RELATIONSHIP BETWEEN THYROID GLAND HORMONES AND REPRODUCTIVE FUNCTIONS IN JAPANESE QUAIL KEPT UNDER DIFFERENT SYSTEMS OF PHOTOPERIODS

By

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Abstract: *A total of 243 Japanese quails at 3 weeks of age were used to investigate the effect of thyroid status and length of photoperiod on their reproductive performance. Birds were randomly assigned to 3 main groups of (control; hyperthyroidism and hypothyroidism) till sexual maturity and each treatment was divided into 3 sub treatments of light programs; control (12hrs), long day of photoperiod (16hrs) and short day of photoperiod (8hrs). Results reveled that birds subjected to hyperthyroidism reached sexual maturity after 85.60 days and 50% of production after 90.81 days which was significantly earlier than control and hypothyroidism also 16 hrs of photoperiod significantly enhanced age at sexual maturity and at 50% of production. Egg number significantly decreased under hypothyroidism by (42.03%) of control from the period (6 - 26) weeks of age. However, 16hr of photoperiod increased egg number and egg production percentage by (32.64%) and (32.69%) of control during the same period. Thyroid status had no significant effect on shape index, shell thickness, specific gravity, and yolk color. There was a significant decrease (10.63%) and increase (25.97%) in fertility percentage with hypothyroidism and hyperthyroidism, respectively. Also, there was a significant reduction and increase in hatchability was associated with hypothyroidism by (34.32%) and hyperthyroidism by (12.80%) of control, respectively. Fertility significantly improved with 16 hr by (4.22%) of control (12hr); however, it significantly decreased with 8hr by (64.35%) of control.*

Moreover, there was a significant increase (33.78%) and decrease (37.93%) of control in hatchability with 16hr and 8hr, respectively. Chick weight significantly decreased with hypothyroidism by (7.27%) and increased with hyperthyroidism by (5.42%) of control, respectively. It was concluded that inducing hyperthyroidism under short days photoperiods can increase egg production, egg weight, fertility, and hatchability without any effects on egg quality.

INTRODUCTION

Light intensity, spectral composition of light, and length of lighting period represent effective stimuli for animals. It is known that variation in lighting modifies growth and activity of endocrine glands and thus induces biochemical and behavioral changes of organisms. Changes in photoperiod are recognized as the major determinants of the timing of reproduction and other endocrine-associated events in birds and mammals (Lincoln *et al.*, 1980 and Ibrahim, 2005). Lincoln *et al.,* (1980) reported that changes in photoperiod are recognized as the major determinants of the timing of reproduction and other endocrine-associated events in birds and mammals. Increasing daylight resulted in earlier onset of lay, less feed consumed per chicken hen to peak egg production, earlier age at peak egg production, higher peak egg production, and more total eggs per hen than produced by hens in regimen with an 8- hr photoperiod supplied by daylight beginning at 12wk of age (Brake and Baughman, 1989). Ahmed *et al*, (2000) noted that the transfer of female Japanese quail from short days LD8: 16 to long days 12: 12, 16: 8 and 20: 4 at 5wk of age induced early sexual maturity. Boon *et al.,* (2000) reported that sexual maturation of Japanese quail was stimulated by photoperiod. At the age of 71 days, eight out of nine females subjected to 18L : 6D were producing eggs, but non of the 6L : 18D females.

On the other hand, thyroid hormones are major regulators of development, metabolism and homeostasis in birds. Studies addressed that thyroid hormones influence both aspects of development; growth and differentiation, and maturation. In general, they appear to act permissively or indirectly in concert with other control substances, in their stimulation of growth in birds (McNabb and King, 1993). It is suggested that in sexually mature birds the concentrations of plasma T_4 and T_3 are depressed because of a reduction in the concentration of plasma thyroid-hormone-binding protein. The

production of these proteins is suggested to be inhibited by gonadal steroids (Sharp and Klandorf, 1981).

The interaction of the thyroid with photoperiod is complex (Sturkie, 1986). During photostimulation there is an initial rise in thyroid activity, which is then depressed when the gonads are stimulated and produce steroid (Peczely *et al.*, 1980), masking the stimulatory action of the long days of T_4 production. "Long" days seem to exert an inhibitory effect on thyroid function, although they stimulate pituitary thyrotrophic activity in birds (Sturkie, 1986). Péczely *et al.*, (1980) stated that in female Japanese quail exposed to short days, treatment with T4 increased both the plasma concentrations of progesterone, estrone and estradiol also the ovarian weight. In 1981, Sharp and Klandorf reported that in the quail, long day lengths may directly stimulate the hypothalamo-pituitary-thyroid axis and the production of T_4.

Many studies in birds have focused on the interaction between the thyroid and gonads, since the function of these organs shows a profound reciprocal relationship, which is apparently related to the photoperiod (Peczely *et al.*, 1980).The present study was conducted to shed more light on the interrelationships among thyroid gland, photoperiod and reproductive function of Japanese quail.

MATERIALS AND METHODS

The present study was carried out at the Poultry Research Laboratory , Faculty of Agriculture (Saba Basha), Alexandria University.

A total of 243 Japanese quails were used for about 23 weeks as an experimental period. Birds at 3 weeks of age were kept in three separate rooms; each equipped with separate illumination. Eighty one Japanese quail chicks for each main groups of (control; hyperthyroidism and hypothyroidism). Birds were rendered hypothyroid by administering Thiouorea [CS $(NH_2)_2$] at a level of 0.1% and hyperthyroidism was induced by administering thyroxin as Eltroxine-100 µg tablets at a level of 0.5ppm. Each group was divided to 3 sub treatments of light programs {control (12hrs), long day of photoperiod (16hrs) and short day of photoperiod (8hrs)} Average light intensity was adjusted by reostate key to 5 Lux during the growing period and 12 Lux during the laying period for fluorescent light in each light program according to Refaat (2004). Treatments comprised of 9 replicates involving 2 females and 1 male. Feed and water were provided *ad libitum*. A quail grower ration which used during the

growing period 3 : 6 wks was (24.12% cp ; 2914 Kcal ME)/ Kg). The second ration was used during the laying period 6 weeks to the termination of the experiment at 26 weeks of age (19.97% cp ; 2884 Kcal ME/ Kg).

Measurements:

Body weight and age at sexual maturity were determined for each hen at the first egg laid and at 50% egg production. Eggs weight and egg number were recorded for each replicate. Percentage of egg production and egg mass were calculated.

Eggs laid for three consecutive days per each period of age for each treatment were used for egg quality measurements. Egg shape index, Specific gravity, Egg shell was weighted with its shell membranes Yolk visual color was measured by comparison with the color Fan of Hoffman La Roch. Total of (1836) eggs were collected during the experimental period for incubation. Fertility and hatchability were calculated, embryonic mortality was determined.

Blood samples were withdrawn from the bronchial vein from each treated bird at 9.0 a-m. before access to feed and water birds at (50% of production and at 26 weeks of age), Plasma was obtained and stored at -20°C for later analyses of biochemical parameters. Plasma calcium concentration (mg/dl) was determined according to the method of Tietz and Saunders (1970). Phosphorus concentration (mg/dl) was determined by the method descried by Tietz and Saunders (1995). Aspartate aminotransferase (AST) concentration (U/l) and alanine aminotransferase (ALT) concentration (U/l) were determined by the method descried by Reitman (1957). Plasma estrogen concentration (pg/ml) was determined with radioimmunoassay kits manufactured by diagnostic products corporation USA according to Yalow and Berson (1971). Plasma T_3 and T_4 concentration (ng/ml) were measured with RIA kits manufactured by Immunotech Beckman coulter Co.

Statistical analysis:

The experiment was set in a completely randomized design. Data were analyzed by analysis of variance using the general liner model procedure (Proc GLM; SAS Institute, 1996). Differences among means were determined using Duncan's test (Duncan, 1955).

