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IMPROVING THE PRODUCTIVE PERFORMANCE OF JAPANESE QUAIL UNDER HOT ENVIRONMENTAL STRESS IN NORTH AFRICA

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ABSTRACT: The aim of this work was to investigate the effect of addition of (Ginseng, Methionine, Vitamin E, Folic acid and Zinc) to conventional diet on the fertility of Japanese quail under hot environmental stress during summer season (May- June- July 2013) of Egypt. A total number of two hundred and sixteen birds of Japanese quail at 6 weeks of age, which 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) with initial body weight (223.4 ±1.89 g). Birds in the 1st group were served as control, While, groups 2, 3, 4, 5 and 6 were fed on the experimental layer diet with the addition of 300 mg Ginseng, 0.3% Methionine, 200 mg Vitamin E, 10 mg Folic acid and 60 mg Zinc / kg experimental layer diet, respectively.

Key Words: Japanese Quail, Hot Environment, North Africa.

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Results of 14 weeks feeding trail of Ginseng, Methionine, Vitamin E, Folic acid and Zinc to laying quail hens during the environmentally high temperature stress showed that, body weight, feed consumption, feed conversion ratio, egg production, fertility and hatchability improved (P≤0.05) compared to their counterparts in control group. Egg quality characteristics were not affected by feeding quail laying hens on diets supplemented with feed additives except yolk weight which (P≤0.05) lower as compared with control one. Seminal total proteins were (P≤0.05) increased with the addition of methionine only and decreased (P≤0.05) with the addition of ginseng, vitamin E, folic acid and zinc. Generally, Seminal urea and Creatinine were decreased (P≤0.05) by the addition of all feed additives. In Physical characteristics of diluted fresh semen: The supplementation of feed additives to quail male diets caused (P≤0.05) enhancement of mass sperm motility (Score), advanced sperm motility (%) and sperm-cell concentration as compared to un-supplemental control diet. However, dead spermatozoa (%), sperm abnormalities (%) and acrosomal damages (%) were (P≤0.05) significantly improved as affected by feeding diets inclusion of feed additive. It could be concluded from this trial that, supplementation of Ginseng, Methionine, Vitamin E, Folic acid and Zinc for 14 weeks can improve (P<0.05) the productive performance and semen characteristics by reducing the side effects of environmentally high temperature stress during summer months in Egypt (North Africa).

INTRODUCTION

Summer months can represent stressful difficulties for poultry production and that is a problem in many parts of the world. The main consequences of hot environment are a reduction in feed intake, egg production (Peguri and Coon, 1991), eggshell quality (Grizzle et al., 1992) and concomitant with poor feed efficiency and growth (McKee et. al., 1997). Therefore, dietary supplementation of some compounds such as vitamins (Folic acid and Choline) or amino acid (Glycine betaine) may give us the opportunity to take appropriate preventive to avoid the adverse effects of hot summer months on laying hens performance.

Ginseng has many functions mainly attributed to the bioactive components of ginseng, including saponins, antioxidants, peptides, polysaccharides, alkaloids, lignin and polyacetylness (Jo et. al., 1995), and has immune – stimulatory, anti – fatigue and hepatoprotective physiological effects (Yan et. al., 2011 a). Various studies have suggested that saponins and polysaccharides from ginseng could enhance immunity in vitro and perform a variety of functions, including immune-modulation, anti- tumor and anti- oxidant activities (Jo et. al., 1995 and Zhang et. al., 2009) The reasons for the increased egg production is likely to be the improved health status of birds fed on diets supplemented with ginseng adventitious root meal.

Methionine is Sulfur and Essential amino acid, classified as non polar and an intermediat in the biosynthesis of cysteine, carnitine, taurine,lecithin, phosph atidylcholine and other phospholipids. Methionine is the first limiting amino acid. This means that an adequate quantity of methionine is necessary for most practical diets to obtain optimum performance. Therefore, it is common practice to supplement diets with synthetic methionine source such as DL- methionine (Liu et. al., 2004 b).

Vitamin E is anti- stress effects and their synthesis is reduced during heat stress (Bollengier- lee et. al., 1998) and serves as a physiological anti- oxidant through inactivation of free radicals (Gonzalez et. al., 1995). (Bollengier- lee et. al., 1998) reported that heat stress impairs the synthesis and release of vitellogenine and that dietary supplementation with vit E facilitates release of vitellogenine necessary for yolk formation and can alleviate the detrimental effects of high temperature. Supplementation with high levels of vit E in poultry diets may protect cells from damage of lipid peroxidation stimulated by heat stress, allowing regular yolk precursor formation and ovulation (Ciftci et. al., 2005). Vitamin E can reduce the negative effects of corticosterone (Tengerdy, 1989); improve egg production, feed intake and yolk and albumin solids (Kirunda et. al., 2001) and improve egg quality (Puthpongsiriporn, 1998).

