Egypt. Poult. Sci. Vol (35) (I): (69 -91) (2015) (1551)

Egyptian Poultry Science Journal

http://www.epsaegypt.com

ISSN: 1110-5623 (Print) – 2090-0570 (On line)

IMPROVING JAPANESE QUAIL PHYSIOLOGICAL PERFORMANCE UNDER HOT ENVIRONMENTAL STRESS IN NORTH AFRICA

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Received: 26/11/2014 Accepted: 25/12/2014

ABSTRACT: The objective of the present study was to determine the effect of supplementation of Ginseng, methionine, vitamin E, folic acid and zinc on the immune function and physiological performance of Japanese quail challenged with hot environmental stress during summer season (May–June–July 2013) of Egypt (North Africa). Two hundred and sixteen birds were distributed in six treatment groups of thirty six birds which divided into three replicates, each containing twelve birds (4 males and 8 females) at 6 weeks of age. Japanese quail hens were fed the diets supplemented with 0 (nothing), 300 mg Ginseng, 0.3% Methionine , 200 mg Vitamin E, 10 mg Folic acid and 60 mg Zinc / kg experimental layer diet. All groups were put under observation for 14 weeks from 6 to 20 weeks of age.

Results of this study could be summarized as follows:

Key Words: Japanese Quail , Physiological Performance , Hot Environment

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1. Adding Ginseng, methionine, vitamin E, and folic acid to Japanese quail laying hen diets during the environmentally high temperature stress resulted in significantly ($P \leq 0.05$) better improvements in live body weight and feed consumption at all intervals studied.
2. All feed additives are exhibited no significant effect in each of blood AST, ALT, urea, creatinin, calcium and phosphorus as compared to control group.
3. Adding folic acid causes a significantly ($P \leq 0.05$) higher total protein, albumin and globulin than the control diet.
4. Total lipids and total cholesterol were significantly ($P<0.05$) decreased by feeding ginseng, methionine and folic acid.
5. Adding ginseng, methionine, vitamin E, folic acid and zinc are exhibited no significant effect in each of progesterone and testosterone comparing to control group.
6. Quail laying hens fed diet supplemented with vitamin E and folic acid were exhibited ($P \leq 0.05$) higher T_3 hormone than control hens; but, other feed additives did not affect.
7. Quail laying hens fed supplemental diets achieved significantly ($P \leq 0.05$) higher total counts of blood erythrocytes and leukocytes, lymphocytes or basophil cells than the control.
8. heterophil cells and H / L ratio were significantly ($P \leq 0.05$) decreased due to feeding Japanese quail laying hens on feed additive diets as compared with control diet.
9. Heart histopathological examination showed no pathognomonic lesion in all groups
10. Kidney histopathological examination showed that birds fed control or ginseng diets showed degeneration of renal tubules
11. Liver histopathological examination showed that birds fed methionine, vitamin E, folic acid and zinc exhibited vacuolar degeneration.
12. Briefly, supplementation of Ginseng, methionine, vitamin E, folic acid and zinc to Japanese quail laying hens diet can practically compensate symptoms resulted from incidence of hot environmental stress during summer months.

INTRODUCTION

Summer months can represent stressful difficulties for poultry production and that is a problem in many parts of the world. Therefore, the harmful effects of high temperature on the physiological performance of laying hens have been well-studied. Beside that, high ambient temperature has great effects on physiological processes and productive performance. Therewith, hot environmental stress may depress the immune function of birds by impairing the production of antibodies and effective cell-mediated immunity. Thus, hot environmental stress not only has an adverse effect on laying performance but also can impede disease resistance. Therefore, it caused economic losses such as impeded growth rate, egg production, fertility, hatchability, immunity function, rising morbidity and mortality rate. High ambient temperature caused abnormal physiological responses such as increasing both of respiratory rate (Panting) and core or deep body temperature, decreasing immune responses and metabolic hormones as well as decline sub-optimal albumin quality (Bollengier-lee et. al., 1998; Kocaman et. al., 2006 and Ramnath et. al.,2007). Also, Stress conditions increased the mobilization of some minerals from the tissues and their excretion in poultry (McDowell, 1989). Thus may results in marginal minerals deficiency or increased minerals requirements, implying that minerals should be supplemented in such conditions. These beneficial effects of vit E, folic acid, zinc, ginseng and methionine might be more profound if birds were under stressful environmental conditions. In order to overcome the adverse effect of high ambient temperature, a considerable amount of researches has been conducted depending upon nutritional conditions, such as feeding time (Teeter et. al., 1987), quantity and quality of feed (Hussein, 1996), supplementing critical essential amino acids (Yanming and Baker, 1993), minerals and vitamins (Moreng, 1980), herbs and edible plants (Tolba, 2003 and Tollba and Hassan, 2003), herbal extracts and organic acids (Tolba, et al 2009), Herbal Additives (Tolba, et al 2005) and antioxidant materials (Tolba, et al 2007). Moreover, a lot of feed additives have been utilized in order to improve the productive performance of growing and laying quails under stressful conditions. More specifically, there are certain amino acids, vitamins, minerals and trace elements that support healthy and improve physiological and immunological performance. Therefore, the present work was designed to shed some light on the effects of ginseng, methionine, vit E, folic acid, and zinc supplementation on some immunological and physiological traits of Japanese quail laying hens under stressful summer hot conditions.

MATERIALS AND METHODS

This study was conducted at Agriculture Experiments Station, Faculty of Agriculture, Cairo University.

Birds: A total number of two hundred and sixteen birds Japanese quail at 6 weeks old assigned to similitude groups. The birds are having nearly equaled live weights were distributed randomly into six treatment groups. Thirty six birds were assigned to each group which divided into three replicates, each containing twelve birds (4 males and 8 females).