RESULTS AND DISCUSSION

Age, and body weight at first egg and 50% egg production

Results concerning effect of thyroid status and length of photoperiods on age and body weight at sexual maturity at first egg and 50% of production are presented in table (1). Birds subjected to hyperthyroidism reached sexual maturity after 85.6 days which was significantly earlier than control and hypothyroidism. The same group reached 50% of production after 90.81 days which was also significantly ($P = 0.0006$) earlier than control and hypothyroidism. On the other hand, thyroid status had no significant effect on body weight at sexual maturity and at 50% production. This results are in good agreement with the finding of Hamdy and Abdel-Latif (1999) who reported that supplementing drinking water with potassium iodide at level of 300 : 600 ppm reduced age at sexual maturity in Japanese quail, which can be attributed to thyroxine ability to stimulate increases in the secretion of follicle-stimulating hormone (FSH), luteinizing hormone (LH) and in the hypothalamic content of gonadotropin-releasing hormone (Gn-Rh) (El-Sebai *et al.,* 2001).

Regardless of thyroid status, length of photoperiod had a significant effect on age at sexual maturity and 50% of production (Table 1). 16 hr of photoperiod significantly enhanced age at sexual maturity and 50% of production, 63.50 and 65.35 days, respectively. Nevertheless, age of sexual maturity and 50% of production under 8hr of photoperiod was significantly later than control (12hr), 138.64 and 155.51 days, respectively. Body weight at sexual maturity and 50% of production did not differ significantly among different lengths of photoperiod. These results generally supported the data reported by Abdelrazik (1980) and Yalcin *et al.,* (1993) who observed that birds under long photoperiod started to lay earlier than birds under short photoperiod. Also, confirmed results found by Sakurai (1984) and Parkbaran *et al.,* (1991) who reported that female Japanese quail reared under light regimen of 14hr light per day began to lay early. Also, Lewis *et al.,* (1992) stated that age at first egg is advanced when growing pullets are exposed to an increase in photoperiod and the degree of advancement can be modified by the size and timing of the light changes. Also, Ahmed *et al.,* (2000) reported that transferring female Japanese quails from short days LD8:16 to long days 12:12, 16:8 and 20:4 at 5 week of age induced early sexual maturity. In addition, Boon *et al.,* (2000) reported that sexual maturity was stimulated by long photoperiod. At the age of 71 days eight out of nine females subjected to 18L : 6D were

producing eggs, but none of the 6L : 18D females. Results show that, when comparing females reared on a short day with those reared on long day, the large age differences at first egg which results, is almost entirely attributable to the direct influence of light on sexual development of reproductive organs. It could be due to the acceleration of light to stimulate the gonadotropin releasing hormones from hypothalamus to pituitary gland and then stimulate the secretion of LH and FSH. This endocrine signal accelerated gonadal development and then egg production in females reared under long photoperiod when compared with females that reared under short photoperiod, where the light was insufficient to enhance acceleration the plasma concentration of LH or to initiate egg production (Ahmed *et al.,* 2000).

Table (1) shows that, there was a significant interaction between thyroid status and length of photoperiods on age at sexual maturity. The oldest age was under hypothyroidism and 8hr (166.00 and 180.33 days), however, the youngest age was under control and hyperthyroidism, both under 16hr of photoperiod. The interaction had no significant effect on body weight at sexual maturity, while it significantly (P = 0.0392) affected body weight at 50% of production. The highest weight was observed under hyperthyroidism and 12hr, while the lowest weight was under hyperthyroidism and 8hr of photoperiod.

Egg number and egg production percentage

Table (2) and (3) show the effect of thyroid status and length of photoperiod on egg number and egg production percentage during the laying period from (6 - 26) weeks of age. Regardless of length of photoperiod, egg number decreased significantly under hypothyroidism throughout the 5 intervals of laying period (6 - 10), (10 - 14), (14 - 18), (18 - 22) and (22 - 26) weeks of age. This decrease was (28.68%), (38.98%), (54.76%), (45.89%) and (34.69%) of control, respectively. Overall, hypothyroidism decreased egg number from the whole laying period (6 − 26wks) by (42.03%) of control. Effect of hyperthyroidism was exhibited from the second period when egg number significantly (P = 0.0005) increased by (40.80%) of control.

In the last 3 periods of laying stage hyperthyroidism continued increasing egg number by (10.92%), (10.11%) and (5.01%) as compared to control but without reaching significance. Generally, it increased egg number insignificantly during the period (6 − 26wks) by (12.70%) of control. Egg production percentage was significantly affected during the second period of laying intervals, and had the same trend as egg number. At the rest of laying

period, hyperthyroidism lost the significant effect on egg production percentage, but hypothyroidism still reduced them significantly in compare to control. These results can be explained with the findings of Elnagar and Beck (2000), who reported that in laying hens, thiouracil induced hypothyroidism, induces VIP (Vasoactive Intestinal Peptide) secretion from the hypothalamus, which stimulates prolactin secretion from the pituitary gland and in turn suppresses reproduction. Moreover, Liu and Han (1998) reported that hyperthyroid laying hens had higher laying rates than controls. Also, Hamdy and Abd El-Latif (1999) found that supplementation of Japanese quail water with iodine as KI at levels of 300 or 600 ppm improved egg number. Elnagar *et al.,* (2005) reported that egg number of Silver Montazah strain increased significantly by 2.34 and 8.77% in compare with control with the 50 and 100μg T_4 /kg body weight (bwt). doses, respectively.

Effects of length of photoperiod on egg number and egg production percentage are presented in table (2) and (3). As it appears from these tables, 16hr of photoperiod caused a significant increase in egg number and egg production percentage at the first 3 intervals of laying period. The increases in egg number were (183.18%), (45.58%) and (15.19%) of control, while the increases in egg production percentage were (182.85%), (45.58%) and (15.15%) of control, and the last two periods, the effect of 16hr of photoperiod lost significance. In addition, 16hr of photoperiod increased egg number and egg production percentage by (32.64%) and (32.69%) of control during the whole experimental period (6 - 26) weeks of age. On the other hand, 8hr of photoperiod reduced egg number and egg production percentage throughout different intervals of laying period. These results can be explained by the findings of Sharp (1993) who stated that transfer of the birds to long days after being exposed to short days, immediately activate a stimulatory neural input to GnRH-l neurons to induce gonadotropin release and consequently activates the growth and maturation of the ovary. In the present study, the direct effect of light was clear and strong on egg number and egg production percentage. Photostimulated birds, which exposed to long day, produced more eggs than non-photostimulated birds, which exposed to short day.

Tables (2) and (3) showed the two-way interaction effect on egg number and egg production percentage of Japanese quail through the laying period. Data indicates that the highest records of egg number and egg production percentage under control were obtained from 16hr during the different intervals of laying periods. The increase in egg number under 16hr of photoperiod was

(307.01%), (211.86%), (137.91%), (26.08%), (1.25%) and (77.01%) of normal photoperiod (12hr), while, the increases in egg production percentages under 16hr was (306.47%), (211.89%), (137.98%), (26.08%), (1.24%) and (76.98%) of normal photoperiod (12hr). Birds subjected to 8hr of photoperiod under control did not start production throughout the first two periods of laying stage. Under hypothyroidism, the normal photoperiod (12hr) was almost better than 16hr of photoperiod during the laying period, while the 8hr of photoperiod approximately stopped egg production. Under hyperthyroidism, 16hr of photoperiod generally was better than 12hr and 8hr photoperiods. It was increased by (818.93%), (58.18%), (21.26%), (2.81%), (10.81%) and (42.14%) of normal photoperiod (12hr), respectively, while egg production increased by (819.84%), (58.25%), (21.26%), (2.80%), (10.82%) and (42.31%) of normal photoperiod (12hr). This result is in good agreement with the finding of Péczely *et al.,* (1980) who reported that in quail exposed to short days of photoperiod no eggs were laid by either the control birds or thyroxine treated birds.

Egg weight

Data presented in table (4) shows effect of thyroid status and length of photoperiod on egg weight throughout laying period. Average weight of eggs produced by hens under hypothyroidism was significantly lower than those under control by (6.93%), (13.80%), (10.86%), (5.00%), (6.88%) and (8.70%) throughout the different intervals of laying period .

There was no significant effect of length of photoperiod on egg weight except in the first period of laying stage (Table 4). At this month, 8hr of photoperiod did not produce any eggs, while there were no significant differences between 16hr and control in average egg weight.

The two-way interaction had no significant effect on egg weight.

