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PRODUCTIVE AND PHYSIOLOGICAL RESPONSE OF PEKIN AND DOMYATI DUCKS TO DIETARY SUPPLEMENTATION OF EXCESS IODINE DURING LAYING PERIOD

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ABSTRACT: A total number of 132 (108 females and 24 males) ducks of both Pekin and Domyati at 24 weeks of age were assigned randomly into four treatment groups with three replicates of each (9 females and 2 males), to evaluate the effect of iodine supplementation to the duck diets on productive and physiological performance during laying period. The four experimental groups were as follow: The control group (C) received basal diet contained 0.3 mg iodine/ kg diet, while groups 2, 3 and 4 received the basal diet supplemented with 1.0, 1.5 and 2.0 mg iodine/ kg diet, respectively.

The obtained results could be summarized as follows:

1-The best ($p \leq 0.05$) egg number was recorded for Pekin ducks during the whole experimental periods.

2-The Domyati ducks recorded significantly heavier egg weight throughout the experimental periods compared to Pekin ducks.

3-Iodine supplementation (2.0, 1.5, and 1.0 mg/kg diet) resulted in a significant increase in egg weight at the whole experimental period compared to the control one.

4-The Domyati ducks fed diet contained 1.5 mg CaI/kg diet pronounced the best ($p \leq 0.05$) egg number/ duck and egg weight, whereas, Pekin ducks fed of 2.0 mg CaI/kg diet recorded the same trend in respect of egg number and egg weight.

5-Birds fed 2.0 mg CaI/kg diet had the best value of feed consumption.

6-Birds fed 1.5 and 2.0 mg CaI/kg diet recorded significantly the best feed conversion ratio compared to other groups.

7-Iodine level treatments (1.0 and 2.0 mg CaI/kg diet) significantly improved the hatchability of set and fertile eggs compared to other treatment groups.

8-Dietary iodine supplementation, generally improved blood parameters and hematology traits without any adverse effects.

It is concluded that dietary supplementation of excess iodine (Calcium iodate) at a level of 1.5 and 2.0 mg/kg diet to local Domyati breed and Pekin ducks diets, respectively could be recommended to improve their physiological and productive performance during laying period.

Keywords: Iodine – Ducks – Productive - Blood constituents - Egg production.

INTRODUCTION

Ducks are considered the second common strain of poultry in the world. In Egypt, more attention is focused lately on increasing ducks meat production (El-Soukkary et al., 2005; Awad et al., 2009; and Kout El-kloub et al., 2010). Domyati ducks are considered a local breed in Egypt, as its meat is more favorable to the Egyptian consumers. It is well known that the trace minerals have a very important role to play in the mechanism of nutrient circulation in the animal organism. Deficiency or imbalance of any of these vital micronutrients results in occurrence of deficiency diseases, metabolic disorders, poor growth rate, low egg production, low hatchability and low feed efficiency. Since, iodine is one of the essential trace minerals in poultry diets, due to its role in thyroid hormones synthesis, and their effects on growth performance and nutrients metabolism. Deficiency of iodine can cause metabolic disorders, decreased hatchability and laying rate, and stimulates enlargement of the thyroid gland causing goiter (Lewis, 2004; Sturki, 1986; and Patrick, 2008).

Thyroid gland needs about 70- 100 micrograms iodine/ day to requisite of triiodothyronine (T_3) and thyroxine (T_4) hormones (Brown, 1991). Christensen and Ort (1991) reported that iodine toxicity might occur in large white turkey hens when diets contain iodine at a level of 350 ppm. Lesson and summers (2001) indicated that in intact chickens it is generally thought that the use of thyroid active substances has little advantage in the production of meat birds because hormones usually function as a catabolic agent in intact chickens whereas, they demonstrated that the productive performance of broiler chickens was improved by an appropriate amount of thyroid active substances.

Abaza et al. (2003) reported that addition of iodine as potassium iodide (KI) at different concentrations (06, 1.2, and 2.4 mg/kg diet) to Golden Montazah laying hens (over the requirements) did not causeany adverse effect on growth and egg production whereas the best feed conversion ratio was recorded for those fed diet containing 1.2 followed by 2.4 mg KI/kg diet. They added that concentration of T_3 and T_4 were significantly increased by increasing iodine levels. Moreover, laying hens fed diet supplemented with 0.6, 1.2, 2.4 and 4.8 mg iodine/kg diet improved economic efficiency compared to the control group. Jiang et al. (1996) observed significantly lower egg production towards the end of experimental period (16 weeks) in hens which were fed with high iodine supplements.

Nofal and hassan (2001) observed that supplementing of drinking water with KI at level of 200 ppm for Japanese Quail improved feed intake, feed conversion and efficiency index while, applying level of 400 ppm decreased egg mass/ day, feed conversion ratio, fertility and hatchability percentages, egg specific gravity, shell weight, albumin weight and feed intake were increased by increasing KI level. McDowell (1992) indicated that the standardized requirement of Iodine is 0.3 mg/kg diet for hens of light laying type and 0.5 mg iodine per kg of diet for hens of heavier laying type. The Domyati duck is considered a light-weight breed compared to the Pekin duck. The information on the requirements of iodine in ducks diets is relatively limited and the chicken requirements of iodine are often included the duck diets. However, the requirements of iodine to improve egg laying efficiency in the ducks need to be better defined.

Therefore, the goal of the current research was to throw a light on the effect of using different levels of calcium iodate (CaI) supplementation in diets on some productive and physiological performance of Domyati ducks as a local breed in Egypt and Pekin ducks during laying period.

MATERIALS AND METHODS

The present investigation was conducted at El–Serw Water Fowl Research Branch, Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt.

Experimental design:

A total number of 132 (108 females and 24 males) ducks of both Pekin and Domyati at 24 weeks of age were assigned randomly into four treatment groups with three replicates of each (9 females and 2 males), to evaluate the effect of iodine supplementation to the duck diets on their productive and physiological performance. The present study was carried out during laying period (from 24 weeks to end of experiment at 35 weeks of age). The four experimental groups were as follows: The control group (C) received basal diet contained 0.3 mg iodine/ kg diet based on the calculated analysis from NRC (1994) as shown in Table 1, while groups 2, 3 and 4 received basal diet supplemented with 1.0, 1.5 and 2.0 mg iodine/ kg diet, respectively. According to the treatment groups, the ducks were arranged in completely randomized factorial design (2 breeds and four iodine levels). Experimental diets and water were offered *adlibitum* during the experimental period. Ducks were reared under similar environmental and managerial conditions.

Measurements:

Laying performance traits:

Egg number: Hen-day egg production per each replicate was recorded and then subdivided by the number of ducks to obtain average of egg number (EN) per duck through 4- week intervals from 24-35 weeks of age. Egg weight (EW, g) was individually recorded to the nearest 0.1 gram for each replicate and egg mass (EM, g) was calculated per each replicate and then subdivided on number of duck per replicate to obtain egg mass per duck through four weeks intervals from 24-35 wks of age.