Housing and diets: All birds were kept under the same managerial and environmental conditions in gregarious battery cages (100cm long × 50 cm wide ×30 cm height), set up in an open-sided laying house. Birds were fed the standard diet with different additives from 6 to 20 week of age and arranged as follows: The 1st group was fed on standard diet (Table 1), while the 2nd, 3rd, 4th, 5th and 6th groups were fed on the same diet enriched with 300 mg Ginseng, 0.3% Methionine, 200 mg Vitamin E, 2 mg Folic acid, 60 mg Zinc / kg basal diet, respectively. Birds had free access to feed and water throughout the experimental period.

Samples taken and Measurements: Body weight of experimental hens was recorded at the beginning and then weighed at interval period of 2-weeks tells the end of experimental period. Feed intake was recorded per replicates of each treatment bi-weekly intervals. Daily maximum and minimum ambient temperature or relative humidity were recorded inside and outdoor the houses during the experimental period (Table 2). The work was carried out "between" May to July 2013 under summer high temperature stress.

Blood biochemical variables: At the end of the experiment (20 weeks of age), three birds/ treatment were randomly taken and slaughtered and blood samples were collected in a sterile heparinized centrifuge tubes. The samples were then centrifuged for 10 min. at 3000 r.p.m. and plasma samples were removed then stored frozen at – 20 C^{o} until analyzed. Plasma samples were analyzed to determine sexual hormones (Testosterone, progesterone), Thyroid Hormones: (T3, T4 ng/dl). Plasma Total protein (g/dl) Albumin (g/dl), T_3, Cholesterol (mg/dl), Total lipids (mg/dl), Creatinine (mg/dl), Aspartate aminotransferase (AST) (U/L) and Alanine aminotransferase (ALT) (U/L) were calorimetrically determined using commercial kits following the recommendations of manufactures. Globulins were estimated by subtraction of albumin value from total protein value of each sample.

Blood hematological variables: Eighteen blood samples were used for measurement of erythrocyte, leukocyte and its differentiation count according to (Natt and Herrick, 1952). Blood smears were stained by Giemsa stain and the differential leucocytic count was performed according to Jain, (1986). Then, Heterophil to Lymphocytes ratio (H/L) was calculated.

Histopathological examination: At the 19th week of age, tissue samples from the liver and kidney were removed and collected in 10% neutral buffered formalin. After fixation, samples were dehydrated in alcohol, cleared in xylene and embedded in paraffin wax. Sections were cut at 5 µm and stained with hematoxylin and eosin (Riddell, 1987), then fixed with microscope 10, 60, 100 power.

Statistical analysis: Data were subjected to computerize statistical analysis using one way analysis of variance of SAS Institute, Inc. (1996). Significant difference among means of treatments was detected by Duncan's (1955) multiple range test procedures. The differences were considered significant at ($P \leq 0.05$). The following model was used to study the effect of test materials on parameters investigated as follows:

$$Y_{ij} = G_i + T_j + E_{ij}.$$

Where:

Y_{ij} = observation for each dependent variable

G_i = Overall mean.

T_i = Treatment effects (i = 1, 2... and 6).

E_{ij} = Random error.

RESULTS AND DISCUSSION

I - Productive performance:

a. Live body weight

Live body weight at 8, 12, 16 and 20 wks of ginseng, methionine, vitamin E and folic acid supplemented groups during hot climate stress was significantly ($P<0.05$) increased compared to that of the respective control group. While, live body weight would respond ($P<0.05$) due to zinc supplementation at 12 or 20 wks of age only compared to control group (Table 3). It is obvious that ginseng, methionine, vitamin E, folic acid and zinc treatments could cover or avoid the negative effect of heat stress concerning live body weight.

These results are in agreement with the findings of Simonová et al., (2008) who reported that average daily weight gain significantly increased in rabbits fed on dietary supplemented with ginseng extract. Chen, et al., (2013) demonstrated that higher dietary methionine concentration (5.9 g/kg) can improve growth performance. Supplementation with α-tocopherol acetate at 125-250 mg/kg in Matrouh laying hens diets had positive effects on growth performance and linearly increased growth rate (Hassan et al., 2009). Supplementation with 2 mg folic acid /kg of diets resulted a significantly increased in live body weight compared with control group under severe heat stress during summer season (Kamel, 2012). Kucuk (2008) investigated the effect of Zinc (30mg/kg) supplementation on performance responses in heat-stressed quail and reported that live weight gain was greatest with zinc supplementation, it may be due to elevation of feed intake.

b. Feed consumption and Feed conversion ratio:

Effects of dietary supplementation during the hot climate of the Egyptian summer on feed consumption and feed conversion ratio (g feed/g egg) of Japanese quail laying hens at experimental or overall periods are presented in Table (4 and 5). In general, feed consumption and feed conversion ratio was ($P \leq 0.05$) significantly improved as affected by all dietary supplementation as compared to control group. Concerning the action of supplemental zinc, it was clear to note that there was no significant action in feed consumption as compared to un-supplemental diet group. The present result is in agreement with the finding of Simonová et al., (2008) who showed that the application of ginseng extract had a beneficial effect on feed consumption and feed conversion ratio and average daily weight gain. Koreleski and Świątkiewicz (2011) reported that Methionine supplementation significantly improved feed intake and feed conversion per kg of eggs. Ciftci, et al., (2005) reported that dietary supplementation with 125 mg Vitamin E in laying hens diet exposed to chronic stress (35°C) improved feed intake and feed efficiency. Sahin and Kucuk (2003) showed that 1 mg of folic acid/kg of diet improved feed intake and feed efficiency in Japanese quail exposed to high ambient temperature (34°C). An improvement in feed intake and feed efficiency was reported in Zinc picolinate (30 or 60 mg/kg) supplemented quail reared under heat stress conditions (Sahin et al., 2005).