Egg mass:

Table (5) presents egg mass during laying period. Hypothyroidism caused significant reduction in egg mass by (30.78%), (47.82%), (59.88%), (49.14%) and (39.55%) throughout the 5 intervals of laying period. Also, hypothyroidism decreased egg mass by (46.73%) of control at the period of (6 - 26) weeks of age. On the other hand, hyperthyroidism insignificantly increased egg mass at reproductive stage by (5.70%), (35.05%), (18.45%), (16.49%) and (11.02%) of control, respectively. This result is in harmony with those of El-Ansary *et al.,*(1996) who found that in chickens, egg mass was increased

significantly at low level of KI   (400ppm). The previous result can be correlated to the decrease and increase associated with hypothyroidism and hyperthyroidism in egg number and egg weight, respectively. Effect of photoperiod length on egg mass is presented in table (5). 16hr of photoperiod was accompanied by significant increase in egg mass during the 5 intervals of laying period. This increase was (168.95%), (48.76%), (20.58%), (13.24%) and (9.36%) of normal photoperiod (12hr). From the period (6 - 26) weeks of age, 16hr of photoperiod increased egg mass significantly by (31.05%) of normal (12hr). On the other hand, 8hr did not start in production at the first period but after that it was associated with significant reduction in egg mass by (82.81%), (60.00%), (54.15%) and (41.50%) through the last intervals of laying period. Also, it was accompanied by significant reduction by (59.90%) of normal photoperiod in egg mass during the period (6 - 26) weeks of age. This result is in accordance with the findings of Ahmed *et al.,* (2000) who reported that in Japanese quail, egg mass of birds maintained on (LD12 : 12) light regimen was significantly lower in comparison with the long day groups (LD16:8 and 20 : 4). Variations in egg mass are mainly attributed to the significant differences in the egg number values mentioned above.

Interaction between thyroid status and length of photoperiod significantly affected egg mass (Table 5), 16hr of photoperiod under control and hyperthyroidism had the highest egg mass throughout laying period. Nevertheless, 8hr of photoperiod under hypothyroidism did not produce any egg during laying period except in the last period which is the lowest record in egg mass.

Egg quality traits:

Data concerning effect of thyroid status and length of photoperiod on yolk index are presented in table (6). Results revealed that thyroid status had a significant (P = 0.0202) effect on this trait. Yolk index under hypothyroidism significantly increased by (5.39%) as compared to those hyperthyroidism. However, insignificant increase or decrease reached (2.46%) or (3.06%) of control under hypothyroidism or under hyperthyroidism was observed, respectively. As it appears from table (6), length of photoperiod had a significant effect on yolk index. It increased significantly (P = 0.0447) under 16hr of photoperiod. This increase was (4.66%) of control (12h). These findings can be correlated to the increase of yolk height or the decrease of its

width. Data show that there was no significant effect on yolk index under this interaction.

Regardless of length of photoperiod, thyroid status had no significant effect on shape index as it presented in table (6). Moreover, regardless of thyroid status, there was a significant (P = 0.0036) reduction in shape index with 8hr. This reduction was (1.65%) of control. This result could be attributed to the increase in width of egg or the reduction in its length. There was a significant (P = 0.0172) interaction between thyroid status and length of photoperiod on shape index (table 15). The highest value was under the interaction between hypothyroidism and 16hr, while the lowest value was under control and 8hr.

Data presented in table (6) shows effect of thyroid status and length of photoperiod on yolk color. Data indicated that yolk color was not significantly affected by different thyroid status. Moreover, data showed that regardless of thyroid status, yolk color decreased significantly (P = 0.0001) under 8hr of photoperiod. It was (3.82) under 8hr, while it was (4.55) under control (12hr). Also, yolk color was affected significantly (P = 0.0383) with the two-way interaction. The highest value was under control and 16hr (5.16); however the lowest value was under control and 8hr (3.69).

Data presented in table (6) revealed that thyroid status, length of photoperiod and the two-way interaction between them had no significant effect on shell thickness and specific gravity.

Hatching traits:

Fertility and hatchability:

Data presented in table (7) shows effects of thyroid status and length of photoperiod on fertility and hatchability of total eggs set. First, there was a significant (P = 0.0001) decrease (10.63%) and increase (25.97%) in fertility percentage with hypothyroidism and hyperthyroidism, respectively. Also, there was a significant (P = 0.0001) reduction by (34.32%) and increase by (12.80%) in hatchability was associated with hypothyroidism and hyperthyroidism, respectively. This result generally supported the data reported by El-Sebai *et al.,* (2001) who found that fertility of Japanese quail's eggs showed decrease (3.34%) and slight increase (5.60%) under hypothyroidism and hyperthyroidism, respectively compared to euthyroid control birds. Also, they concluded that hypothyroidism impaired it by about (13.92%) compared to

the euthyroid control birds, whereas hyperthyroidism improved hatchability by about (7.30%). Also, McNabb, *et al.,* (1985) reported that in Japanese quail, maternal diets containing 150mu.g I / kg diet can improve hatchability by providing sufficient egg I for the thyroid function of embryos and hatchlings.

As it appears from table (7), fertility improved significantly (P = 0.0001) with 16 hr. This improve was (4.22%) of control (12hr). however, it decreased significantly (P = 0.0001) with 8hr. This reduction was (64.35%) of control. Moreover, there was a significant (P = 0.0001) increase in hatchability with 16hr by (33.78%) and decrease by (37.93%) of control with 8hr.

There was a significant interaction between thyroid status and length of photoperiod on fertility and hatchability(table 7). The highest value in fertility was recorded under hyperthyroidism, control and 16hr, while the lowest value was with hypothyroidism and 8hr (0.00%). On the other hand, the highest record in hatchability was obtained from hyperthyroidism and 16hr (91.43%), however, the lowest record was obtained from hypothyroidism and 8hr (0.00%).

Dead in shell percentage:

As, it appears from table (7), there was a significant (P = 0.0001) increase in dead in shell percentage under hypothyroidism (76.27%) of control. This result can be correlated to the reduction in hatchability which observed in this experiment under hypothyroidism.

Moreover, dead in shell percentage decreased and increased significantly (P = 0.0001) with 16hr and 8hr of photoperiod by (35.55%) and (27.86%) of control, respectively.

There was a significant interaction effect on dead in shell percentage. The worst percentage was under hypothyroid and 8hr while the best percentage was under control, hyperthyroidism and 16hr.

Chick weight:

Data revealed that chick weight decreased and increased significantly (P = 0.0001) with hypothyroidism and hyperthyroidism (Table 7), by (7.27%) and (5.42%) of control, respectively. This result generally supported the data reported by El-Nagar *et al.,* (2005) who reported that chicks' weights increased significantly in compare to control by the administration of thyroxine to Silver Montazah and Gimmiza strains. The increased one-day-old chicks' weight with

the hyperthyroidism treatment is correlated with the increased egg weight observed with this treatment (Table 4).

There was a significant increase in chick weights under 16hr of photoperiod, (3.17%) of control. This result can be attributed to the increased egg weight which was observed under 16hr in this study (Table 4).

There was no significant effect of interaction on chick weight.

Plasma biochemical parameters and hormonal assay of female Japanese quails at 50% of production and at 26 weeks of age:

AST and ALT enzymes:

Thyroid status had no significant effect on plasma AST and ALT concentration at 50% of production (table 8). While, there was a significant increase in AST and ALT concentration with hypothyroidism at 26 weeks of age (table 9), by (27.62%) and (46.39%) of control, respectively. This findings is generally supported those of El-Nagar *et al.,* (2001) who found that in broiler chicks, serum AST and GGT concentrations increased significantly with hypothyroidism. Also, El-Sebai *et al.*, (2001) reported that in Japanese quail, AST and GPT concentrations increased significantly by (7%) and (15%) of control, respectively under hypothyroidism.

As it appears from table (8) and (9), AST concentration decreased significantly ($P = 0.0001$) with 8hr of photoperiod by (50.23%) in compare to control at 50% of production. However, plasma ALT increased significantly ($P = 0.0002$) with 16hr by (32.66%) of control. While, at 26 weeks of age, there was a significant increase in AST under 16hr of photoperiod (85.34% of control). Also, length of photoperiods had no significant effects on ALT concentration.