Feed consumption (FC):

For all treatment groups, feed consumption (FC, g) of each replicate was recorded weekly and expressed in gram per /duck/ 4 weeks intervals and throughout the experimental period.

Feed conversion ratio (F.C.R): F.C.R (g feed / g egg) was calculated for the same periods.

Fertility and hatchability: Hatching eggs of each treatment group were separately incubated at 30, 32 and 34 wks of age. The incubated eggs were candled on tenth day of incubation to determine fertility percentage. Fertility was estimated as number of fertile eggs / number of eggs set. Hatchability was estimated as percentage of the number of hatched chicks to the number of total set or fertile eggs.

Egg quality parameters: At 35 weeks of age, atotal of 60 eggs (15 eggs from each treatment) of both Pekin and Domyati duck eggs were taken to determine the exterior and interior egg quality parameters. Eggs from each treatment were individually weighed (g). They were broken and the inner contents were placed on aleveled glass surface to determine the inner quality. Also, albumin (AW, g), yolk (YW, g) and Shell (SW, g) were weighted; shell thickness (mm) including shell membranes were measured using micrometer at three locations on the egg (air cell, equator and small end). Records were also taken for egg length (EL, mm), egg width (EWd, mm). Shape index (SI) estimated as the percentage of EWd to EL.

Slaughter test:

At the end of experimental period (35 weeks of age) 3 birds from each treatment were randomly chosen, weighted and slaughter until complete bleeding and feather were removed. The heart, liver as well as thyroid gland were separated, weighed and their relative weights as percentages to live body weight were calculated.

Plasma biochemical analysis and hematological picture:

Immediately after slaughtering, blood samples of ducks were collected from three birds/each group. The samples were collected into dry clean centrifuge tubes; the plasma was separated by centrifugation at 3500 r.p.m. for 15 minutes and kept in a deep freezer at -20 ˚C until biochemical analysis. Blood plasma was analyzed to determine total protein concentrations (TP, g/dl) according to Gornal et al. (1949) and albumin (Alb, g/dl) according to Doumas et al. (1971). Globulin (Glb, g/dl) concentration was estimated by subtracting the values of Alb from the corresponding values of TP.

Aspartate (AST, U/L) and alanine amino transaminases (ALT, U/L) were determined using the method described by Reitman and Frankel (1957). The plasma was assayed for total cholesterol, (Allain et al., 1974), triglycerides and total lipids (Fassati, and Prencipe, 1982); high density lipoprotein (HDL) and low density lipoprotein (LDL) according to (Lopez-Virella., 1977 and Friedewald, 1972).

The radioimmunoassay (RIA) technique was used for the determination of triiodothyronine (T_3) and thyroxin (T_4) according to Britton et al. (1975).

Non-coagulated blood was tested shortly after collection for determination blood pictures including, red blood cells count (RBCs, 10^6/mm^3); hemoglobin (Hb, g/100 ml) concentration; Hematocrit (Ht, (%)), main corpuscular volume (MCV, μ^3/ml), main corpuscular hemoglobin (MCH, Pg/ml), main corpuscular hemoglobin concentration (MCHC, g/100 ml); white blood cells count (WBCs, 10^3/mm^3) and differential of white blood cells (hetrophil "H" and lymphocytes "L" percentages) according to Cambell (1995). Then H: L ratios were calculated. All blood plasma samples were measured by commercial kits (Spectrum Diagonstic kits, Spect., Corp. for Biotech. S. A. E., Egypt).

Statistical analysis:

Data were subjected to two – way analysis of variance using general linear model (GLM) procedure of SAS program (SAS, 2004). Significant differences among means were detected by using Duncan's multiple range test (Duncan, 1955) at a probability level of 0.05 ($p \leq 0.05$). The percentage values were transferred to percentage angle using arcsine equation before subjected to statistical analysis, and then actual means are presented. The following model was used:

$Y_{ijk} = \mu + T_i + R_j + (TR)_{ij} + e_{ijk}$ where,

Y_{ijk} = Observation of the ijth ducks; μ = Overall mean, common element to all observations;

T_i = Effect of Breed; I = (1, 2), R_j= Effect of iodine level; j = (1, 2, 3 and 4), TR= Effect of interaction between breed and iodine levels and e_{ijk} = Random error component assumed to be normally distributed.

RESULTS AND DISCUSSION

Laying performance traits:

Egg number/ duck and egg weight:

Data presented in Table (2) clarify the effects of duck breeds (DB), different levels of iodine (IL) and their interactions on egg number/ duck and egg weight (g) throughout the experimental periods (24-27, 28-31, 32-35 and 24-35 weeks of age). Significant ($p \leq 0.05$) increasing have been recorded in egg number/ duck. The best egg number/ duck was recorded for Pekin ducks during the whole experimental periods except the period of 32-35 wks of age. The accumulative egg number/ duck at the whole experimental period (24-35 weeks of age) for Pekin ducks was better than those Domyati ducks by about 2.2%. On the other hand, Domyati ducks were recorded the heavier egg weight throughout the experimental periods compared to Pekin ducks. The accumulative egg weight at the whole experimental period (24-35 wks of age) for Domyati ducks was better than those Pekin ducks by about 4.8 %.

Table 2 shows that the (Ca I) levels had positive effects on egg number/ duck and egg weight, where, resulted in a pronounce improvement of egg production/ duck and egg weight than the control group (C).the accumulative egg number/ duck at the whole experimental period (24-35 weeks of age) for ducks received 1.5 mg CaI was better than control group by about 13.3%. However, the group fed diet contained 2.0 mg CaI/kg feed produced heavier egg weight. Meanwhile, those groups received 1.5 and 1.0 mg CaI in diet were intermediate in this respect. The poorest one was recorded for control group (C). The improvement of egg number/ duck and egg weight may be due to the effect of excess dietary iodine as a component of thyroxine hormone which regulates metabolism and has a strong influence on performance. These results are in agreement with those obtained by Liu and Han (1998); they reported that hyper thyroid laying hens had higher laying rates and egg weight than the control. However, Hamdy and Abdel latif (1999) reported that supplementation of Japanese quail water with iodine as KI at level of 300 or 600 ppm showed the opposite trend.

Interactions between duck breeds and iodine levels in diet had significant effects on EN per duck and EW throughout all experimental periods. The Domyati duck group fed diet contained 1.5 mg caI/kg diet recorded the best EN per duck and EW during the overall experimental period (24-35 weeks of age). On the other hand, Pekin ducks group fed diet contained 2.0 mg CaI recorded the best EN per duck and EW during all experimental period from 24-35 weeks of age. It is clear from the results that, CaI level 1.5 and 2.0 mg / kg diet supplementation to the basal diet for Domyati and Pekin ducks respectively was enough for physiological functions of each breed to improvement of their EN/ duck and egg weight.

