة على مائتين وستون من طيور السينا البياضة (٢٤٠ أنثى ٢٠ ديك) لكل عمر(٢٢ ، ٤٢ أسبوع) أثناء موسمى الصيف والشتاء غذيت علائق تحتوى أربع مستويات التروكسين، كنترول صفر، ٤٠، ٦٠، ٨٠ ميكروجرام التروكسين /كجم عليقة وهذه المعاملة استمرت لمدة ١٦ أسبوع (٨ أسبوع بإضافة التروكسين و ثمانية أسابيع أخرى بدون التروكسين)

أمكن تلخيص النتائج المتحصل عليها كالتالى:

١-أظهرت النتائج أن التغير فى وزن الجسم المطلق أنخفض معنوياً عن مجموعة الكنترول للطيور المغذاه على العليقة المحتوية على ٨٠ ميكروجرام التروكسين أثناء فترة إضافة الألتروكسين بينما أرتفع معنوياً مع نفس المستوى بعد توقف الألتروكسين فى العليقة ٠ وأظهرت النتائج أن التغير فى وزن الجسم كان أقل معنوياً فى الطيور الكبيرة عن الصغيرة أثناء فترة إضافة الألتروكسين وخلال الفترة التجريبية الكلية بينما حدثت زيادة معنوية فى وزن الجسم أثناء موسم الشتاء عن الصيف سواء أثناء فترة إضافة أو توقف الألتروكسين فى العليقة و خلال الفترة التجريبية الكلية ٠

٢- وجد أن استهلاك الغذاء وكفاءة تحويل الغذاء لم تتأثر معنوياً بإضافة الالتروكسين ولكن استهلاك الغذاء كان أقل معنوياً فى الطيور الكبيرة عن الصغيرة سواء أثناء إضافة أو توقف الالتروكسين أو طوال فترة التجربة بحوالى ١٩,٨ ، ١٣% على التوالى وتحسنت كفاءة تحويل الغذاء معنوياً فى فى الطيور الكبيرة عن الصغيرة أثناء فترة إضافة الالتروكسين وطوال فترة التجريبية وأثناء موسم الشتاء عن الصيف٠

٣-عدد البيض ، وزن البيضة ، كتلة البيض لم تتأثر معنوياً أثناء إضافة الالتروكسين ولكن عدد البيض كتلة البيضة زادت معنوياً عن مجموعة الكنترول أثناء فترة توقف الألتروكسين بحوالى ٥,٦ و ٥,٣٤% على التوالى للفراخ المغذاه على علائق تحتوى ٤٠ ميكروجرام التروكسين بينما نقصت هذه الصفات عن الكنترول بحوالى ٦,٣ ، ٧,٨ % على التوالى للطيور المغذاه على المستوى ٨ ميكروجرام التروكسين / كيلو جرام عليقة٠

- لم يتأثر عدد البيض معنوياً فيما بين كل من الطيور والكبيرة والصغيرة بينما كل من وزن البيضة وكتلة البيضة كانت أعلى معنوياً للطيور الكبيرة عن الصغيرة بحوالى ١٨,٤ ، ١٦,١% على التوالى أثناء إضافة الالكتروكسين ولكن بعد توقف الألتروكسين كل من عدد البيض وكتلة البيض كانت أقل معنوياً للعمر الكبير عن الصغير بينما وزن البيضة كان العكس بالعكس ٠

-عدد البيض ووزن البيضة وكتلة البيضة كانت أعلى معنويا أثناء موسم الشتاء عن الصيف سواء أثناء فترة إضافة أو توقف الألتروكسين فى العليقة٠

٤- أظهرت النتائج أن دليل شكل الصفار ووحدات جودة البيضة (HU) نقصت معنوياً للطيور الكبيرة عن الصغيرة بحوالى ٥,٩ أو ٧,١% على التوالى أثناء فترة إضافة الألتروكسين للعليقة ٠ بينما قيم سمك القشرة ووحدات جودة البيضة (HU) كانت أعلى معنوياً أثناء الشتاء بحوالى ٧,٣ ، ٨,٥% على التوالى أثناء فترة إضافة الألتروكسين ، ووحدات جودة البيضة (HU) ودليل شكل الصغار نقص معنوياً أثناء الشتاء عن الصيف بعد توقف المعاملة٠