On the other hand, table (8) showed that plasma AST and ALT concentration were significantly affected by the interaction at 50% of production. The highest record was observed with control and 16hr, but the lowest record was observed with hyperthyroidism and 8hr of photoperiod. On the other hand, table (9) shows that the interaction between thyroid status and length of photoperiods had no significant effect on AST and ALT concentration at 26weeks of age.

Calcium and phosphorus:

Plasma calcium and phosphorus concentration of females did not differ significantly under the different thyroid status at 50% of production (table 8). In addition, there was a significant increase in calcium and phosphorus with hyperthyroidism at 26 weeks of age (table 9), by (40.28%) and (39.72%) of control, respectively. This result is in accordance with the findings of El-Sebai *et al.*, (2001) who concluded that both serum calcium and phosphorus concentrations increased significantly under hyperthyroidism. The observed increase can be correlated to the increase in egg production under this treatment (Tables 2 and 3).

Moreover, there was an insignificant reduction calcium and phosphorus concentration under 8hr of photoperiod at 50% of production (table 8). Theses reduction were (25.81%) of control. On the other hand, at 26 weeks of age, length of photoperiods had no significant effects on calcium and phosphorus of females. This reduction in calcium and phosphorus concentration may be due to thyroid status observed reduction in egg production under 8h of photoperiod in this study (Tables 2 and 3).

The interaction between thyroid status and length of photoperiod had no significant effect on females' calcium and phosphorus concentration at 50% of production and at 26 weeks of age (table 8 and 9).

T_3 and T_4 hormones:

As it appears from tables (8) and (9), there was a significant decrease and increase in T_3 concentration of females with hypothyroidism and hyperthyroidism as compared to by (36.38%) and (58.42%), respectively at 50% of production. T_4 followed the same trend with hypothyroidism and hyperthyroidism resulting in a significant decrease by (35.42%) and increase by (46.59%) of control, respectively. In addition, plasma T_3 concentration of females increased significantly with hyperthyroidism by (78.65%) of control, respectively at 26 weeks of age. Also, there was a significant decrease and increase in plasma T_4 concentration of females with hypothyroidism by (34.81%) and hyperthyroidism by (54.87%) of control. This result is in good agreement with El-Nagar *et al.,* (2001) who found that on laying hens as feeding thiouracil as an antithyroid drug affected the thyroid gland secretion of T_4 therefore caused a reduction in plasma T_3 which led to a hypothyroid condition. Also, El-Nagar *et al.,* (2001) reported that serum thyroid hormones

analysis at 3rd week of age reveled that thiouracil treatment resulted in a decrease in serum T_3 and T_4 compared to control birds. On the other hand, the DL-thyroxine treatment caused an increase in serum T_3 and T_4. El-Nagar *et al.,* (2005) found that in Silver Montazah and Gimmiza strain, DL-thyroxine administration caused increases in serum thyroid hormones.

At 50% of production, there was a significant increase and reduction in females' plasma T_3 and T_4 concentration under 16hr and 8hr of photoperiod, respectively (table 8). This increase were by (43.16%) and (34.84%) and the decrease were by (25.84%) and (24.29%) of control, respectively. On the other hand, data showed that length of photoperiod had no significant effect on T_3 and T_4 concentration at 26 weeks of age (table 9).

Both T_3 and T_4 concentration were significantly affected by the interaction between thyroid status and length of photoperiod at 50% of production (Table 8). The highest records were under hyperthyroidism and 16hr, but the lowest records were under hypothyroidism and 8hr. In addition, the interaction had a significant effect on T_3 and T_4 concentration at 26 weeks of age (table 9). The highest value of T_3 hormone was under hyperthyroidism and 16hr, while the lowest value was under hypothyroidism and 16hr. Also, the highest value of T_4 hormone was under hyperthyroidism and 12hr, but the lowest was under hypothyroidism and 16hr of photoperiod.

Estrogen (E$_2$):

Table (8) and (9) showed that, irrespective of length of photoperiod, there was a significant increase in estrogen concentration with hyperthyroidism at 50% of production and at 26 weeks of age. This increase was (54.5%) and (15.19%) of control. The significant increase in estrogen concentration associated with hyperthyroidism can be correlated to the early sexual maturity of birds reared under this treatment in the present study (Table 1) and the increased egg production (Table 2 and 3).

Estrogen increased and decreased significantly with 16hr and 8hr of photoperiod at 50% of production (Table 8). This increase and decrease was (68.65%) and (27.47%) of control. In addition, there was a significant increase in estrogen concentration by (15.53%) under 16hr of photoperiod at 26 weeks of age (Table 9). This increase in estrogen concentration observed at 16hr can be attributed to the early sexual maturity of birds reared under this treatment (Table 1) and the increased egg production (Table 2 and 3).

Estrogen was also significantly affected (P = 0.0001) with the interaction between thyroid status and length of photoperiod at 50% of production (Table 8). The highest concentration was under hyperthyroidism and 16hr, while the lowest concentration was under control and 8hr. on the other hand, estrogen was significantly (P = 0.0001) affected with the interaction at 26 weeks of age (Table 9). The highest value was recorded under hypothyroidism and 16hr, while the lowest value was recorded under hypothyroidism and 12hr.

It can be concluded that inducing hyperthyroidism under short days photoperiods can increase egg production, egg weight, fertility, and hatchability without any effects on egg quality.

Table (1): Effect of thyroid status and length of photoperiods on age and body weight at sexual maturity and at 50% of production in female Japanese quails.

Items		At sexual maturity		At 50% of production	
		Age (days)	Body weight (g)	Age (days)	Body weight (g)
Thyroid status:					
Control		90.03 ± 7.46^{ab}	221.86 ± 4.75	102.70 ± 5.21^{a}	213.06 ± 4.16
Hypothyroidism		114.85 ± 8.70^{a}	215.11 ± 4.53	121.94 ± 13.11^{a}	212.96 ± 5.01
Hyperthyroidism		85.60 ± 4.64^{b}	214.19 ± 3.89	90.81 ± 3.54^{b}	208.01 ± 3.81
P. Value		0.0128	0.1163	0.0006	0.9507
Photoperiod:					
Normal (12L:12D hr)		88.07 ± 4.43^{b}	217.30 ± 3.94	94.59 ± 4.87^{b}	212.37 ± 4.52
Long (16L: 8D hr)		63.50 ± 2.47^{c}	211.68 ± 3.84	65.35 ± 2.29^{c}	207.56 ± 3.81
Short (8L :16D hr)		138.64 ± 6.93^{a}	225.62 ± 5.79	155.51 ± 8.3^{a}	213.66 ± 4.43
P. Value		0.0001	0.4026	0.0001	0.5102
Interaction effect: **Thyroid status X photoperiod**					
Control:	Normal (12L:12D hr)	81.00 ± 4.65^{d}	238.71 ± 8.77	89.50 ± 8.39^{e}	212.05 ± 6.50^{ab}
	Long (16L: 8D hr)	60.33 ± 2.44^{de}	208.51 ± 6.03	62.89 ± 3.86^{f}	203.68 ± 5.99^{ab}
	Short (8L :16D hr)	128.75 ± 10.08^{b}	225.35 ± 7.78	156.14 ± 3.28^{b}	221.30 ± 7.83^{ab}
Hypothyroidism:	Normal (12L:12D hr)	104.00 ± 12.70^{c}	220.63 ± 10.84	110.33 ± 11.56^{d}	203.56 ± 6.46^{ab}
	Long (16L: 8D hr)	73.75 ± 4.73^{de}	213.85 ± 6.74	75.17 ± 2.01^{ef}	208.21 ± 5.48^{ab}
	Short (8L :16D hr)	166.00 ± 15.28^{a}	212.21 ± 5.40	180.33 ± 1.33^{a}	216.08 ± 8.53^{ab}
Hyperthyroidism:	Normal (12L:12D hr)	79.22 ± 7.14^{de}	210.66 ± 7.02	84.22 ± 4.17^{e}	225.13 ± 9.75^{a}
	Long (16L: 8D hr)	56.42 ± 1.20^{e}	212.65 ± 7.42	58.00 ± 1.24^{f}	211.22 ± 9.44^{ab}
	Short (8L :16D hr)	121.16 ± 15.47^{bc}	219.77 ± 8.39	130.20 ± 15.34^{c}	201.26 ± 4.91^{b}
P. Value		0.0057	0.1679	0.0077	0.0392

[a, b, c, d, e and f.] Means having different letters within a column are significantly different at (P≤0.05).