Egg mass and feed consumption:

Results in Table 3 showed the influence of duck breeds and iodine levels and their interactions on EM and FC of Domyati and Pekin ducks during studied periods. It is clear from the results that, Domyati ducks had ($p \leq 0.05$) higher egg mass/ duckas compared with Pekin ducks during most periods and the whole experimental period (24-35 weeks of age). On the other hand, Pekin ducks recorded lower ($p \leq 0.05$) feed consumption during the whole experimental period (24-35 wks of age) compared to Domyati once.

The effect of CaI levels on egg mass and feed consumption throughout all the experimental periods were significant ($p \leq 0.05$).The noticeable observation is that, the duck fed diet contained 1.0, 1.5 and 2.0 mg CaI/ kg diet resulted in obviously higher values of accumulative egg mass/ duck throughout the experimental period (24-35 wks of age). The best egg mass/ duck was recorded for ducks fed diet contained 1.5 mg CaI/kg feed. However, the poorest one was recorded for control ducks.

Feed consumption ofthe control group (C) was significantly ($p \leq 0.05$) the highest group, whereas, those of 2.0 mg CaI/kg diet recorded the best value. However, those of 1.0 and 1.5 mg CaI/kg diet were intermediate in this respect. Our results are in agreement with Samar et al. (2005) who reported that, with a mild hyperthyroidism, egg mass increased significantly by 6.07 and 14.81 % compared with control in two local hen strains after peak of production. Also Christensen et al. (1991) and Yalcin et al. (2004), used high dietary levels of both potassium iodide 3.5 mg/ kg diet and calcium iodide, (3, 6, 12 and 14 mg / kg diet), in breeder turkey and laying hens respectively; they found that, the potassium iodide or calcium iodide administration could improve feed consumption. In the contrary, Saki et al. (2012), reported that no significant differences among laying hens fed diet supplemented with 0, 5, 10, 15 and 20 mg calcium iodide / kg diet in respect of feed consumption.

The interactions between DB and IL were significant ($p \leq 0.05$) at all studied periods in respect of egg mass/ duck and feed consumption. The best values of accumulative egg mass was recorded by Domyati ducks fed diet contained 1.5 mg CaI/ kg diet, whereas, Pekin ducks recorded the best values of egg mass and feed consumption for ducks fed diet contained 2.0 mg CI/ kg diet in the same period.

Feed conversion ratio (FCR):

The FCR values at various studied periods of laying ducks were significantly ($p \leq 0.05$) affected by duck breeds and iodine levels and their interactions (Table 4). The Pekin ducks recorded the better value of (FCR) than those of Domyati ducks throughout all experimental period (24-35 weeks of age).

The FCR was significantly ($p \leq 0.05$) affected by (IL). The ducks fed diet contained 1.5 or 1.0 mg CaI/ kg diet were efficient in accumulative FCR than the other treatments group. The ducks of 1.5 or 1.0 mg CaI needed less amount of feed to produce one unite of egg than the other treatment groups during the overall period from 24-35 weeks of age. These findings are in agreement with Christensen et al. (1991), Yalcin et al. (2004) and disagree with Saki et al. (2012).

The interactions between DB and IL were significant at all studied ages in respect of FCR, the better values FCR were obtained by Domyati ducks fed diet contained 1.5 mg CaI/ kg diet and Pekin ducks fed diet contained 2.0 mg CaI/ kg diet than the other treatments group. It is concluded that, 1.5 mg CaI/ kg for Domyati ducks diet was enough for normal thyroid activity than Pekin ducks which need 2.0 mg CaI/ kg diet for the same target.

Egg quality traits (EQ):

Results of Table 5 clearly revealed that all EQ traits were not significantly affected due to duck breeds and iodine levels, except yolk weight which was significantly affected. It is observed that Pekin ducks were produced higher value of yolk weight than Domyati by about 6.4 %.

The control (C) group produced the best ($p \leq 0.05$) value of yolk weight as compared to the ducks fed 1.5 mg CaI/ kg diet. Whereas, no significant differences were observed between control group (C) and the other iodine treatment groups (1.0 or 2.0 mg CaI) in respect of yolk weight. Similar results were obtained by Yalcin et al. (2004) on SHSY type brown fed diet supplemented with 0, 3, 6, 12 and 24 mg/kg feed iodine as calcium iodate, they stated that no significant differences among treatment groups in shell thickness, egg yolk index and egg weight. In addition, Songserm et al. (2006) indicated that adding 400 mg iodine/ ton to commercial layer diets did not affect egg quality.

The interaction between DB and IL show that no significant effects for albumin weight, shell weight and egg shape index, except egg weight, yolk weight and shell thickness were significantly affected.

Fertility and hatchability:

Data in Table 6 showed the influence of duck breeds and iodine levels and their interactions on fertility and hatchability of Domyati and Pekin ducks. It is clear from the results that, the fertility and hatchability (%) of set eggs were not significantly affected by DB, while, the hatchability of fertile eggs (%) was significantly affected by DB. The best value of hatchability of fertile eggs was recorded by Pekin ducks.

The IL had insignificant effects on fertility, whereas, the hatchability of set or fertile eggs were significantly affected. The IL levels treatments were improved the hatchability of set and fertile eggs compared to the control group. The best results of hatchability of set and fertile eggs were obtained from duck fed diet contained 1.0 and 2.0 mg CaI/ kg feed respectively. The improvement of hatchability may be due to the maternal dietary iodine depressed maternal thyroid hormones, increased embryonic T4, and improved survival rates of embryos during latter stages of incubation (Christensen and Davis, 2001). Thyroid hormones of maternal origin are thought to play a role in early embryonic development (Prati et al., 1992), and thyroid hormones play major roles on tissue differentiation and in the final maturation of many tissues just prior to hatching (Black, 1978; Mallon and Betz, 1982; and Decuypere et al., 1979). The iodide or thyroid hormones were assumed to be readily available to the embryo through the yolk. Thus, hormone levels during hatching may be the total combination of T3 and T4 from embryonic synthesis and extra maternal hormone or iodide in excess of the metabolic requirements for maternal maintenance and egg production (Sechman et al., 2000).

The interaction between DB and IL were significant at all studied ages in respect of fertility, hatchability of set and fertile eggs. The Domyati ducks fed diet contained with 1.0 mg CaI/ kg diet recorded the best results of fertility, hatchability of set and fertile eggs. On the other hand, Pekin ducks fed diet contained 2.0 mg CaI/ kg diet recorded the best values of fertility, hatchability of set and fertile eggs.

Live body weight (LBW) and some organs:

Data of Table 7 revealed that LBW, thyroid weight (%) and heart weight (%) were not significantly affected by DB differences except the relative weight of liver was significantly affected. It was observed that the pekin ducks had significantly ($p \leq 0.05$) higher liver weight than Domyati ducks by about 23.0 %.

The effect of CaI levels on LBW, liver, thyroid and heart weight (%) were significant ($p \leq 0.05$) except thyroid weight (%). It was observed that increasing of CaI levels in diets resulted in lower body weight for IL treatment compared with control once. Our results are in agreement with Traynicek et al. (2000) who reported that the thyroid weight was not influenced by iodine intake.