2 - Blood biochemical parameters:

Effects of dietary supplementation during the hot climate of the Egyptian summer on blood biochemical of Japanese quail laying hens at 20 wks of age are presented in (table 6). Supplementation of feed additives are exhibited no significant effect in each of blood biochemical measurements like AST, ALT, urea, creatinin, calcium and phosphorus as compared to un-supplement control group. However, total protein, albumin and globulin were significantly ($P \leq 0.05$) higher for the hens fed the diet supplemented with folic acid than the control birds. In spite of, the other feed additives did not affect total protein, albumin and globulin. Whereas, total lipids and total cholesterol were significantly ($P<0.05$) decreased by feeding ginseng, methionine and folic acid to quail laying hens. The previous results may indicate that the supplemented doses of ginseng, methionine, vitamin E, folic acid and zinc were not toxic or pathologically to chicks and having no deleterious effects on liver or kidney. Evidently, the results confirmed the fact that; the physiological status may play an important role in immune response. Azazi et al., (2011) demonstrated that the effect of dietary ginseng supplementation (150 and 300 mg ginseng/Kg) on plasma total protein, albumin, globulin, albumin/globulin ratio, AST, ALT, and phosphorus values are within the normal ranges and were not significantly affected. However, saponins reduced the blood cholesterol levels in chickens; this may be due to binding interaction between saponins and cholesterol in the intestinal bile. Also, Zeweil et al., (2011) demonstrated that plasma albumin concentration was not significantly affected by methionine levels. The present result is also in agreement with Ebeid et al. (2013) who suggested that in the growing rabbit diets serum total cholesterol, LDL-cholesterol, HDL-cholesterol, triglycerides, total protein and albumen were not significantly affected by Vitamin E dietary treatment. Also, the present result is in agreement with Munyaka et al., (2012) who showed that total protein, albumin, and globulin were found to be high ($P<0.05$) with dietary Folic Acid (4 mg/kg diet) on laying hens at 24 wk compared with the control group. Farasati and Tohidi (2007) showed that the effect of Zinc on cholesterol concentration of plasma was Significant. The maximum concentration of cholesterol in plasma was observed in male chicks administered 40 mg / kg of Zinc.

3 - Blood hormones:

Effects of dietary supplementation during the hot climate of the Egyptian summer on blood hormones of Japanese quail laying hens at 20 weeks of age are presented in (table 7). The statistical analysis revealed that, the addition of ginseng, methionine, vitamin E, folic acid and zinc in quail laying hens diet are exhibited no significant effect in each of progesterone and testosterone comparing to control group. Also, quail laying hens fed diet supplemented with vitamin E and folic acid were exhibited the significantly ($P\leq0.05$) higher T_3 hormone than control hens. However, ginseng, methionine and zinc supplementation did not affect significantly on T_3 hormone compared to the control group. Previous studies report that T_3 concentrations consistently decrease in high temperature conditions (Mack, et al., 2013). Our result is agreed with finding of Azazi et al., (2011) who demonstrated that the effect of dietary ginseng supplementation (150 and 300 mg ginseng/Kg) on blood T_3 and testosterone hormones values are within the normal ranges and were not significantly affected. Cheng and Mong (2002) showed that, when methionine was between 0.5% and 1.0 %, plasma thyroid hormone wasn't affected by methionine levels. Also, Golzar Adabi et al., (2011) reported that there were no differences in Plasma Testosterone concentration in any treatments that received Vit.E. Kamel (2012) reported that significant increase was determined in blood plasma testosterone level received 2 mg Folic acid /kg of diets under severe heat stress during summer season. Kaya et al. (2001) reported that plasma T_3 level was not affected by zinc supplementation in diets of Hisex brown laying hens.

4 - Blood hematological variables:

a – Erythrocytes and Leucocytes cells:

Effects of dietary supplementation during the hot climate of the Egyptian summer on blood hematological (Immunity) of Japanese quail laying hens at 20 wks of age are presented in (table 8). It is well known that, heat stress causes high ($P<0.05$) values of erythrocytes and leucocytes as well as heterophils of blood, with a corresponding decrease ($P<0.05$) in lymphocytes cells number comparing to control (Shini, 2003). The present results referred that, hens fed diet inclusive ginseng, methionine, vitamin E, folic acid and zinc are exhibited ($P\leq0.05$) significantly increase in counts of leucocytes cells and erythrocytes cells. Moreover, the WBC's differential such as lymphocytes or basophile cells were significantly ($P<0.05$) increased compared to the corresponding control diet. However, significantly ($P\leq0.05$) decreased in heterophil cells on hens on treated diets were recorded as compared with control diet. The supplementations caused ($P<0.05$) increasing leucocytes cells which attributed to increase ($P<0.05$) lymphocyte cells and decreasing ($P<0.05$) in heterophil (Table, 8), indicating that increased the immunity of hens and also can be ameliorate haematological stress of hot stress. Also, the significant reduction in stress levels, as indicated by the lower heterophile to lymphocyte ratio (H/L), observed in the hens supplemented with ginseng (Zhang et al. (2009), methionine (Haider, 2007), vitamin E (Bollengier et al., 1998), folic acid and zinc (Kidd et al, (2000). Also, EL-Kaiaty et al., (2001) found that supplementing Zinc oxide or Zinc -methionine to chicken diet increased total and differential counts of WBC for Fayoumy than Hubbard chicks.

b – Heterophil : Lymphocyte ratio (H/L ratio)

Firstly, the heterophil to lymphocyte ratio (H/L ratio) has become widely accepted as a reliable and accurate physiological indicator of the stress response in chickens, exposure to stressors causes it to increase progressively, the reference values for it of about 0.2, 0.5 and 0.8 are characteristic of low, optimal and high degrees of stress, respectively (Shini, 2003).