Table (2): Effect of thyroid status and length of photoperiods on egg number/hen/period through different laying periods of the study

Items	Egg number / hen / period at					
	(6-10) wk	(10-14) wk	(14-18) wk	(18-22) wk	(22-26) wk	(6-26) wks
Thyroid status:						
Control	7.95±0.22 [a]	11.57±0.77 [b]	16.58±0.89 [a]	19.00±0.20 [a]	22.34±1.49 [a]	77.54±5.44 [a]
Hypothyroidism	5.67±0.24 [b]	7.06±0.82 [c]	7.50±0.29 [b]	10.28±0.50 [b]	14.59±0.46 [b]	44.95±3.04 [b]
Hyperthyroidism	8.25±0.14 [a]	16.29±0.31 [a]	18.39±0.55 [a]	20.92±1.90 [a]	23.46±1.28 [a]	87.39±5.74 [a]
P. Value	0.0463	0.0005	0.0025	0.0014	0.0001	0.0007
Photoperiod:						
Normal (12L:12D hr)	5.71±0.20 [b]	13.25±0.87 [b]	16.65±0.26 [b]	19.28±1.34 [a]	22.16±1.06 [a]	77.08±4.23 [b]
Long (16L: 8D hr)	16.17±0.78 [a]	19.29±1.17 [a]	19.18±2.20 [a]	22.31±1.63 [a]	25.31±1.73 [a]	102.24±10.55 [a]
Short (8L.:16D hr)	0 [c]	2.25±0.29 [c]	6.65±0.44 [c]	8.72±0.67 [b]	12.93±0.44 [b]	30.56±3.91 [c]
P. Value	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Interaction effect:						
Thyroid status X photoperiod						
Control:						
Normal (12L:12D hr)	4.71±0.30 [e]	8.43±0.10 [cd]	11.29±0.56 [c]	20.17±0.36 [b]	24.86±2.67 [ab]	69.43±6.01 [bc]
Long (16L: 8D hr)	19.17±0.66 [b]	26.29±0.29 [a]	26.86±0.46 [a]	25.43±0.75 [a]	25.17±2.75 [ab]	122.90±8.55 [a]
Short (8L :16D hr)	0 [g]	0 [e]	11.63±0.42 [c]	11.67±0.67 [e]	17.00±0.53 [cd]	40.30±5.41 [d]
Hypothyroidism:						
Normal (12L:12D hr)	10.00±0.68 [c]	15.00±0.77 [bc]	17.50±1.66 [b]	13.83±1.40 [d]	17.50±0.77 [cd]	73.82±6.80 [b]
Long (16L: 8D hr)	7.00±0.41 [d]	5.75±0.43 [d]	5.00±0.65 [e]	17.00±1.54 [c]	24.00±2.31 [ab]	58.74±5.32 [c]
Short (8L :16D hr)	0 [g]	0 [e]	0 [f]	0 [f]	2.29±0.13 [e]	2.29±0.13 [e]
Hyperthyroidism:						
Normal (12L:12D hr)	2.43±0.95 [f]	16.33±0.78 [b]	21.17±1.70 [b]	23.83±0.75 [a]	24.14±0.86 [abc]	88.00±7.33 [b]
Long (16L: 8D hr)	22.33±1.12 [a]	25.83±0.17 [a]	25.67±0.42 [a]	24.50±0.62 [a]	26.75±0.37 [a]	125.08±9.77 [a]
Short (8L :16D hr)	0 [g]	6.76±0.49 [d]	8.33±0.82 [d]	14.50±0.25 [d]	19.50±2.21 [bcd]	49.09±4.08 [d]
P. Value	0.0001	0.0003	0.0137	0.0111	0.0168	0.0426

a, b, c, d, e, f and g: Means having different letters within a column are significantly different at (P≤0.05)

Table (3): Effect of thyroid status and length of photoperiods on egg production percentage/hen/period through different laying periods in female Japanese quails.

Items	Egg production percentage / hen / period at					
	(6-10) wk	(10-14) wk	(14-18) wk	(18-22) wk	(22-26) wk	(6-26) wks
Thyroid status:						
Control	28.40±0.69 ^{a}	41.33±0.89 ^{b}	59.25±2.33 ^{a}	68.17±3.85 ^{a}	79.79±1.31 ^{a}	55.39±6.30 ^{a}
Hypothyroidism	20.24±0.42 ^{b}	24.70±0.40 ^{c}	26.78±0.18 ^{b}	36.71±0.94 ^{b}	52.12±0.79 ^{b}	32.11±2.38 ^{b}
Hyperthyroidism	29.47±0.69 ^{a}	58.23±0.26 ^{a}	65.68±3.74 ^{a}	74.80±2.78 ^{a}	83.79±2.58 ^{a}	62.39±6.54 ^{a}
P. Value	0.0321	0.0006	0.0024	0.0014	0.0001	0.0004
Photoperiod:						
Normal (12L:12D hr)	20.41±0.28 ^{b}	47.32±0.70 ^{b}	59.47±1.06 ^{b}	68.85±2.79 ^{a}	79.12±3.43 ^{a}	55.04±4.09 ^{b}
Long (16L:8D hr)	57.73±0.84 ^{a}	68.89±1.28 ^{a}	68.48±0.94 ^{a}	79.67±3.80 ^{a}	90.37±6.88 ^{a}	73.03±6.10 ^{a}
Short (8L:16D hr)	0 ^{c}	8.03±0.34 ^{c}	23.76±0.72 ^{c}	31.15±0.55 ^{b}	46.17±0.71 ^{b}	21.82±3.55 ^{c}
P. Value	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
Interaction effect: **Thyroid status X photoperiod**						
Control:						
Normal (12L:12D hr)	16.84±0.20 ^{d}	30.10±0.64 ^{d}	40.31±0.27 ^{d}	72.03±1.42 ^{b}	88.78±2.39 ^{ab}	49.61±8.59 ^{bc}
Long (16L:8D hr)	68.45±4.93 ^{a}	93.88±1.09 ^{a}	95.93±2.22 ^{a}	90.82±2.68 ^{a}	89.88±2.67 ^{ab}	87.80±2.83 ^{a}
Short (8L.:16D hr)	0 ^{f}	0 ^{f}	41.52±0.77 ^{d}	41.67±0.69 ^{d}	60.71±0.17 ^{d}	28.78±7.63 ^{c}
Hypothyroidism:						
Normal (12L:12D hr)	35.72±0.61 ^{b}	53.57±0.32 ^{c}	62.50±1.32 ^{c}	49.41±0.99 ^{d}	62.50±2.31 ^{cd}	52.74±3.03 ^{bc}
Long (16L:8D hr)	25.00±0.15 ^{c}	20.54±1.46 ^{e}	17.86±0.44 ^{f}	60.71±1.51 ^{c}	85.71±1.25 ^{abc}	41.96±4.36 ^{bc}
Short (8L:16D hr)	0 ^{f}	0 ^{f}	0 ^{g}	0 ^{f}	8.16±0.03 ^{e}	1.63±0.23 ^{d}
Hyperthyroidism:						
Normal (12L:12D hr)	8.67±0.38 ^{e}	58.30±0.97 ^{b}	75.60±1.22 ^{b}	85.12±2.68 ^{a}	86.21±3.06 ^{abc}	62.78±7.50 ^{b}
Long (16L:8D hr)	79.75±5.88 ^{a}	92.26±0.55 ^{a}	91.67±2.51 ^{a}	87.50±1.21 ^{a}	95.54±2.31 ^{a}	89.34±1.73 ^{a}
Short (8L.:16D hr)	0 ^{f}	24.13±1.75 ^{e}	29.76±0.22 ^{e}	51.79±0.73 ^{e}	69.64±1.47 ^{bc}	35.06±3.27 ^{c}
P. Value	0.0001	0.0005	0.0127	0.0112	0.0168	0.0312

a, b, c, d, e, f and g Means having different letters within a column are significantly different at (P≤0.05).