The live body weight, liver weight (%) and heart weight (%) were significantly affected by the interaction DB x IL, while, thyroid gland weight (%) was not significantly affected.

Blood plasma constituents:

Results of plasma total protein (TP); albumin (Alb) and globulin (G) as influenced by breed and iodine level are shown in Table 8. It appears that the duck breed had no effect on plasma protein fractions, however, TP level was significantly higher for ducks from medium and high dietary iodine groups compared to the control and those fed the low iodine diet. Similarly, plasma globulin level was significantly higher for ducks from the high iodine– fed group compared with the control and other treatments.

A similar trend was also observed for the interaction effect on plasma TP and globulin, however, albumin level was not significantly influenced by breed, iodine level and their interaction.

Concerning plasma lipid fractions, the present results showed that the duck breed had significant effect on plasma total lipids and LDL – cholesterol only with higher level for Pekin ducks than Domyati ones, however, no breed effect was recorded for the other lipid fractions. However, plasma cholesterol, triglycerides, and HDL levels were significantly higher for ducks fed the iodine - supplemented diets compared to the control once.

The previous results indicate that dietary iodine supplementation help improving both plasma protein and lipid fractions in adose – dependent manner, probably as response to the increased egg number and egg mass of these groups compared to the control ducks, as previously discussed in Table 2 and 3. The interaction results showed similar trend, in general, where the medium and high iodine diets achieved better results within each strain.

The present data showed also that the breed has insignificant effect on plasma thyroid hormones (T_3 and T_4) level but both hormones were significantly increased as the level of dietary iodine increased (Table 8). This trend was also observed for the values obtained from breed by iodine level interaction. Earlier reports by Kobayashi et al. (1996) declared that supplementation of iodine (0.5 mg of KI/ kg diet) mitigated the decrease in the T4 concentration and increased thyroid glands weight. Similarly, Hamdy and Abd- El-latif (1999) using quail, El-kaiaty et al. (2004) using Muscovy ducklings and El-Wardany et al. (2011) using broiler chickens, they found that potassium iodide supplementation to water or diet improved thyroid gland activity, which in close agreement with our results.

Results showed also that ducks breed has no significant effect on transaminases activity (ALT and AST), but dietary iodine level decreased significantly ALT level without any effect on AST concentration. This effect was extended for the breed by iodine level interaction, where, ALT level, but not AST, was significantly decreased compared to the control group.These results indicate that supplemental iodine had no deleterious effect on liver functions and may protect the hepatocytes of ducks from being destroyed and that is meant a better liver function associated with iodine supplementation. Our results are in agreement with El-nagar et al. (2001) in broiler chicks and El-sebai et al. (2000) in Japanese quail, they reported that serum AST concentration was significantly decreased with hyperthyroidism.

It is likely that, increase of IL from 1.0 to 2.0 mg/ kg diet enhances the concentration of T_3, T_4, cholesterol, HDL, total protein and LDL than the control group. The group fed diet supplemented with 2.0 mg CaI/ kg diet had significantly higher value of globulin than the other treatment groups.

The interactions between DB x IL had significant ($p \leq 0.05$) effects in respect of blood plasma constituents at 36 weeks of age except for AST activity, total lipids, HDL and albumin which were not significantly affected. The control group from both Domyati and pekin ducks had higher concentration of blood plasma ALT compared to the other treatment groups.

That both thyroid gland hormones (T_3; T_4) were significantly influenced by IL supplementation to the diets may be due to the iodine level in the basal diet was not enough for normal thyroid activity for Domyati and Pekin ducks. The group fed diet contained 2.0 mg CaI/ kg diet had higher value of T_3 or T_4 followed by the group fed 1.5 mg CaI/ kg diet. These results are in harmony with those of El-Wardany et al. (2011) in broilers and Abdel-Malak et al. (2012) in laying hens by adding CaI 1 mg/kg diet or different levels of iodine (0.6, 1.2, and 2.4 mg/kg diet, respectively). They observed that thyroid hormones were significantly increased by increasing iodine levels.

Blood hematology parameters:

The effect of duck breed, iodine level and their interaction on blood hematology is presented in Table 9. It is clear from the results thatduck breed has no significant effect on RBC count, Ht, MCV and lymphocytes (%), while, significant differences were recorded between breed for the other hematological parameters. In this respect, Pekin ducks showed significantly higher Hb level; MCH; MCHC; heterophils (%) and H/ L ratio, but lower WBC count than Domyati ducks. This may be due to the genetic background of each breed and/ or the productive status of each breed.

Results revealed also that iodine level-regardless breed effect- had significant influence on the studied parameters except for the mean corpuscular hemoglobin (MCH) level. It appears from these results that both the higher and medium iodine levels were significantly increased RBC's count and Hb along with the Ht value, as it depends on the number and size of RBC's. However, MCV was significantly higher for the control group followed by those from 1.0 mg/kg fed group compared to the other groups. The observed increase in MCV for the control and the low iodine supplementation ducks may indicate an adaptive response of ducks to compensate for the decrease in RBC's count, Hb and Ht values. This holds true as the MCH values were nearly similar in all groups with a slight decrease ($p \leq 0.05$) in the MCHC for the control ducks compared to these of the treatment groups.

Concerning the effect of both duck breed and iodine level on WBC's count, heterophils, lymphocyts (%) and their ratio (H/L), the present data showed an interested figures. Since, Domyati ducks had significantly higher WBC's count, low heterophils and then low H/L ratio indicative of better immunity and better thermotolerance than pekin once (Table 9). Moreover, the best H/L ratio was recorded for ducks that fed diets containing the low and medium iodine level compared to those of the control and high iodine level treatments.

It is well known that H/L ratio was considered as a more reliable indicator for determining stress response(s) in poultry (Gross and Siegel, 1983). Thus, Puvadolpirod and Thaxton (2000 a, b) stated that a stress response may include an increase in H/L ratio more than 0.50, which is the case for pekin ducks and those fed the control or high iodine diets. This indicated that the higher iodine level could induce a hyperthyroidism status, which results in an increased metabolic heat production representing a state of stress that caused an increase in H/L ratio. The interaction of breed by iodine level in our study supported the previous findings, where, Domyati ducks were more resistant to stressors of different types than Pekin ducks with the low iodine levels being better than the high level.

These results reflect the productive status of hens and support the concept that dietary iodine, in excess, could improve the productivity of laying ducks, via increasing thyroid gland activity, hemoglobin concentration and enhancing immune responses (WBC's count, H/L ratio). These results are in close agreement with those reported by Williams and Njova (1998), Islam et al. (2004) and Song et al. (2006).

CONCLUSION

From the previous results, it is concluded that dietary supplementation of excess iodine (Calcium iodate) at level of 1.5 and 2.0 mg/kg feed to local Domyati breed and Pekin ducks diets, respectively could be recommended as a practical approach to improve physiological and productive performance of ducks during laying period without any adverse effect.