The H/L ratio in the present study was significantly ($P<0.05$) decreased in supplemented groups as compared to un-supplemented control group. This result suggests that control group hens were more stressed than other groups (Table 8). The significant decreases were due to increases in its denominator (lymphophilia), indicating that the treatment can be ameliorate haematological stress of supplementation groups. The alterations in heterophils, lymphocytes cells or their ratio suggest that hens may have a great effect on the stress response (Shini, 2003).

c – Eosinophil and Monocyte cells

Monocyte cells were associated with high ambient temperature, which has been reported previously by Shini, 2003. However, hens fed diets inclusive ginseng, methionine, vitamin E, folic acid and zinc had no response on monocyte cells, suggesting that diet treatments are effective to alleviate the hot environment stress. Shini, (2003) found an extreme stress monocytes becomes evident in avian species.

Seemingly, supplementation groups had a significantly decreased H/L ratio that were due to significant increases in leucocytes which attributed to significant increases in lymphocytes cells, indicating that the feed additive increased the immunity of hens and also can be ameliorate partially the haematological stress of hot environmental stress. Finally, the blood hematology and biochemical results show that the feed additive involved in adjustment the H/L ratio and disappearance of monocyte cells, indicating that they can attenuate the physiological stress of hot environment and consequently increase the immunity.

5 – Histopathological examination:

a – Heart examination:

Concerning of heart histopathological examination showed that no pathognomonic lesion in all groups (Plate 1).

b – Liver examination:

Concerning of liver histopathological examination showed that birds fed control or ginseng diets showed vacuolar degeneration (Plate 2). Whereas, birds fed methionine, vitamin E, folic acid and zinc exhibited vacuolar degeneration and congested blood vessels (Plate 3).

c - Kidney examination:

Concerning of kidney histopathological examination showed that birds fed control or ginseng diets showed degeneration of renal tubules (Plate 4). Whereas, birds fed methionine, vitamin E, folic acid and zinc exhibited degeneration of renal tubules with inflammatory cell infiltration (Plate 5). Finally, it is recommended that control diet or ginseng supplementation to laying hens diet is the best.

In conclusion: It is worth mentioning that the present results are enough to consider that feed additive such as ginseng, methionine, vit. E, folic acid and zinc can practically compensate symptoms resulted from incidence of hot environmental stress which related with the depression in the immunity or haematological stress of Japanese quail laying hens in north of Africa countries during hot summer months (Egypt).

Table (1): Composition and chemical analysis of the experimental diets of layers of Japanese quail

.Ingredients	Basal diet (%)
Yellow corn	59.20
Soybean(44%CP)	20.00
Corn gluten meal 60%	10.00
Vegetable oil	2.30
Limestone	5. 50
Di calcium phosphate	2.00
Premix*	0.30
Salt	0.40
DL– Methionine)	0.10
L.Lysine Hcl	0.20
Total	100
Crude protein %	20.00
ME, kcal/kg diet	3000
Crude fiber %	3.00
Ether extract %	2.80
Calcium %	2.60
Available phosphorus %	0.50
Lysine %	1.00
Methionine %	0.50

*Supplied per Kg of diet: Vit. A, 12000 IU; Vit. D_3, 2200 IU; Vit. E, 10mg; Vit. K_3 2mg; Vit. B_1,1mg; Vit.B_2, 5mg; Vit. B_6, 1.5 mg; Vit. B_{12}, 0.01mg; Nicotinic acid, 30mg; Folic acid, 1mg; Pantothinc acid, 10mg; Biotin, 0.05mg; Choline chloride, 500mg; Copper, 10mg; Iron, 30mg; Manganese, 60mg; Zinc, 50mg; Iodine, 1mg; Selenium, 0.1mg and Cobalt, 0.1mg.

Table (2): Means of out door and indoor ambient temperature or relative humidity measured within the open-sided Japanese quail laying house during experimental period

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Months	Ambient temperature (ºC)				Relative humidity (%)			
	Indoor		Out door		Indoor		Out door	
	min	max	min	max	min	max	min	max
May	28.1 ±0.7	32.2 ±0.5	28.5 ±0.5	35.2±0.3	48.02±2.27	56.05 ±1.84	49.65 ±0.39	71.05 ±1.84
June	29.5 ±0.4	33.6 ±0.6	30.6 ±0.5	37.1 ±0.4	47.13 ±0.19	61.90±0.60	52.15 ±0.54	73.90 ±0.60
July	30.3 ±0.5	35.2 ±0.7	31.2 ±0.5	39.1 ±0.5	53.75 ±0.97	61.87 ±1.47	59.7 ±0.61	77.87 ±1.47

Table (3): Live body weight (g) of Japanese quail laying hens fed diets supplemented with feed additives (Means±S.E.)

Treatment Age (wks)	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
6	224.16 ^{a}±2.67	222.91 ^{a} ±1.81	225.13 ^{a}±1.81	224.44 ^{a}±1.32	221.94^{a}±1.92	221.80^{a}±1.81
8	249.25 ^{c} ±2.61	258.88 ^{ab}±2.60	255.69 ^{abc}±3.15	259.80 ^{ab}±3.78	261.05 ^{a}±3.21	251.66^{bc}±1.51
12	262.02 ^{d} ±1.85	281.11 ^{b} ±0.85	284.33 ^{a}±0.85	282.71 ^{ab}±0.85	282.97 ^{ab}±1.03	270.75 ^{c}±1.05
16	278.49 ^{c} ±1.62	296.61 ^{ab} ±2.34	295.83 ^{ab} ±3.46	300.94 ^{ab}±5.67	309.02 ^{a}±9.78	286.63^{bc}±4.09
20	286.07 ^{b} ±3.42	321.80 ^{a} ±1.66	325.16 ^{a} ±4.98	333.52 ^{a}±13.39	326.35 ^{a}±8.41	319.13 ^{a}±13.81

^{a,b,c,d} means having different superscripts in the same row are significantly different at ($P \leq 0.05$).