٥- نسبة الصفار والبياض والقشرة لم تتأثر معنوياً بإضافة الالتروكسين عند المستويات المختلفة ، زادت نسبة البياض والقشرة معنوياً مع الطيور الصغيرة عن الكبيرة بينما نسبة الصغار كانت العكس بالعكس٠

٦-وزن الكتكوت المطلق عند الفقس تناقص معنوياً عن مجموعة الكنترول بمقدار حوالى ٣,١% للبيض الناتج من طيور مغذاه على عليقة تحتوى ٨٠ ميكروجرام بينما لم يتأثر معنوياً مع المحتويات ٤٠، ٦٠ ميكروجرام٠

- نسبة الخصوبة والفقس زادت معنوياً للطبور الصغيرة عن الكبيرة بينما وزن الكتكوت المطلق عند الفقس زاد معنوياً مع الطيور الكبيرة عن الصغيرة بحوالى ٩,٨% بينما الوزن النسبى للكتكوت لم يتأثر بين كلا العمرين

- نسبة الخصوبة والفقس ووزن الكتكوت المطلق والنسبى كانت أعلى معنويا أثناء موسم الشتاء عن الصيف٠

- ومن النتائج هذه الدراسة اتضح أن المستوى ٤٠ ميكروجرام /كجم عليقة هو أنسب المستويات عند استخدام الالتروكسين فى علائق طيور السينا البياضة

Table (1): Effect of Eltroxine, age, season and their interaction on body weight changes of Sinai hens at different treatment period.

Items	Body weights					
	Body weight at begi. Of tretm. (w_1) initial	During addition of Eltroxine (w_2)	Change of body weight (w_2- w_1)	During cessation of Eltroxine (w3)	Change of body weight ($w_3 – w_2$)	($w_3 – w_1$) (g)
1. Eltroxine level µg/kg diet (E)						
Control	1288.8±15.3	1332.03±15.2^a	43.23^a	1372.7±16.6	40.67^b	83.9
40	1289.9±15.0	1319.4±15.0^a	29.50^a	1379.6±20.0	60.2^b	89.7
60	1289.1±14.3	1330.8±15.4^a	41.7^a	1387.9±17.6	57.1^b	98.8
80	1287.9±15.2	1281.3±14.4^b	-6.6^b	1377.8±18.2	96.5^a	89.9
Significance level	NS	*	**	NS	*	Ns
2. Age of birds (A)						
22 weeks	1209.6±7.5^b	1293.4±9.7^b	89.3^a	1347.2±11.4^b	53.3	142.6^a
42 weeks	1368.6±10.5^a	1337.6±11.3^a	-31^b	1411.8±13.4^a	74.2	43.2^b
Significance level	**	**	**	**	Ns	**
3. seasons (S)						
Summer	1232.5±9.4^b	1237.9±9.6^b	5.4^b	1300.3±11.2^b	62.4^a	67.8^b
Winter	1345.6±10.2^a	1393.3±9.0^a	47.7^a	1457.1±11.6^a	63.8^b	111.5^a
Significance level	**	**	**	**	*	**
Interactions						
E x A	NS	NS	*	NS	Ns	NS
E x S	NS	NS	NS	NS	Ns	NS
A x S	**	**	**	**	**	NS
E x A x S	NS	NS	NS	NS	*	NS

Means within columns in each treat having smaller superscripts are not significantly different
NS: not significant ; * significant at P<0.05; ** significant at P<0.01
W1= Initial body weight, W2 = Body weight after 8 weeks of Eltroxine treatment
W3 = body weight after 8 weeks of Elroxine treatments cessation.