Table (4): Effect of thyroid status and length of photoperiods on egg weight (g) through different laying periods of study.

Items	Egg weight (g) at					
	(6-10) wk	(10-14) wk	(14-18) wk	(18-22) wk	(22-26) wk	(6-26) wks
Thyroid status:						
Control	10.96±0.27[a]	12.03±0.23[a]	11.33±0.25[a]	11.41±0.27[a]	11.20±0.24[b]	11.38±0.21[a]
Hypothyroidism	10.20±0.22[b]	10.37±0.12[b]	10.10±0.15[b]	10.84±0.20[b]	10.43±0.13[c]	10.39±0.12[b]
Hyperthyroidism	11.06±0.29[a]	11.42±0.22[a]	12.03±0.22[a]	12.21±0.16[a]	11.84±0.27[a]	11.71±0.15[a]
P. Value	0.0169	0.0021	0.0030	0.0083	0.0001	0.0001
Photoperiod:						
Normal (12L:12D hr)	11.19±0.54	11.37±0.23	11.24±0.25	11.54±0.19	11.36±0.24	11.34±0.17
Long (16L:8D hr)	10.29±0.33	11.22±0.23	11.32±0.28	11.48±0.24	10.93±0.17	11.05±0.32
Short (8L:16D hr)	---	11.29±0.18	11.31±0.54	11.73±0.53	11.16±0.30	11.37±0.30
P. Value	0.1235	0.8324	0.2260	0.9100	0.2173	0.4589
Interaction effect:						
Thyroid status X photoperiod						
Control:						
Normal (12L:12D hr)	11.84±0.39	12.19±0.16	11.63±0.29	11.85±0.30	11.39±0.26	11.78±0.07
Long (16L:8D hr)	10.08±0.35	11.86±0.31	11.43±0.39	11.37±0.44	10.99±0.47	11.15±0.24
Short (8L:16D hr)	---	---	10.94±0.95	11.02±0.94	11.18±0.71	11.05±0.39
Hypothyroidism:						
Normal (12L:12D hr)	10.31±0.18	10.35±0.18	10.09±0.21	10.68±0.21	10.56±0.07	10.40±0.11
Long (16L:8D hr)	10.11±0.39	10.41±0.16	10.12±0.27	10.99±0.59	10.20±0.33	10.36±0.23
Short (8L:16D hr)	---	---	---	---	10.54±0.41	10.54±0.41
Hyperthyroidism:						
Normal (12L:12D hr)	11.44±0.27	11.57±0.31	12.00±0.17	12.10±0.11	12.13±0.13	11.45±0.23
Long (16L:8D hr)	10.67±0.41	11.40±0.40	12.42±0.28	12.08±0.28	11.61±0.25	11.64±0.39
Short (8L:16D hr)	---	11.29±0.18	11.68±0.70	12.45±0.51	11.77±0.38	11.79±0.58
P. Value	0.4504	0.7772	0.9732	0.3599	0.9954	0.7864

a, b and c Means having different letters within a column are significantly different at (P≤0.05).

Table (5): Effect of thyroid status and length of photoperiods on egg mass (g /hen/period) through different laying periods of study.

Items		Egg mass (g/hen/period)					
		(6-10) wk	(10-14) wk	(14-18) wk	(18-22) wk	(22-26) wk	(6-26) wks
Thyroid status:							
Control		83.89±3.63 [a]	138.26±13.18 [a]	188.42±22.23 [a]	218.73±25.81 [a]	250.13±17.63 [a]	878.74±50.76 [a]
Hypothyroidism		58.07±2.68 [b]	72.15±9.10 [b]	75.60±2.95 [b]	111.24±7.37 [b]	151.20±15.50 [b]	468.12±43.33 [b]
Hyperthyroidism		88.67±4.87 [a]	186.72±27.40 [a]	223.18±19.01 [a]	254.80±23.00 [a]	277.69±15.98 [a]	1030.74±44.98 [a]
P. Value		0.0404	0.0005	0.0007	0.0004	0.0001	0.0001
Photoperiod:							
Normal (12L:12D hr)		62.28±3.43 [b]	149.32±12.63 [b]	186.97±16.04 [b]	224.78±17.16 [b]	253.68±13.14 [b]	876.89±75.67 [b]
Long (16L:8D hr)		167.50±10.84 [a]	222.13±26.40 [a]	225.45±28.04 [a]	256.92±19.40 [a]	277.42±9.87 [a]	1149.12±75.33 [a]
Short (8L:16D hr)		0 [c]	25.67±1.75 [c]	74.78±9.19 [c]	103.07±12.10 [c]	148.41±9.17 [c]	351.59±39.23 [c]
P. Value		0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
interaction effect: Thyroid status X photoperiod							
Control:	Normal (12L:12D hr)	56.77±2.75 [d]	103.03±10.37 [d]	131.22±11.03 [d]	238.38±28.74 [b]	283.49±10.92 [b]	812.88±30.87 [c]
	Long (16L:8D hr)	193.30±14.10 [b]	311.75±7.93 [a]	306.71±9.24 [a]	289.07±4.69 [a]	276.96±15.98 [bc]	1377.33±42.97 [a]
	Short (8L:16D hr)	0 [f]	0 [g]	127.33±13.31 [d]	128.73±18.99 [d]	189.96±11.34 [d]	446.00±92.32 [e]
Hypothyroidism:	Normal (12L:12D hr)	102.80±7.10 [c]	156.17±0.90 [c]	175.95±14.38 [c]	147.40±10.77 [d]	184.82±18.89 [d]	767.10±77.85 [cd]
	Long (16L:8D hr)	71.00±4.47 [d]	60.28±1.55 [f]	50.87±7.31 [f]	186.33±5.40 [c]	244.59±16.92 [c]	612.47±71.47 [de]
	Short (8L:16D hr)	0 [f]	0 [g]	0 [g]	0 [e]	24.80±1.53 [c]	24.79±1.53 [f]
Hyperthyroidism:	Normal (12L:12D hr)	27.82±1.92 [e]	188.77±14.77 [b]	253.74±29.71 [b]	288.57±6.41 [a]	292.75±10.62 [ab]	1050.68±84.06 [b]
	Long (16L:8D hr)	238.20±24.04 [a]	294.37±10.02 [a]	318.77±12.96 [a]	295.36±12.85 [a]	310.71±9.09 [a]	1457.55±42.11 [a]
	Short (8L:16D hr)	0 [f]	77.03±2.71 [e]	97.03±7.47 [e]	180.46±9.67 [c]	230.48±23.64 [cd]	583.98±69.32 [e]
P. Value		0.0001	0.0009	0.0493	0.0433	0.0332	0.0152

a, b, c, d, e, f and g: Means having different letters within a column are significantly different at (P≤0.05)

Table (6): Effect of thyroid status and length of photoperiods on egg quality traits in Japanese quails.