Table (4): Feed consumption (g/bird) of Japanese quail laying hens fed diets supplemented with feed additives (Means ± S.E.)

Treatment Age (wks)	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
9	18.89 ^{ab} ±2.99	21.98^{a}±2.65	15.91 ^{ab} ±2.65	18.11^{ab} ±2.65	13.26^{b} ±2.65	13.41 ^{b} ±2.65
12	32.87^{b} ±2.91	40.28^{a} ±3.71	40.06^{a} ±3.90	37.32^{a} ±2.81	40.18^{a} ±3.49	39.84^{a} ±3.17
16	41.61^{b} ±1.81	43.84^{ab} ±1.81	46.38 ^{a} ±1.81	42.37^{b} ±1.81	43. 37^{ab} ±1.81	42. 86^{b} ±1.81
20	40.78 ^{b} ±2.15	42. 52^{a} ±2.32	43. 52^{a} ±2.98	43.06^{a} ±2.53	44. 03^{a} ±2.91	39.25^{b} ±2.87
Overall	36.43^{d} ±1.05	39.90^{ab} ±0.08	40.23^{a} ±0.42	38.46^{bc} ±0.12	38.68^{abc} ±0.32	37.51^{cd} ±0.13

^{a,b,c,d} means having different superscripts in the same row are significantly different at (P≤0.05).

Table (5): Feed conversion ratio of Japanese quail laying hens fed diets supplemented with feed additives (Means ± S.E.)

Treatment Age(wks)	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
9	3.38^{a} ±0.02	3.06^{b} ±0.01	3.22^{ab} ±0.03	3.19^{ab} ±0.02	3.05^{b} ±0.01	3.13^{b} ±0.01
12	3.68^{a} ±0.01	3.41^{c} ±0.04	3.56^{ab} ±0.04	3.46^{bc} ±0.04	3.42^{bc} ±0.03	3.37^{c} ±0.01
16	3.90^{a} ±0.03	3.60^{bc} ±0.02	3.66^{b} ±0.01	3.58^{bc} ±0.04	3.49^{c} ±0.02	3.49^{c} ±0.03
20	4.05^{a} ±0.01	3.74^{bc} ±0.01	3.81^{b} ±0.02	3.76^{bc} ±0.01	3.73^{bc} ±0.02	3.65^{c} ±0.04
Overall	3.78^{a} ±0.01	3.51^{bc} ±0.02	3.59^{b} ±0.01	3.52^{bc} ±0.02	3.47^{c} ±0.02	3.48^{c} ±0.01

^{a,b,c}means having different superscript in the same row are significantly at (P≤0.05).

Table (6): Blood biochemical parameters of Japanese quail laying hens fed diets supplemented with feed additives (Mean±S.E)

Treatment Items	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
Total protein (g/dl)	4.76^{b} ±0.01	4.87^{b} ±0.24	4.90^{b} ±0.42	4.92^{b} ±0.17	5.31^{a} ±0.21	4.88^{b} ±0.15
Albumin (g/dl)	3.50^{b} ±0.17	3.56^{b} ±0.12	3.62^{b} ±0.38	3.58^{b} ±0.82	3.82^{a} ±0.22	3.59^{b} ±0.01
Globulin (g/dl)	1.25^{b} ±0.18	1.31^{b} ±0.28	1.28^{b} ±0.53	1.30^{b} ±0.23	1.49^{a} ±0.38	1.29^{b} ±0.16
Total lipid (mg/dl)	773.05^{a} ±111.46	697.59^{b} ±222.92	692.79^{b} ±66.24	752.94^{a} ±125.92	679.55^{b} ±58.59	758.87^{a}±50.54
Cholesterol (mg/dl)	214.76^{a} ± 27.67	164.61^{b} ±60.70	131.77^{b} ±16.13	197.57^{a} ±42.14	159.82^{b} ±31.52	208.70^{a}±58.85
AST (U/L)	25.67^{a} ±2.72	20.67^{a} ±0.33	25.00^{a} ±4.05	23.67^{a} ±2.66	25.00^{a} ±6.11	24.67^{a} ±2.66
ALT (U/L)	42.00^{a} ±1.15	40.33^{a} ±0.33	43.00^{a} ±1.15	43.67^{a} ±2.96	43.00^{a} ±2.88	43.67^{a} ±2.40
Urea (mg/dl)	5.79^{a} ±0.20	4.92^{a} ±0.29	5.34^{a} ±0.39	4.86^{a} ±0.81	6.08^{a} ±0.76	6.25^{a} ±0.95
Creatinin (mg/dl)	0.39^{a} ±0.01	0.22^{a} ±0.05	0.26^{a} ±0.04	0.33^{a}±0.19	0.30^{a} ±0.001	0.29^{a}±0.04
Calcium (mg/dl)	11.83^{a} ±0.36	11.22^{a} ±0.37	10.73^{a} ±0.67	10.93^{a} ±0.62	10.87^{a} ±0.79	10.51^{a} ±0.39
Phosphorus (mg/dl)	1.70^{a} ±0.21	1.86^{a} ±0.15	1.78^{a} ±0.14	1.47^{a} ±0.20	1.48^{a} ±0.14	1.69^{a} ±0.01

^{a,b,c} means having different superscripts in the same row are significantly different at (P≤ 0.05).