Table (2): Effect of Eltroxine, age, season and their interaction on feed consumption and feed conversion of Sinai hens during addition and cessation of Eltroxine treatments.

	Feed consumption (kg)			Feed conversion		
Items	**During addition of Eltroxine**	**During cessation of Eltroxine**	**Total mean**	**During addition of Eltroxine**	**During cessation of Eltroxine**	**Total mean**
1. Eltroxine level µg/kg diet (E)						
Control	0.104±0.003	0.121±0.003	0.113±0.002	3.78±0.23	3.91±0.103	3.85±0.123
40	0.105±0.002	0.126±0.003	0.116±0.002	3.81±0.21	3.87±0.111	3.84±0.116
60	0.104±0.002	0.122±0.003	0.113±0.002	4.03±0.28	4.05±0.122	4.04±0.150
80	0.105±0.003	0.121±0.002	0.113±0.002	3.80±0.17	4.24±0.113	4.02±0.106
Significance level	NS	NS	NS	NS	NS	Ns
2. Age of birds (A)						
22 weeks	0.116±0.006[a]	0.127±0.001[a]	0.121-0.001[a]	4.53±0.12[a]	3.97±0.06	4.24±0.074[a]
42 weeks	0.093±0.003[b]	0.118±0.002[b]	0.105±0.001[b]	3.18±0.12[b]	4.07±0.09	3.62±0.090[b]
Significance level	**	**	**	**	NS	**
3. seasons (S)						
Summer	0.106± 0.001 [a]	0.120±0.001	0.113±0.001	4.21±0.12[a]	4.21±0.06[a]	4.21±0.069[a]
Winter	0.102 ± 0.002 [b]	0.125±0.002	0.114±0.001	3.51±0.17[b]	3.83±0.08[b]	3.67±0.097[b]
Significance level	**	NS	Ns	**	**	**
Interactions						
E x A	NS	NS	NS	NS	NS	NS
E x S	NS	NS	NS	NS	NS	NS
A x S	**	NS	NS	**	NS	**
E x A x S	NS	NS	NS	NS	NS	NS

Means within columns in each treat having smaller superscripts are not significantly different
NS: not significant ; * significant at P<0.05; ** significant at P<0.01

Table (3): Effect of Eltroxine, age, season and their interactions on egg number , egg weight and egg mass during addition and cessation of Eltroxine of Sinai laying hens.

Items	Egg number			Egg weight (g)			Egg mass (g)		
	During addition of Eltroxine	During cessation of Eltroxine	Total mean	During addition of Eltroxine	During cessation of Eltroxine	Total mean	During addition of Eltroxine	During cessation of Eltroxine	Total mean
1. Eltroxine level µg/kg diet (E)									
Control	19.27±0.66	19.32±0.60^{b}	19.29±0.44^{ab}	42.21±0.97	45.45±0.70	43.83±0.63	816.25±35.90	874.09±25.70^{b}	845.14±22.3^{ab}
40	19.02±0.56	20.40±0.48^{a}	19.71±0.38^{a}	42.22±0.92	45.25±0.62	43.73±0.59	806.15±32.32	918.08±15.33^{a}	862.11±19.56^{a}
60	18.39±0.66	18.80±0.57^{cb}	18.59±0.43^{b}	42.01±1.1	45.79±0.54	43.90±0.66	780.71±39.73	858.27±24.91^{b}	819.49±23.97^{ab}
80	18.87±0.50	18.11±0.53^{c}	18.49±0.35^{b}	42.16±0.94	44.79±0.76	43.47±0.62	796.52±27.84	806.16±19.33^{c}	801.3±16.85^{b}
Significance level	NS	**	*	NS	NS	NS	NS	**	*
2. Age of birds (A)									
22 weeks	19.11±0.47^{a}	21.03±0.26^{a}	20.07±0.28^{a}	38.60±0.23^{b}	42.97±0.19^{b}	40.79±0.27^{b}	740.35±20.77^{b}	903.34±11.55^{a}	821.85±14.58
42 weeks	18.66±0.35^{b}	17.29±0.33^{b}	17.97±0.23^{b}	45.70±0.60^{a}	47.66±0.4^{a}	46.68±0.37^{a}	859.46±24.09^{a}	824.96±18.32^{b}	842.21±15.24
Significance level	NS	**	**	**	**	**	**	**	Ns
3. seasons (S)									
Summer	17.60±0.28^{b}	18.28±0.40^{b}	17.94±0.24^{b}	40.93±0.50^{b}	44.32±0.29^{b}	42.63±0.33^{b}	720.11±13.04^{b}	806.90±15.33^{b}	763.51±11.03^{b}
Winter	20.17±0.45^{a}	20.03±0.36^{a}	20.1±0.28^{a}	43.36±0.79^{a}	46.32±0.56^{a}	44.84±0.50^{a}	879.70±26.84^{a}	921.40±12.63^{a}	900.55±14.9^{a}
Significance level	**	**	**	**	**	**	**	**	**
Interactions									
E x A	NS	NS	NS	NS	NS	NS	NS	NS	NS
E x S	NS	**	NS	NS	NS	NS	NS	**	NS
A x S	**	NS	**	**	**	**	**	**	**
E x A x S	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means within columns in each treat having smaller superscripts are not significantly different
NS: not significant ; * significant at P<0.05; ** significant at P<0.01