Items	Yolk index (%)	Shape index (%)	Yolk color	Shell thickness (mm)	Specific gravity
Thyroid status:					
Control	47.08±0.59[ab]	77.97±0.32	4.53±0.13	0.11±0.002	1.08±0.0004
Hypothyroidism	48.24±0.74[a]	78.37±0.43	4.30±0.14	0.12±0.002	1.08±0.0003
Hyperthyroidism	45.46±0.49[b]	77.75±0.32	4.21±0.10	0.11±0.002	1.07±0.1460
P. Value	0.0202	0.6875	0.0695	0.3911	0.2145
Photoperiod:					
Normal (12L:12D hr)	45.92±0.51[b]	77.31±0.32[a]	4.55±0.10[a]	0.12±0.002	1.08±0.0004
Long (16L: 8D hr)	48.06±0.51[a]	78.80±0.32[a]	4.62±0.12[a]	0.11±0.002	1.07±0.1676
Short (8L.:16D hr)	47.00±0.84[ab]	76.02±0.39[b]	3.82±0.15[b]	0.11±0.002	1.08±0.0005
P. Value	0.0447	0.0036	0.0001	0.0526	0.3073
Interaction effect:					
Thyroid status X photoperiod					
Control:					
Normal (12L:12D hr)	46.57±1.31	79.17±0.62[a]	4.69±0.18[ab]	0.12±0.0040	1.08±0.0009
Long (16L: 8D hr)	47.41±0.85	78.51±0.50[ab]	5.16±0.22[a]	0.11±0.0037	1.07±0.0004
Short (8L.:16D hr)	74.17±0.96	76.32±0.45[c]	3.69±0.21[d]	0.11±0.0034	1.08±0.0007
Hypothyroidism:					
Normal (12L:12D hr)	46.37±0.82	79.07±0.68[a]	4.33±0.21[bcd]	0.12±0.0037	1.08±0.0007
Long (16L: 8D hr)	49.39±0.89	79.36±0.05[a]	4.47±0.24[bc]	0.12±0.0036	1.08±0.0005
Short (8L.:16D hr)	51.02±1.52	76.70±0.94[bc]	4.10±0.35[bcd]	0.12±0.0042	1.08±0.0006
Hyperthyroidism:					
Normal (12L:12D hr)	44.81±0.60	76.68±0.38[bc]	4.58±0.13[abc]	0.11±0.0034	1.08±0.0005
Long (16L: 8D hr)	47.39±0.82	78.53±0.56[ab]	4.18±0.15[bcd]	0.11±0.0032	1.07±0.0057
Short (8L.:16D hr)	44.18±1.40	78.04±0.89[abc]	3.88±0.31[cd]	0.11±0.0037	1.08±0.0009
P. Value	0.1894	0.0172	0.0383	0.5651	0.4442

a , b , c and d Means having different letters within a column are significantly different at (P≤0.05).

Table (7): Effect of thyroid status and length of photoperiods on hatching traits in Japanese quails.

Items		Fertility (%)	Hatchability (%)	Dead in shell (%)	Chick weight (g)
Thyroid status:					
Control		67.54±2.50[b]	65.99±4.59[b]	7.46±0.07[b]	7.57±0.05[b]
Hypothyroidism		60.36±3.09[c]	43.34±1.14[c]	13.15±1.35[a]	7.02±0.12[c]
Hyperthyroidism		85.08±3.11[a]	74.44±4.49[a]	6.48±0.30[b]	7.98±0.06[a]
P. Value		0.0001	0.0001	0.0001	0.0001
Photoperiod:					
Normal (12L:12D hr)		88.79±0.76[b]	62.11±2.27[b]	11.45±0.41[a]	7.56±0.06[b]
Long (16L: 8D hr)		92.54±0.81[a]	83.09±2.84[a]	7.38±0.06[b]	7.80±0.06[a]
Short (8L :16D hr)		31.65±1.81[c]	38.55±4.60[c]	8.26±1.52[a]	7.49±0.13[b]
P. Value		0.0001	0.0001	0.0001	0.0016
Interaction effect: **Thyroid status X photoperiod**					
Control:	Normal (12L:12D hr)	86.90±0.35[d]	59.32±0.43[f]	10.17±0.98[c]	7.72±0.10
	Long (16L: 8D hr)	94.01±0.06[a]	84.11±0.33[b]	0[e]	7.53±0.08
	Short (8L :16D hr)	21.72±0.99[f]	54.52±0.71[h]	12.22±0.74[c]	7.41±0.10
Hypothyroidism:	Normal (12L:12D hr)	91.74±0.29[b]	56.27±1.70[g]	17.31±0.88[b]	7.17±0.11
	Long (16L: 8D hr)	89.34±0.36[c]	73.73±1.00[c]	22.14±1.36[a]	7.04±0.10
	Short (8L :16D hr)	0[g]	0[i]	0[e]	---
Hyperthyroidism:	Normal (12L:12D hr)	87.72±0.11[dc]	70.74±0.91[d]	6.88±0.53[d]	8.24±0.09
	Long (16L: 8D hr)	94.28±0.08[a]	91.43±1.02[a]	0[e]	7.75±0.09
	Short (8L :16D hr)	73.24±0.40[e]	61.14±0.42[e]	12.56±1.39[c]	8.02±0.13
P. Value		0.0001	0.0001	0.0317	0.1040

[a, b, c, d, e, f, g, h and i.] Means having different letters within a column are significantly different at (P≤0.05).

Table (8): Effect of thyroid status and length of photoperiods on plasma biochemical parameters an hormonal assay of female Japanese quails at 50% of production.

Items	AST (U/l)	ALT(U/l)	Calcium (mg/dl)	Phosphorus (mg/dl)	T_3 (ng/ml)	T_4 (ng/ml)	Estrogen (pg/ml)
Thyroid status:							
Control	8.18±0.34	62.58±2.73	3.23±0.27	2.15±0.18	5.05±0.68[b]	28.57±1.64[b]	66.00±2.71[b]
Hypothyroidism	6.87±0.46	52.60±1.04	3.15±0.31	2.10±0.21	3.40±0.18[c]	18.15±0.74[c]	63.52±2.75[b]
Hyperthyroidism	7.63±0.38	57.73±2.82	3.27±0.32	2.18±0.21	8.00±0.81[a]	41.88±2.10[a]	101.97±8.95[a]
P. Value	0.1098	0.0596	0.9437	0.9451	0.0001	0.0001	0.0001
Photoperiod:							
Normal (12L:12D hr)	8.85±0.55[a]	52.63±1.81[b]	3.16±0.33[ab]	2.11±0.22[ab]	5.12±0.82[b]	28.53±0.60[b]	67.88±3.67[b]
Long (16L: 8D hr)	9.42±0.06[a]	69.82±2.64[a]	3.72±0.20[a]	2.48±0.13[a]	7.33±0.97[a]	38.47±1.84[a]	114.48±9.41[a]
Short (8L :16D hr)	4.42±0.84[b]	50.47±1.05[b]	2.76±0.26[b]	1.84±0.17[b]	4.00±0.41[c]	21.60±0.84[c]	49.23±2.73[c]
P. Value	0.0001	0.0002	0.0383	0.0385	0.0001	0.0001	0.0001
Interaction effect:							
Thyroid status X photoperiod							
Control:							
Normal (12L:12D hr)	9.05±0.49[bc]	50.85±1.78[b]	2.79±0.69	1.86±0.46	3.85±0.49[d]	21.60±1.04[cd]	35.40±1.56[c]
Long (16L: 8D hr)	12.30±0.29[a]	83.70±1.73[a]	3.87±0.05	2.58±0.03	7.60±0.52[b]	42.55±1.42[b]	127.55±4.30[a]
Short (8L :16D hr)	3.20±0.23[c]	53.20±2.35[b]	3.03±0.27	2.02±0.18	3.70±0.35[d]	21.55±0.28[cd]	35.05±1.73[c]
Hypothyroidism:							
Normal (12L:12D hr)	7.20±0.81[cd]	54.40±1.70[b]	3.13±0.74	2.09±0.49	3.45±0.14[d]	18.10±0.17[d]	43.25±1.68[c]
Long (16L: 8D hr)	5.75±0.84[d]	48.10±0.98[b]	3.27±0.56	2.18±0.37	3.95±0.09[d]	20.40±0.27[cd]	78.65±2.57[b]
Short (8L :16D hr)	7.65±0.49[cd]	55.30±2.45[b]	3.05±0.53	2.03±0.35	2.80±0.12[d]	15.95±0.09[d]	68.65±2.11[b]
Hyperthyroidism:							
Normal (12L:12D hr)	10.30±0.58[ab]	52.65±2.00[b]	3.56±0.37	2.37±0.25	8.20±0.92[b]	45.90±1.85[ab]	125.00±7.50[a]
Long (16L: 8D hr)	10.20±0.27[ab]	77.65±1.78[a]	4.02±0.03	2.68±0.02	10.45±0.55[a]	52.45±1.22[a]	137.25±5.11[a]
Short (8L :16D hr)	2.40±0.46[e]	42.90±1.71[b]	2.21±0.45	1.47±0.30	5.53±0.32[c]	27.30±0.85[c]	43.65±1.38[c]
P. Value	0.0001	0.0013	0.2442	0.2437	0.0019	0.0003	0.0001

a, b, c, d and e : Means having different letters within a column are significantly different at ($P \leq 0.05$).

Table (9): Effect of thyroid status and length of photoperiods on plasma biochemical parameters and hormonal assay of female Japanese quails at 26 weeks of age.