Table (7): Blood hormones of Japanese quail laying hens fed diets supplemented with feed additives (Mean±S.E)

Treatment Items	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
Progesterone (ng/dl)	2.29^{a} ±0.23	2.36^{a} ±0.04	2.31^{a} ±0.001	2.45^{a} ±0.001	2.35^{a} ±0.001	2.42^{a} ±0.001
Testosterone (ng/dl)	4.86^{a} ±0.06	5.01^{a} ±0.04	5.00^{a} ±0.03	5.12^{a} ±0.03	4.94^{a} ±0.09	5.05^{a} ±0.34
T_3 (ng/dl)	152.02^{b} ±12.01	161.50^{b} ±16.74	163.01^{b} ±9.01	206.4^{a} ±10.50	199.37^{a} ±10.95	160.03^{b} ±21.55

^{a,b,c} means having different superscripts in the same row are significantly different at (P≤ 0.05).

Table(8): Blood cell counts of Japanese quail laying hens fed diets supplemented with feed additives (Means±S.E.)

Treatment Items	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
Erythrocytes ($\times 10^6$)	$2.30^b \pm 0.23$	$3.01^a \pm 0.04$	$3.05^a \pm 0.02$	$2.78^a \pm 0.23$	$2.86^a \pm 0.14$	$2.75^a \pm 0.23$
Leukocytes ($\times 10^3$)	$12.00^b \pm 1.15$	$14.00^a \pm 1.15$	$13.65^a \pm 1.29$	$13.33^a \pm 1.36$	$14.00^a \pm 1.29$	$13.83^a \pm 1.29$
Heterophil (H)	$34.53^a \pm 2.18$	$27.00^b \pm 3.21$	$28.33^b \pm 2.40$	$28.67^b \pm 3.28$	$27.00^b \pm 3.28$	$26.67^b \pm 3.46$
Lymphocyte(L)	$62.33^b \pm 2.30$	$66.67^a \pm 2.98$	$67.33^a \pm 2.40$	$67.67^a \pm 5.36$	$65.67^a \pm 2.98$	$66.33^a \pm 2.98$
H / L ratio	$0.55^a \pm 0.05$	$0.40^b \pm 0.07$	$0.42^b \pm 0.06$	$0.42^b \pm 0.05$	$0.41^b \pm 0.09$	$0.40^b \pm 0.07$
Basophil	$3.00^b \pm 0.57$	$5.67^a \pm 0.33$	$7.67^a \pm 0.33$	$5.33^a \pm 0.75$	$6.67^a \pm 0.05$	$7.33^a \pm 0.66$
Eosinophil	1.33 ±0.03	1.67 ±0.03	1.03 ±0.03	1.67 ±0.03	1.63 ±0.01	------ ------
Monocyte	6.67 ±0.04	----------	0.33 ±0.04	----------	0.33 ±0.04	------ ------

^{a,b,c} means having different superscripts in the same row are significantly different at ($P \leq 0.05$).

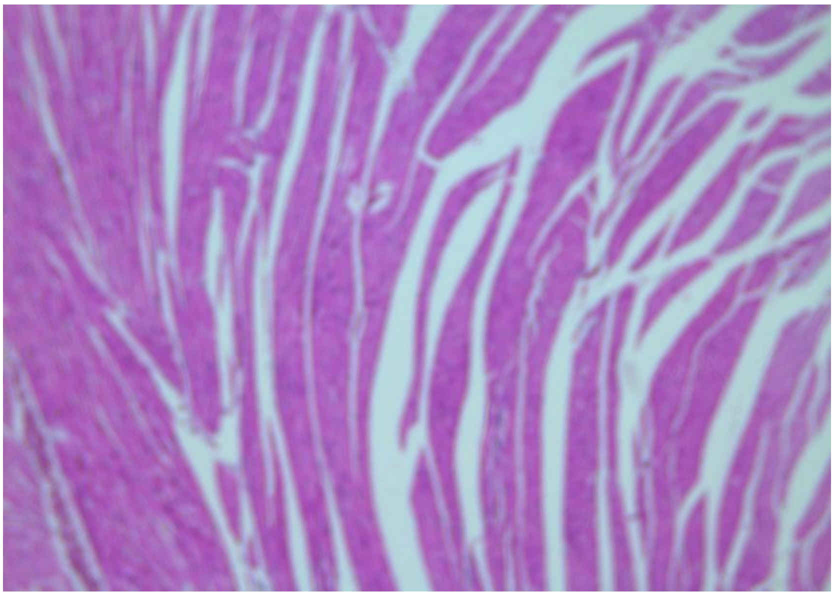

Plate 1: Heart showed no pathognomonic lesion in all groups (H&E- X 10).

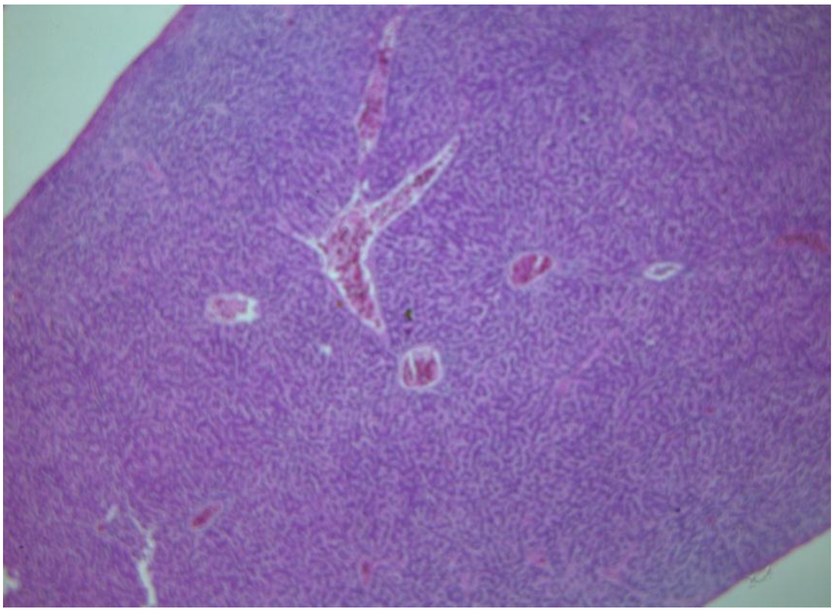

Plate 2: Liver G1 showed vacuolar degeneration (H&E- X40).