Table (4): Effect of Eltroxine, age, season and their interaction on egg shape, shell thickness, yolk index and haugh unit, during addition and cessation of Eltroxine in the diets of Sinai laying hens.

	Egg shape index			Shell thickness			Yolk index			Haugh unit		
Items	**During addition of Eltroxine**	**During cessation of Eltroxine (w3)**	**Total mean**	**During addition of Eltroxine**	**During cessation of Eltroxine**	**Total mean**	**During addition of Eltroxine**	**During cessation of Eltroxine**	**Total mean**	**During addition of Eltroxine**	**During cessation of Eltroxine**	**Total mean**
1. Eltroxine level µg/kg diet (E)												
Control	0.825±0.004	0.819±0.003^{ba}	0.826±0.004	0.347±0.003	0.336±0.003	0.344±0.002^{a}	0.430±0.003	0.427±0.004^{ba}	0.430±0.003	75.7±1.0	73.09+1.1^{a}	74.82±0.79
40	0.823±0.004	0.827±0.004^{a}	0.823±0.075	0.339±0.002	0.326±0.003	0.335±0.002^{b}	0.434±0.003	0.428±0.003^{ba}	0.435±0.003	77.0±0.9	71.32+1.0^{a}	75.08±0.75
60	0.830±0.006	0.809±0.00^{bc}	0.830±0.006	0.343±0.002	0.330±0.003	0.339±0.002^{ab}	0.430±0.003	0.416±0.005^{b}	0.430±0.003	77.0±1.0	67.38+0.4^{b}	73.81±0.92
80	0.823±0.005	0.806±0.004^{c}	0.823±0.005	0.338±0.003	0.337±0.003	0.338±0.002^{ab}	0.425±0.003	0.429±0.004^{a}	0.425±0.003	75.2±0.9	70.03+1.4^{ab}	73.74±0.81
Significance level	NS	**	Ns	NS	NS	*	NS	NS	Ns	NS	**	Ns
2. Age of birds (A)												
22 weeks	0.829±0.004	0.812±0.002	0.830±0.004	0.342±0.001	0.329±0.002	0.338±0.002	0.443±0.002^{a}	0.427±0.002	0.443±0.002^{a}	79.1±0.6^{a}	71.33+0.9	76.46±0.58^{a}
42 weeks	0.821±0.002	0.818±0.003	0.821±0.003	0.341±0.002	0.335±0.002	0.340±0.002	0.417±0.002^{b}	0.423±0.003	0.417±0.002^{b}	73.5±0.7^{b}	69.58+0.9	72.18±0.55^{b}
Significance level	NS	NS	Ns	NS	NS	Ns	**	NS	**	**	NS	**
3. seasons (S)												
Summer	0.825±0.004	0.816±0.004	0.825±0.004	0.330±0.001^{b}	0.330±0.002	0.330±0.002^{b}	0.428±0.002	0.433±0.003^{a}	0.429±0.002	74.7±0.7^{b}	69.76+1.4	73.03±0.58^{b}
Winter	0.825±0.002	0.815±0.003	0.826±0.020	0.357±0.001^{b}	0.334±0.002	0.348±0.002^{a}	0.431±0.002	0.416±0.002	0.431±0.002	77.8±0.7^{a}	71.15+1.2	75.56±0.57^{a}
Significance level	NS	NS	Ns	**	NS	**	NS	**	Ns	**	NS	**
Interactions												
E x A	**	**	**	NS	NS	NS	NS	NS	NS	NS	NS	NS
E x S	NS	NS	NS	**	*	**	*	NS	*	NS	*	NS
A x S	NS	**	NS	**	NS	**	NS	NS	NS	NS	NS	NS
E x A x S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Means within columns in each treat having smaller superscripts are not significantly different
NS: not significant ; * significant at P<0.05; ** significant at P<0.01