Table (1): Composition and calculated analysis of the basal diets

Ingredients	%
Yellow Corn	64.65
Soybean meal (44 %)	24.35
Gluten meal (60%)	1.0
Di-calcium phosphate	1.70
Limestone	7.5
Vit. & Min. premix[1]	0.30
Salt (NaCl)	0.30
DL. Methionine (97%)	0.2
Total	100.0
Calculated Analysis[2]	
Crude protein	17.01
ME (Kcal / kg)	2752
Ether extract	2.86
Crude fiber	3.94
Calcium	3.29
Av. phosphorus	0.44
Lysine	1.17
Methionine	0.35
Methionine + Cyst	0.68
Sodium	0.15

[1] Each 3 kg of the Vit and Min. premix manufactured by Agri-Vit Company, Egypt contains: Vitamin A, 10 MIU; Vit. D2, MIU; Vit. E, 10 g; Vit. K, 2 g; Thiamin, 1 g; Riboflavin, 5 g; Pyridoxine, 1.5 g; Niacin, 30 g,; Vit. B12, 10 mg; Pantothenic acid, 10 g; Folic acid, 1.5 g; Biotin, 50 mg; Choline chloride, 250 g; Manganese, 60 g; Zinc, 50 g; Iron, 30 g; Copper, 10 g; Iodine, 1 g; Selenium, 0.10 g; Cobalt, 0.10 g; and carrier CaCo3 to 3000 g.

[2] According to NRC (1994).

Table (2): Egg number/duck and egg weight as affected by duck breed and dietary iodine supplementation level during laying period

Traits / Main effects		Egg number/ duck				Egg weight			
		Periods (wks)				Periods (wks)			
		24-27	28-31	32-35	24-35	24-27	28-31	32-35	24-35
Duck breeds (DB)									
Domyati		8.5^{b}	9.5^{b}	13.4^{a}	31.3^{b}	67.2^{a}	69.1^{a}	70.3^{a}	68.3^{a}
Pekin		8.9^{a}	10.7^{a}	12.3^{b}	32.0^{a}	61.6^{b}	65.3^{b}	67.6^{b}	65.2^{b}
SEM		0.06	0.13	0.2	0.14	0.26	0.16	0.23	0.17
Probability		*	*	*	*	*	*	*	*
Iodine levels (IL)									
(C)		8.3^{c}	9.0^{c}	12.4^{b}	29.4^{c}	64.1^{b}	65.7^{c}	67.2^{c}	65.6^{c}
1.0		9.1^{b}	10.1^{b}	13.6^{a}	32.8^{a}	66.9^{a}	65.1^{c}	71.3^{a}	66.7^{b}
1.5		9.3^{a}	11.2^{a}	12.8^{ab}	33.3^{a}	63.9^{b}	66.8^{b}	69.4^{b}	67.0^{b}
2.0		8.1^{d}	10.1^{b}	12.6^{b}	30.9^{b}	62.7c	71.1^{a}	67.9^{c}	67.8^{a}
SEM		0.08	0.18	0.28	0.0.20	0.37	0.23	0.32	0.24
Probability		*	*	*	*	*	*	*	*
Interactions									
DB	**x IL**								
Domyati	(C)	7.4^{c}	7.6^{e}	13.4^{ab}	28.3^{e}	66.6^{b}	73.8^{a}	68.4^{cd}	69.4^{a}
	1.0	9.5^{a}	10.8^{cb}	13.8^{a}	34.0^{ab}	71.7^{a}	61.0^{f}	73.5^{a}	65.8^{d}
	1.5	9.4^{a}	11.6^{b}	13.5^{ab}	34.4^{a}	66.8^{b}	69.6^{dc}	70.6^{b}	69.5^{a}
	2.0	7.6^{c}	7.8^{e}	13.0^{abc}	28.3^{e}	63.5^{c}	71.8^{b}	68.6^{cd}	68.6^{ab}
Pekin	(C)	9.3^{a}	10.3^{c}	11.4^{d}	30.6^{d}	61.6^{d}	57.6^{g}	66.0^{e}	61.7^{f}
	1.0	8.6^{b}	9.3^{d}	13.3^{abc}	31.6^{c}	62.0^{dc}	69.1^{d}	69.1c	67.6^{bc}
	1.5	9.3^{a}	10.8^{cb}	12.1^{dc}	32.2^{c}	61.0^{d}	64.0^{e}	68.2^{cd}	64.4^{e}
	2.0	8.5^{b}	12.4^{a}	12.2^{dc}	33.4^{b}	62.0^{dc}	70.0^{c}	67.2^{de}	67.1^{c}
SEM		0.12	0.35	0.40	0.28	0.52	0.33	0.46	0.34
Probability		*	*	*	*	*	*	*	*

(C) = Control group. a, b, c.. means within same columns with different superscripts are significantly different ($p \leq 0.05$).*= significant

Table (3): Egg mass/duck and feed consumption as affected by duck breed and dietary iodine supplementation level during laying period

Traits / Main effects		Egg mass/ duck				Feed consumption			
		Periods (wks)				Periods (wks)			
		24-27	28-31	32-35	24-35	24-27	28-31	32-35	24-35
Duck breeds (DB)									
Domyati		572.1^{a}	646.9^{b}	945.4^{a}	2133.3^{a}	4690.9^{a}	5849.5^{a}	5281.3^{a}	15821.7^{a}
Pekin		549.0^{b}	700.3^{a}	765.4^{b}	2085.0^{b}	4845.8^{b}	4760.3^{b}	5272.3^{b}	14877.8^{b}
SEM		4.9	9.7	21.4	14.4	0.82	9.93	0.85	9.8
Probability		*	*	*	*	*	*	*	*
Iodine levels (IL)									
(C)		531.7^{b}	576.7^{c}	837.0	1925.4^{c}	4964.0^{a}	5164.2^{c}	5300.0^{b}	15428.2^{a}
1.0		608.5^{a}	653.4^{b}	898.0	2184.7^{a}	4675.7^{d}	5378.2^{a}	5358.2^{a}	15412.0^{ab}
1.5		597.2^{a}	748.4^{a}	842.9	2234.5^{a}	4738.0^{b}	5344.7^{ab}	5295.5^{c}	15378.2^{b}
2.0		504.7^{c}	715.9^{a}	843.8	2092.0^{b}	4695.7^{c}	5332.5^{b}	5153.5^{d}	15180.7^{c}
SEM		6.9	13.6	30.4	20.4	1.16	14.1	1.2	13.81
Probability		*	*	*	*	*	*	*	*
Interactions									
DB	**x IL**								
Domyati	(C)	492.9^{e}	561.0^{e}	919.2^{ab}	1962.7^{d}	4743.0^{d}	5846.0^{a}	5285.0^{d}	15874.0^{a}
	1.0	683.6^{a}	661.4^{c}	1017.6^{a}	2233.3^{b}	4551.3^{h}	5874.0^{a}	5483.0^{a}	15908.3^{a}
	1.5	629.3^{b}	805.4^{b}	953.2^{a}	2394.2^{a}	4782.0^{c}	5828.0^{a}	5298.0^{c}	15908.0^{a}
	2.0	482.5^{e}	559.7^{e}	891.7^{bac}	1942.9^{d}	4687.3^{g}	5850.0^{a}	5059.0^{g}	15596.3^{b}
Pekin	(C)	570.5^{c}	592.3^{de}	592.3^{dc}	1888.0^{d}	5185.0	4482.3^{d}	5315.0^{b}	14982.3^{c}
	1.0	533.4^{d}	645.3^{cd}	778.5^{dc}	2136.2^{c}	4800.0^{b}	4882.3^{b}	5233.3^{f}	14915.7^{d}
	1.5	565.1^{c}	691.3^{c}	732.5^{d}	2074.8^{c}	4694.0^{f}	4861.3^{cb}	5293.0^{c}	14848.3^{e}
	2.0	526.9^{d}	872.2^{a}	795.9^{bdc}	2241.1^{b}	4704.0^{e}	4815.0^{c}	5248.0^{e}	14765.0^{f}
SEM		9.8	19.3	42.8	28.8	1.64	19.9	1.7	19.5
Probability		*	*	*	*	*	*	*	*