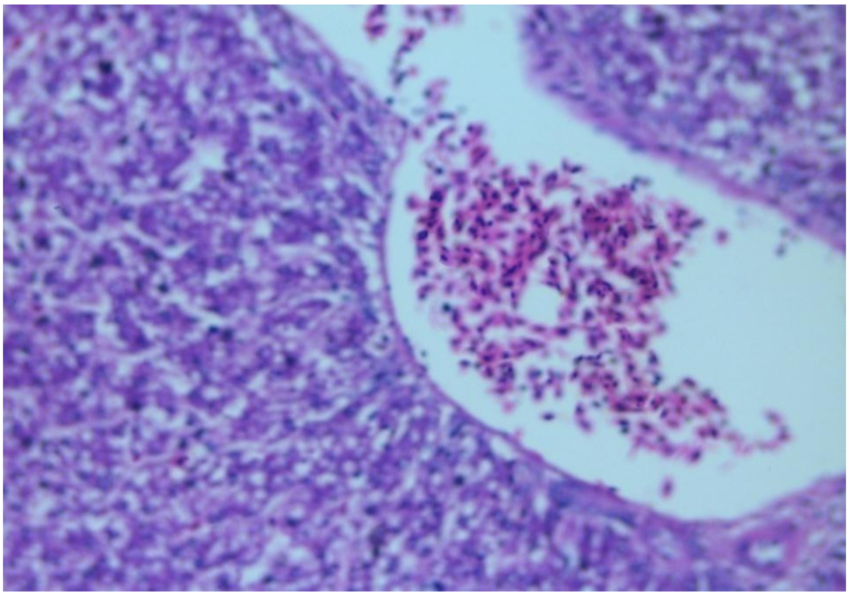

Plate 3: Liver G3, G4 G 5 and G6 showed vacuolar degeneration and congested blood vessels (H&E- X40).

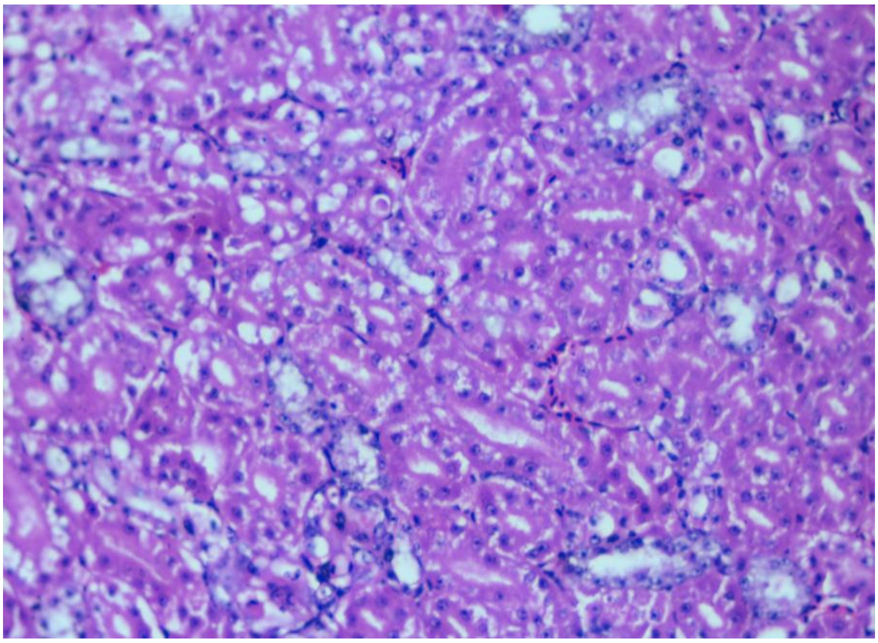

Plate 4: Kidney G1 showed degeneration of renal tubules (H&E-X40).

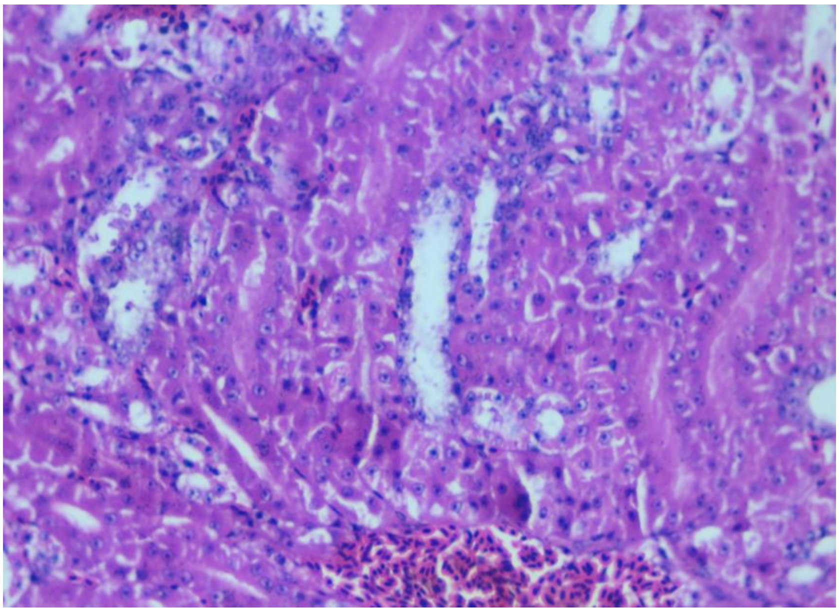

Plate 5: Kidney G3 G4, G5 and G 6 showed degeneration of renal tubules with inflammatory cell infiltration (H&E - X40).