Items	AST (U/l)	ALT(U/l)	Calcium (mg/dl)	Phosphorus (mg/dl)	T_3 (ng/ml)	T_4 (ng/ml)	Estrogen (pg/ml)
Thyroid status:							
Control	5.25±0.28[ab]	52.70±2.23[b]	2.11±0.24[b]	1.41±0.16[b]	4.73±0.29[b]	29.27±1.82[b]	100.88±5.36 [b]
Hypothyroidism	6.70±0.96[a]	77.15±3.72[a]	1.91±0.14[b]	1.27±0.09[b]	4.25±0.12[b]	19.08±0.35[c]	103.40±8.56[b]
Hyperthyroidism	4.40±0.41[b]	47.80±1.23[b]	2.96±0.20[a]	1.97±0.14[a]	8.45±0.78[a]	45.33±2.07[a]	116.20±5.48[a]
P. Value	0.0411	0.0034	0.0143	0.0141	0.0001	0.0001	0.0176
Photoperiod:							
Normal (12L:12D hr)	3.82±0.39[b]	58.43±2.95	2.12±0.21	1.41±0.14	5.47±0.54	30.74±4.29	99.13±4.54[b]
Long (16L:8D hr)	7.08±0.74[a]	60.00±2.06	2.53±0.22	1.69±0.14	6.15±0.92	31.70±3.73	114.52±6.78[a]
P. Value	0.0004	0.7849	0.1299	0.1290	0.0982	0.4871	0.0024
Interaction effect: Thyroid status X photoperiod							
Control:							
Normal (12L:12D hr)	2.70±0.17	56.20±3.39	1.84±0.34	1.23±0.13	5.00±0.52 [c]	26.05±1.28 [c]	112.25±1.30[bc]
Long (16L:8D hr)	7.80±0.27	49.20±2.73	2.37±0.32	1.58±0.21	4.45±0.26 [c]	32.48±2.14[b]	89.50±2.52[d]
Hypothyroidism:							
Normal (12L:12D hr)	4.75±0.84	82.00±1.27	1.72±0.20	1.15±0.13	4.30±0.12 [c]	19.30±0.69 [d]	78.35±3.11[d]
Long (16L:8D hr)	8.65±0.38	72.30±4.30	2.10±0.13	1.40±0.09	4.20±0.23 [c]	18.85±0.26 [d]	128.45±3.78 [a]
Hyperthyroidism :							
Normal (12L:12D hr)	4.00±0.12	37.10±1.98	2.80±0.14	1.86±0.09	7.10±0.44 [b]	46.88±3.52 [a]	106.80±3.00[c]
Long (16L:8D hr)	4.80±0.81	58.50±3.97	3.11±0.41	2.08±0.27	9.80±0.35 [a]	43.77±2.59 [a]	125.60±7.27[ab]
P. Value	0.0510	0.0859	0.9373	0.9440	0.0108	0.0380	0.0001

a, b, c and d Means having different letters within a column are significantly different at (P≤0.05).

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الملخص العربي

العلاقة بين هرمونات الغدة الدرقية والوظائف التناسلية في السمان الياباني المربى تحت ظروف مختلفة من الإضاءة

اجريت هذه الدراسة فى المعمل الخاص بتربية الدواجن فى كلية الزراعة سابا – باشا جامعة الأسكندرية و ذلك بهدف معرفة العلاقة المتبادلة بين الغدة الدرقية و فترات الاضاءة و الوظائف التناسلية فى السمان اليابانى .

تم إجراء التجربة على عدد   243 طائر من السمان اليابانى و استمرت التجربة من عمر   3 اسابيع حتى 26 اسبوع. حيث تم تربية الطيور و تعريضها لثلاث حالات من نشاط الغدة الدرقية و هى الكنترول (بدون أي إضافات) ،تثبيط نشاط الغدة الدرقية (بإستخدام الثيويوريا) و زيادة نشاط الدرقية (بإستخدام إلتروكسين) مع وضع الطيور تحت ثلاث نظم إضاءة وهى: 12 ساعة اضاءة : 12 ساعة اظلام] و أستخدم ككنترول. 16 ساعة اضاءة : 8 ساعات اظلام] و أستخدم كيوم إضاءة طويل.8 ساعات اضاءة : 16 ساعة اظلام] و أستخدم كيوم إضاءة قصير

و استهدفت الدراسة معرفة تاثير المعاملات السابق ذكرها علي بعض الصفات مثل العمر و وزن الجسم عند النضج الجنسي و عند 50٪ من إنتاج البيض، صفات جودة البيض، صفات التفريخ و وزن الكتاكيت عند الفقس وكذلك تم قياس بعض معايير الدم مثل الكالسيوم و الفسفور و بعض الانزيمات وكذلك بعض الهرمونات مثل الإستروجين و هرمونات الغدة الدرقية.

ويمكن تلخيص النتائج التى تم الحصول عليها فى النقاط الاتية :

١.الطيور المعرضة الى تنشيط الغدة الدرقية وصلت الى النضج الجنسى بعد 85.60 يوم والى عمر 50٪ من الانتاج بعد 90.81 يوم والذى كان اقل بشكل معنوى عن الكنترول و التثبيط.

٢.ادت 16 ساعة إضاءة الى تحسين عمر النضج الجنسى و 50٪ من الانتاج حيث كان (63.50) ،(65.35) يوم على الترتيب، فى حين انهما تأخر معنويا تحت 8 ساعات إضاءة حيث كان (138.64) ،(155.51) يوم، على الترتيب.

٣. بغض النظر عن فترات الاضاءة انخفض انتاج البيض معنويا تحت تثبيط الغدة الدرقية بنسبة (42.03٪) خلال الفترة (6-26) إسبوع من العمر في حين أدت (16 ساعة اضاءة : 8 ساعات إضاءة) إلى حدوث زيادة معنوية فى عدد البيض ونسبة انتاج البيض بنسبة (32.64٪)، (32.69٪) من الكنترول خلال نفس الفترة.

٤. كان متوسط وزن البيض الناتج من الامهات المرباه تحت تثبيط الدرقية اقل بشكل معنوى من الكنترول بنسبة (8.70٪) خلال الفترة (6-26) إسبوع من العمر.

٥. أدي تثبيط الدرقية الي حدوث إنخفاض معنوي في كتلة البيض بنسبة (46.73٪) خلال الفترة (6 – 26) إسبوع من العمر في حين كانت 16 ساعة إضاءة مصحوبة بزيادة معنوية في كتلة البيض بنسبة (32.24٪) خلال نفس الفترة ، كما كانت 8 ساعات إضاءة مصحوبة بإنخفاض معنوي فى كتة البيض بنسبة (59.90٪) من الكنترول.

٦. لم يكن لحالات الدرقية اي تاثير معنوي علي كل من معامل شكل البيضة ، سمك القشرة ، الكثافة النوعية ، لون الصفار.

٧. كان هناك إنخفاض معنوى بنسبة (10.63٪) ، (34.32٪) في نسبة الخصوبة و الفقس تحت تثبيط الدرقية، و زيادة معنوية فيهما بنسبة (25.97٪) ، (12.80٪) تحت تأثير تنشيطها ، بالمقارنة بالكنترول علي الترتيب.

٨. تحسنت نسبة الخصوبة تحت 16 ساعة إضاءة بنسبة (4.22٪) في حين أنها إنخفضت تحت 8 ساعات إضاءة بنسبة (64.35٪) من الكنترول، كذلك كان هناك زيادة و إنخفاض معنويان بنسبة (33.78٪) ، (37.93٪) في نسبة الفقس تحت 16 و 8 ساعات إضاءة علي الترتيب.

٩. إنخفض وزن الكتاكيت تحت تثبيط الدرقية و زاد معنويا تحت تنشيطها بنسبة (7.27٪) و(5.42٪) ، على الترتيب بالمقارنة بالكنترول.

من خلال النتائج المبينة سابقا يمكن بأنه عندما يتم تربية الطيور فى فترات نهار قصير مثل شهر نوفمبر، ديسمبر، يناير حيث يصل طول النهار الى 10-11 ساعة فانه يمكن احداث حالة تنشيط للغدة الدرقية لزيادة انتاج البيض بدون التاثير علي جودة البيض