(C) = Control group. a, b, c.. means within same columns with different superscripts are significantly different ($p \leq 0.05$).*= significant
**=not significant

Table (4): Feed conversion ratio as affected by duck breed and dietary iodine supplementation level during laying period

Traits / Main effects		Feed conversion ratio – Periods (wks) 24-27	28-31	32-35	24-35
Duck breeds (DB)					
Domyati		8.4^{b}	9.0^{a}	5.6^{b}	7.5^{a}
Pekin		8.8^{a}	6.9^{b}	6.4^{b}	7.2^{b}
SEM		0.08	0.1	0.11	0.04
Probability		*	*	*	*
Iodine levels (IL)					
(C)*		9.4^{a}	8.4^{a}	6.4^{a}	8.0^{a}
1.0		7.9^{b}	8.3^{b}	5.6^{b}	7.1^{c}
1.5		8.0^{b}	7.1^{c}	6.0^{a}	6.9^{c}
2.0		9.3^{a}	8.0^{b}	6.2^{a}	7.3^{b}
SEM		0.11	0.14	0.15	.06
Probability		*	*	*	*
Interactions					
DB x IL					
Domyati	(C)	9.6^{a}	9.3^{b}	5.8^{b}	8.1^{a}
	1.0	6.7^{d}	8.9^{b}	5.4^{b}	7.1^{b}
	1.5	7.6^{e}	7.2^{c}	5.6^{b}	6.6^{c}
	2.0	9.7^{a}	10.4^{a}	5.7^{b}	8.0^{a}
Pekin	(C)	9.1^{b}	7.6^{c}	7.1^{a}	7.9^{a}
	1.0	9.0^{b}	7.6^{c}	5.7^{b}	7.0^{b}
	1.5	8.3^{c}	7.0^{c}	6.4^{a}	7.2^{b}
	2.0	8.9^{b}	5.5^{d}	6.6^{a}	6.6^{c}
SEM		0.16	0.20	0.22	0.01
Probability		*	*	*	*

(C) = Control group. a, b, c.. means within same columns with different superscripts are significantly different ($p \leq 0.05$).*= significant

Table (5): Egg quality traits as affected byduck breed and dietary iodine supplementation level at 36 weeks during laying period

Main effects	Traits	Egg Weight (g)	Yolk weight (g)	Albumin Weight (g)	Shell weight (g)	Shell thickness (mm)	Egg shape index (mm)
Duck breeds (DB)							
Domyati		74.3	25.0^{b}	39.9	9.4	30.3	0.75
Pekin		76.4	26.6^{a}	40.3	9.5	30.7	0.76
SEM		1.1	0.41	0.91	0.22	0.6	0.01
Probability		**	*	**	**	**	**
Iodine levels (IL)							
(C)		76.4	26.8^{a}	39.6	10.0	31.3	0.76
1.0		76.9	26.1^{ab}	41.5	9.3	29.3	0.75
1.5		74.0	24.9^{b}	39.9	9.2	30.9	0.77
2.0		74.0	25.4^{ab}	39.4	9.2	30.5	0.74
SEM		1.48	0.58	1.28	0.32	0.85	0.02
Probability		**	*	**	**	**	**
Interactions							
DB x IL							
Domyati	(C)	76.2^{ab}	25.8^{abc}	40.6	9.8	0.326^{a}	0.74
	1.0	74.2^{ab}	25.2^{abc}	39.8	9.2	0.276^{b}	0.76
	1.5	72.6^{b}	24.2^{c}	39.4	9.0	0.308^{ab}	0.76
	2.0	74.0^{ab}	24.8^{bc}	39.8	9.4	0.302^{ab}	0.74
Pekin	(C)	76.6^{ab}	27.8^{a}	38.6	10.2	0.300^{ab}	0.78
	1.0	79.6^{a}	27.0^{ab}	43.2	9.4	0.310^{ab}	0.74
	1.5	75.4^{ab}	25.6^{abc}	40.4	9.4	0.310^{ab}	0.78
	2.0	74.0^{ab}	26.0^{abc}	39.0	9.0	0.308^{ab}	0.74
SEM		2.09	0.83	1.81	0.45	1.2	0.02
Probability		*	*	**	**	*	**

(C) = Control group. a, b, c.. means within same columns with different superscripts are significantly different ($p \leq 0.05$). *= significant **= not significant.

Table (6): Fertility and hatchability percentages as affected by duck breed and dietary iodine supplementation levels

Main effects		Traits		
		Fertility (%)	**Hatchability of set egg (%)**	**Hatchability of fertile eggs (%)**
Duck breeds (DB)				
Domyati		94.8	74.1	77.1^{b}
Pekin		94.5	74.4	77.9^{a}
SEM		0.29	0.23	0.27
Probability		**	**	*
Iodine levels (IL)				
(C)		94.0	72.6^{c}	76.4^{b}
1.0		95.0	75.5^{a}	78.3^{a}
1.5		94.5	73.6^{b}	76.8^{b}
2.0		95.0	75.3^{a}	78.7^{a}
SEM		0.41	0.33	0.38
Probability		**	*	*
Interactions				
DB	**x IL**			
Domyati	(C)	94.0^{b}	72.8^{c}	76.0^{d}
	1.0	96.0^{a}	76.4^{a}	78.5^{ab}
	1.5	95.0^{ab}	73.5^{cb}	76.5^{cd}
	2.0	94.0^{b}	73.5^{cb}	$77.4b^{cd}$
Pekin	(C)	94.0^{b}	72.3c	76.7^{cd}
	1.0	94.0^{b}	74.7^{b}	78.0^{bc}
	1.5	94.0^{b}	73.6^{cb}	77.0^{bcd}
	2.0	96.0^{a}	77.1^{a}	80.0^{a}
SEM		0.58	0.47	0.54
Probability		*	*	*