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الملخص العربى

تحسين الأداء الفسيولوجي للسمان الياباني تحت إجهاد البيئة الحارة في شمال أفريقيا

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أجريت هذه التجربة لدراسة تأثيراضافة كلا من الجينسنج ، الميثيونين ، فيتامينE ، حمض الفوليك و الزنك إلى العليقة الاساسية للسمان الياباني على الوظيفة المناعية والحاله الفسيولوجية لأداء السمان الياباني الياباني تحت إجهاد البيئة الحارة خلال فصل الصيف (مايو ويونيو ويوليو٢٠١٣) في شمال أفريقيا (مصر).
تم استخدام 216 طائر من السمان الياباني في عمر 6 أسابيع والتي وزعت عشوائيا إلى ٦ مجموعات متساوية (36 طائر لكل مجموعة) قسمت إلى ثلاث مكررات، يحتوي كل مكرر على ١٢ طائر (4 ذكور و 8 إناث). تم تغذية الطيور على العليقة الاساسية مع إضافات مختلفة من عمر ٦ - ٢٠ أسبوع على النحو التالي (الكنترول ، ٣٠٠ ملجم الجينسنج ، ٠,٣٪ ميثيونين ،٢٠٠ ملجم فيتامينE ، ٢ملجم حمض الفوليك ، ٦٠ ملجم زنك / كجم عليقة أساسية) أثناء فصل الصيف الحار ٣٥- ٣٨ درجة مئوية ودرجة الرطوبة نسبية ٧٥%.
نتائج هذه الدراسة يمكن تلخيصها على النحو التالي

١. أدت إضافة الجينسنج، ميثيونين، وفيتامين E، وحمض الفوليك إلى علائق دجاج السمان الياباني البياض خلال ارتفاع درجة حرارة البيئه إلى تحسين معنوي ($P\leq0.05$) في وزن الجسم الحي واستهلاك العلف في جميع فترات الدراسة.
٢. الإضافات الغذائية لم تظهر أي تحسن معنوي في كل القياسات البيوكيميائية للدم مثل ALT، AST، اليوريا، creatinine والكالسيوم والفوسفور مقارنة بالمجموعة الضابطة.
٣. أدت إضافة حمض الفوليك إلى علائق دجاج السمان الياباني البياض إلى إرتفاع معنوي ($P\leq0.05$) في البروتين الكلي والألبيومين والجلوبيولين بالمقارنة بالمجموعة الضابطة ولكن الإضافات الغذائية الأخرى لم تؤثر معنويا علي البروتين الكلي والألبيومين والجلوبيولين
٤. انخفضت الدهون الكلية والكوليسترول الكلي معنويا ($P\leq0.05$) عند التغذية علي الإضافات الغذائية مثل الجنسنغ والميثيونين وحمض الفوليك في علائق دجاج السمان الياباني البياض خلال ارتفاع درجة الحرارة البيئه.
٥. إضافة الجينسنج، الميثيونين، فيتامين E، حامض الفوليك والزنك في غذاء دجاج السمان الياباني البياض لم تسبب أي تأثير معنوي علي كل من هرمون البروجسترون والتستوستيرون مقارنة بالمجموعة الضابطة.
٦. دجاج السمان الياباني البياض التي تغذي علي فيتامين E وحامض الفوليك أظهرت إرتفاع معنوي ($P\leq0.05$) في الهرمون T_3 بالمقارنة مع الدجاج بالمجموعة الضابطة. ولكن الإضافات الغذائية لأخرى لم تؤثر معنويا علي هرمون T_3 .
٧. أدت إضافة الجينسنج، ميثيونين، وفيتامين E، وحمض الفوليك إلى علائق دجاج السمان الياباني البياض خلال ارتفاع درجة الحرارة البيئه إلى تحسين معنوي ($P\leq0.05$) في الكريات الدم لحمراء والكريات الدم البيضاء و بانواعها و الخلايا الليمفاوية بالمقارنة بالمجموعة الضابطة.
٨. إنخفضت الخلايا المتفاعلة ونسبة L / H معنويا ($P\leq0.05$) عند تغذية دجاج السمان الياباني البياض على الإضافات الغذائية المستخدمة أو المضافة بالمقارنة بالمجموعة الضابطة.
٩. أظهر فحص أنسجة القلب انه لا توجد أعراض مرضيه في جميع المجموعات
١٠. أظهر فحص أنسجة الكلى أن الطيور التي تغذت علي الجينسنج أو عليقه المقارنة أظهرت اضمحلال في الأنابيب الكلوية.

١١. أظهر فحص أنسجة الكبد أن الطيور التي تغذت علي الميثيونين، فيتامين E، حامض الفوليك والزنك أظهرت اضمحلال في الفجوات بين الخلايا.

١٢. باختصار، الإضافات الغذائية المستخدمة أو المضافة من الجينسنغ والميثيونين وفيتامين E وحامض الفوليك والزنك إلى إلى علائق دجاج السمان الياباني البياض يمكن أن تعوض عمليا أعراض حدوث الإجهاد الحراري البيئي التي تتعلق بالمناعة والحالة الفسيولوجية أو الإجهاد الفسيولوجي خلال أشهر الصيف الحارة.