Table (5): Effect of Eltroxine, age, season and their interaction on shell and albumen weight percentage during addition and cessation of Eltroxine in the diets of Sinai laying hens.

	Shell weight percentage			Yolk weight percentage			Albumin weight percentage		
Items	**During addition of Eltroxine**	**During cessation of Eltroxine**	**Total mean**	**During addition of Eltroxine**	**During cessation of Eltroxine**	**Total mean**	**During addition of Eltroxine**	**During cessation of Eltroxine**	**Total mean**
1. Eltroxine level µg/kg diet (E)									
Control	11.525±0.088	11.161±0.062	11.526±0.08	31.115±0.262	32.385±0.309	31.12±0.26	57.359±0.270	56.454±0.319	57.36±0.272
40	11.424±0.088	11.218±0.369	11.424±0.08	31.662±0.293	33.939±0.821	31.66±0.29	56.913±0.274	54.843±1.151	56.91±0.274
60	11.442±0.180	10.96±0.123	11.242±0.12	31.417±0.300	33.144±0.306	31.42±0.30	57.140±0.304	55.894±0.319	57.14±0.307
80	11.384±0.095	11.422±0.388	11.384±0.04	30.958±0.278	34.361±1.253	30.96±0.27	57.658±0.278	54.218±1.618	57.66±0.278
Significance level	NS	NS	NS	NS	NS	NS	NS	NS	NS
2. Age of birds (A)									
22 weeks	11.829±0.073[a]	11.526±0.265[a]	11.83±0.073[a]	29.634±0.146[b]	33.211±0.744	29.63±0.14[a]	58.534±0.163[a]	55.263±0.994	58.54±0.16[a]
42 weeks	11.068±0.062[b]	10.856±0.079[b]	11.07±0.062[b]	32.901±0.191[a]	33.703±0.228	32.90±0.19[b]	56.030±0.199[b]	55.411±0.235	56.03±0.19[b]
Significance level	**	*	**	**	NS	**	**	NS	**
3. seasons (S)									
Summer	11.353±0.084	11.121±0.180	11.35±0.085	31.443±0.214	33.403±0.444	31.44±0.21	57.203±0.207	55.474±0.602	57.20±0.20
Winter	11.534±0.056	11.26±0.198	11.53±0.056	31.134±0.187	33.51±0.645	31.13±0.18	57.331±0.192	55.230±0.824	57.33±0.19
Significance level	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interactions									
E x A	NS	NS	NS	NS	NS	NS	NS		NS
E x S	**	*	**	NS	NS	NS	NS		NS
A x S	**	NS	**	**	NS	**	**		**
E x A x S	NS	NS	NS	NS	NS	NS	NS		NS

Means within columns in each treat having smaller superscripts are not significantly different
NS: not significant ; * significant at P<0.05; ** significant at P<0.01