(C) = Control group. a,b,c…means within same columns with different superscripts are significantly different ($p \leq 0.05$). *= significant**= not significant

Table (7): Live body weight and relative weight of liver, thyroid, and heartas affected by duck breed and dietary iodine supplementation levels during laying period

Main effects		Traits			
		Live body weight (g)	**Liver (%)**	**Thyroid (%)**	**Heart (%)**
Duck breeds (DB)					
Domyati		2469.2	3.0^{b}	0.007	0.67
Pekin		2468.8	3.7^{a}	0.015	0.65
SEM		34.5	0.11	0.005	0.02
Probability		**	*	**	**
Iodine levels (IL)					
(C)		2613.3^{a}	3.1^{b}	0.01	0.62^{b}
1.0		2520.8^{ab}	3.4^{ab}	0.023	0.67^{ab}
1.5		2287.5^{c}	3.1^{b}	0.005	0.72^{a}
2.0		2454.2^{b}	3.7^{a}	0.006	0.63^{b}
SEM		48.8	0.15	0.008	0.024
Probability		*	*	**	*
Interactions					
DB x IL					
Domyati	(C)	2526.7^{abc}	2.7^{d}	0.010	0.63^{b}
	1.0	2716.7^{a}	3.3^{c}	0.006	0.60^{c}
	1.5	2300.0^{cd}	3.0^{cd}	0.006	0.80^{a}
	2.0	2333.3^{c}	3.0^{cd}	0.008	0.63^{b}
Pekin	(C)	2700.0^{ab}	3.6^{b}	0.010	0.60^{c}
	1.0	2325.0^{cd}	3.4^{b}	0.040	0.73^{a}
	1.5	2275.0^{d}	3.3^{c}	0.006	0.63^{b}
	2.0	2575.0^{ab}	4.4^{a}	0.004	0.63^{b}
SEM		69.0	0.4	0.011	0.03
Probability		*	*	**	*

(C) = Control group. a,b,c.. meanswithin same columns with different superscripts are significantly different ($p \leq 0.05$). **= not significant; *= significant.

Table (8): Blood plasma constituents as affected by duck breedand dietary iodine supplementation level during laying period

Traits / Main effcts	T-protein (g/dl)	Albumin (g/dl)	Glbulin (g/dl)	T. lipids (mg/dl)	Cholest- (mg/dl)	Triglyceride (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	T_3 (ng/ml)	T_4 (ng/ml)	ALT (U/l)	AST (U/l)
Duck breeds (DB)												
Domyati	5.9	3.1	2.8	846.9^{b}	200.3	122.6	84.7	91.1^{b}	5.0	23.6	22.0	85.3
Pekin	5.9	3.2	2.7	886.0^{a}	202.4	129.1	82.1	94.4^{a}	5.3	24.1	22.4	87.0
SEM	0.1	0.12	0.1	13.1	4.88	2.68	2.84	3.1	0.14	0.64	0.76	3.26
Probability	**	**	**	*	**	**	**	*	**	**	**	**
Iodine levels (IL)												
(C)	5.7^{b}	3.0	2.6^{b}	844.1	185.2^{b}	118.0^{b}	78.1^{b}	83.6^{b}	4.4^{b}	20.8^{c}	24.3^{a}	87.6
1.0	5.8^{ab}	3.2	2.6^{b}	848.8	196.2^{b}	121.1^{b}	81.4^{ab}	90.0^{ab}	4.9^{b}	22.9^{bc}	20.2^{b}	88.1
1.5	6.1^{a}	3.4	2.7^{b}	871.3	205.9^{ab}	128.1^{ab}	81.0^{ab}	99.3^{a}	5.6^{a}	$24.^{ab}$	22.4^{b}	85.7
2.0	6.1^{a}	3.0	3.1^{a}	901.6	217.9^{a}	136.4^{a}	93.1^{a}	97.6^{a}	5.8^{a}	26.9^{a}	21.9^{b}	83.3
SEM	0.12	0.2	0.11	18.45	6.9	3.8	4.0	4.4	0.2	0.9	1.1	4.6
Probability	*	**	*	**	*	*	*	*	*	*	*	**
Interactions												
DB x IL												
Domyati (C)	5.4^{b}	3.0	2.4^{b}	817.0	185.3^{b}	112.4^{b}	78.8	84.0^{b}	4.2^{c}	21.4^{bc}	24.2^{a}	86.0
Domyati 1.0	5.9^{ab}	3.1	2.8^{ab}	826.6	$196.4b^{a}$	116.3^{b}	81.3	91.8^{ab}	4.7^{c}	22.3^{bc}	18.8^{b}	83.0
Domyati 1.5	6.1^{a}	3.2	2.9^{ab}	839.1	202.0^{ba}	126.4^{ab}	84.6	92.2^{ab}	5.4^{ab}	23.9^{bac}	23.6^{ba}	92.0
Domyati 2.0	6.0^{a}	2.9	3.1^{b}	904.8	217.4^{ba}	135.5^{a}	94.0	96.3^{ab}	5.7^{a}	26.8^{a}	21.2^{ba}	78.0
Pekin (C)	5.9^{ab}	3.1	2.9^{ab}	871.1	185.1^{b}	123.7^{ab}	77.3	83.1^{b}	4.5^{c}	20.3	24.3^{a}	89.0
Pekin 1.0	5.7^{ab}	3.2	2.4^{b}	871.0	196.0^{ba}	125.9^{ab}	81.6	89.3^{ab}	5.1^{bac}	23.4^{bac}	21.5^{a}	93.0
Pekin 1.5	6.1^{a}	3.6	2.5^{b}	903.0	209.8^{ba}	129.7^{ab}	77.4	106.4^{a}	5.7^{a}	25.5^{ba}	21.1^{ba}	79.3
Pekin 2.0	6.2^{a}	3.1	3.1^{a}	898.3	218.5^{a}	137.2^{a}	92.2	98.8^{ab}	5.9^{a}	27.0^{a}	22.6^{ba}	86.5
SEM	0.1	0.2	0.16	26.1	9.8	5.4	5.7	6.2	0.27	1.28	1.5	6.5
Probability	*	**	*	**	*	*	**	*	*	*	*	**

(C) = Control group. a,b,c…. means within same columns with different superscripts are significantly different (p≤ 0.05). **= not significant; *= significant.

Table (9): Blood hematology parameters as affected byduck breeds and dietary iodine supplementation level during laying period

Traits / Main effects		RBC	Hb (g/100 ml)	Ht (%)	MCV (μ^3/ml)	MCH (Pg/ml)	MCHC (g/100 ml)	WBC X10^3	Heterophils (%)	Lymphocytes (%)	H/ L
		Blood hematology parameters									
Duck breeds (DB)											
Domyati		3.5	11.0^{b}	32.3	92.1	31.5^{b}	34.0^{b}	25.0^{a}	26.3^{b}	54.3	0.5^{b}
Pekin		3.5	11.4^{a}	32.6	94.0	33.3^{a}	35.3^{a}	22.8^{b}	29.5^{a}	52.4	0.6^{a}
SEM		0.04	0.12	0.2	1.0	0.5	0.31	0.4	0.48	0.96	0.01
Probability		**	*	**	**	*	*	*	*	**	*
Iodine levels (IL)											
(C)		3.2^{b}	10.2^{c}	31.7^{b}	96.7^{a}	32.0	32.5^{b}	21.0^{b}	27.8^{b}	49.8^{b}	0.6^{a}
1.0		3.3^{b}	11.0^{b}	30.8^{b}	94.9^{ab}	33.9	35.7^{a}	22.5^{b}	25.8^{b}	52.3^{ab}	0.5^{b}
1.5		3.7^{a}	11.8^{a}	33.8^{a}	91.7^{bc}	32.0	35.0^{a}	26.0^{a}	27.8^{b}	56.3^{a}	0.5^{b}
2.0		3.8^{a}	11.8^{a}	33.5^{a}	89.0^{c}	31.7	35.5^{a}	26.2^{a}	30.0^{a}	55.2^{a}	0.6^{a}
SEM		0.05	0.17	0.42	1.46	0.71	0.43	0.58	0.68	1.35	0.02
Probability		*	*	*	*	**	*	*	*	*	*
Interactions											
DB x	**IL**										
Domyati	(C)	3.2^{b}	10.2^{d}	31.7^{bc}	95.8^{ab}	31.4^{abc}	32.2^{c}	22.6^{ed}	25.7^{dc}	49.5^{c}	0.52^{b}
	1.0	3.2^{b}	10.6^{c}	30.0^{c}	95.1^{ab}	33.8^{ba}	35.5^{a}	23.4^{ecd}	28.0^{bc}	57.5^{ab}	0.49^{bc}
	1.5	3.8^{a}	11.2^{c}	33.7^{a}	89.3^{bc}	29.9^{c}	33.5^{bc}	27.4^{a}	23.7^{d}	52.7^{bc}	0.45^{c}
	2.0	3.9^{a}	11.9^{a}	34.0^{a}	88.1^{c}	30.7^{bc}	34.9^{ab}	26.8^{ab}	27.7^{bc}	57.7^{ab}	0.48^{cb}
Pekin	(C)	3.2^{b}	10.3^{d}	31.7^{bc}	97.5^{a}	32.6^{abc}	32.8^{c}	19.4^{f}	30.0^{ab}	50.0^{c}	0.60^{a}
	1.0	3.3^{b}	11.3^{bc}	31.7^{bc}	94.8^{bac}	34.0^{ab}	35.9^{a}	21.6^{ef}	23.7^{d}	47.0^{c}	0.50^{cb}
	1.5	3.6^{a}	12.4^{a}	34.0^{a}	94.0^{bac}	34.1^{ab}	36.5^{a}	24.7^{bcd}	32.0^{a}	60.0^{a}	0.53^{b}
	2.0	3.7^{a}	11.8^{ab}	33.0^{ab}	89.9^{bc}	32.6^{abc}	36.1^{a}	25.6^{abc}	32.4^{a}	52.7^{bc}	0.61^{a}
SEM		0.08	0.23	0.59	2.06	1.0	0.61	0.83	0.96	1.91	0.0.02
Probability		*	*	*	*	*	*	*	*	*	*

(C) = Control group. a,b,c. means within same columns with different superscripts are significantly different ($p \leq 0.05$). **= not significant; *= significant.

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الملخص العربى

الإستجابة الفسيولوجية والإنتاجية للبط البكينى والدمياطى المغذى على علائق تحتوى على مستويات إضافية من اليود خلال فترة إنتاج البيض

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تم استخدام عدد 132 طائر بط (108 أنثى و24 ذكر) من كلاً من سلالتى البط البكينى و الدمياطى عند عمر 24 اسبوع حيث قسمت إلى أربعة مجاميع فى ثلاث مكررات بكل مكررة (9 إناث + 2 ذكر)على النحو التالي:- المجموعة الأولى هى مجموعة الكنترول (المقارنة) والتى غذيت على العليقة الأساسية المحتوية على 0,3 ملجم يود/كجم عليقة بينما المجموعات 2، 3، 4 غذيت على العليقة الأساسية مضاف إليها اليود فى صورة كالسيوم أيوديت بمستوى1,0؛ 1,5؛ 2,0 ملجم أيودين / كيلوجرام عليقة على التوالى. وذلك لدراسة تأثير المستويات الإضافية من اليود على الأداء الإنتاجى والفسيولوجى للبط البكينى والدمياطى خلال فترة إنتاج البيض.

ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلى:

1- سجل البط البكينى زيادة معنوية فى عدد البيض التراكمى خلال فترة التجربة من 24-35 اسبوع.

2- أعطى البط الدمياطى نتائج أفضل معنوياً لقيم وزن البيضة بالمقارنة بالبط البكينى خلال فترة التجربة.

3- البط الدمياطى المغذى على 1,5ملجم أيودين/كجم علف أعطى زيادة معنوية لعدد و وزن البيض فى حين أن البط البكينى أعطى نفس النتائج بالتغذية على مستوى 2,0ملجم أيودين/كجم علف.

4- زيادة الأيودين بالعليقة من1,0 -2,0 ملجم/كجم علف أدى إلى زيادة معنوية فى محصول البيض وكذلك وزن البيضة.

5- سجلت الطيور المغذاة على عليقة تحتوى على2,0 ملجم أيودين/كجم عليقة قيماً أفضل معنوياً للعليقة المستهلكة حيث سجلت أقل إستهلاكاً للعلف.

6- سجلت المجاميع التجريبية المغذاة على 2,0 و1,5 ملجم/كجم عليقة أفضل قيماً معنوية لمعامل تحويل الغذاء لكل من البط البكنى والدمياطى على التوالى.

7- تحسنت نسبة الفقس معنوياً سواء للبيض المخصب أو للبيض الكلى الموضوع بزيادة مستوى اليود بالعليقة وكان أفضلها مستوى2,0 و 1,0 ملجم أيودين/كجم علف.

8- المستويات الإضافية من اليود أدت بصفة عامة إلى تحسن صفات الدم المدروسة دون تأثير عكسى على وظائف الكبد أو الإستجابة المناعية للطيور.

توضح النتائج السابقة إمكانية إضافة الأيودين (فى صورة كالسيوم أيوديت) بمستوى 1,5 و 2,0 ملجم/كجم علف لعلائق البط الدمياطى والبكينى على التوالى زيادة عن محتوى العليقة من اليود الموصى به لتحسين أدائها الإنتاجى والفسيولوجى خلال فترة إنتاج البيض دون حدوث أى تأثيرات عكسية.