Folic acid has numerous and complex interrelationships with other nutrients and the possibility of deficiency play a partial role in reducing the animal performance (Radostits et. al., 2000). Folic acid status is linked to increase serum levels of the sulfur amino acids homocystine due to the role of folic acid as a co- factor in the remethylation of homocystine to form methionine (House et. al., 1999). Also, the supply of folates in the diet and their synthesis by intestinal microflora are sufficient to prevent folic acid deficiency. However, Harms et. al., (1999) results on using folic acid in poultry diets lead to a positive role in improving egg production and feed conversion efficiency.

Zinc is an extremely important element that is necessary for functioning of our immune system. Zinc has been associated with production of testosterone and its lack in the body lead to low sperm count. Zinc is an essential microelement has significant role in the organism, probably because it is a co- factor of more than 200 enzymes (Sahin et. al., 2005). Kim et. al., (1998) predicated that zinc as an antioxidant interact with Vit E. because vit E is impaired in zinc deficient animals. Also, zinc can occupy iron and copper binding sites on lipids, protein and DNA and thus exert a direct antioxidant action (Prasad and Kucuk, 2002). Zinc plays a major role in carbohydrate, protein and fat metabolism (Mohanna et. al., 1999). El-Kaiaty et. al., (2001) concluded that addition of zinc to the diet of chickens could be utilized as a method for pushing the chick toward the best metabolic function to give the satisfactory productive performance.

These beneficial effects of ginseng, methionine, vit E, folic acid and zinc might be more profound if birds were under stressful environmental conditions. Literature on using these substances on reproductive performance of Japanese quail laying hens under environmental stress condition is very scarce. So, making dietary adjustments can be an effective way to boost laying performance and fertility without the need for pharmaceuticals. Therefore, dietary supplementation of some compounds such as ginseng, methionine, vit E, folic acid and zinc may give us the opportunity to take appropriate preventive to avoid the adverse effects of hot summer months on quail laying hens performance.

MATERIALS AND METHODS

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

Birds and housing: A total number of two hundred and sixteen birds Japanese quail with initial body weight (223.4 ±1.89 g).at 6 weeks old assigned to similitude groups. All birds were kept under the same managerial, rearing facilities and environmental conditions in gregarious battery cages (100cm long × 50 cm wide ×30 cm height), set up in an open-sided laying house. Treatments were conducted during summer season (may -june-july) with average temperature ranged between 38°C and 35°C with 75 % relative humidity from 6 to 20 weeks of age (throughout the experimental period).

Experimental diets and design: The birds are having nearly equaled live weights were distributed randomly into sex treatment groups. Thirty six birds were assigned to each treatment group, which divided into three replicates, each containing twelve birds (4 males and 8 females). Birds were fed the experimental layer diets with different tested feed additives from 6 to 20 week of age as follows: The 1st group was fed on the experimental layer diets without any supplementation and served as control, while those in the 2nd group were fed on a diet with Ginseng (300 mg/kg feed). The 3rd group was received a diet containing Methionine (0.3% /kg feed). The 4th group was also received a diet supplemented with Vitamin E (200 mg/kg feed). The 5th group was given a diet inclusive folic acid (10 mg/kg feed). Whereas, the 6th group was also fed diet enriched with zinc (60 mg /kg feed). Experimental diets were formulated as shown in Table (1). Birds had free access to feed and water throughout the experimental period. 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 experiment period. Sexual maturity was pointed at 8 weeks of age thereupon; egg number, egg weight and feed intake were recorded daily to 20 wks of age for each replicate. At the 16th week of age, a total of 90 eggs were collected from each treatment along within consecutive 7 days to measure fertility and hatchability percents. Egg quality was measured at 10 weeks of feeding trial. Ten eggs from each replicate (laid on consecutive days) were collected, weighed, broken and separated into shells, yolks and albumens. The weights of yolk, albumen and shell (with membranes) were recorded and calculated as percentages of egg weight. Egg length, Egg wide, yolk high, yolk diameter and yolk color were measured. Also, Shell thickness was measured by a micrometer as an average of 3 points (top, medial and base). At the end of 16 wks of age, 30 collected eggs from each treatment were set in an electric forced draft incubator to determined fertility and hatchability percents.

Semen samples were individually collected from all males (after 18 wk of age) by the massage method described by Burrows and Quinn (1937) to determine the fresh semen characteristics and semen chemical analysis. The ejaculated semen was diluted with Sodium citrate (2.9 gm disodium citrate + 0.04 gm citric acid anhydrous + 1.25 gm lactose).

Statistical analysis: Data were statistically analyzed using one way analysis of variance of SAS Institute, Inc. (1998). 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 percentage values were transferred to percentage angle using arcsine equation before statistical analyses then turned to natural number. The following model was used to study the effect of test materials on parameters investigated as follows:

$$Y_{ij} = G_j + T_i + E_{ij}.$$

Where:

Y_{ij} = observation for each dependent variable.

G_j = Overall mean.

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

E_{ij} = Random (Standard) error.

RESULTS

I - Productive performance:

a. Live body weight

Supplementation of ginseng, methionine, vitamin E, folic acid, and zinc to quail laying hen diets during hot climate stress significantly (P<0.05) increased live body weight compared to that of the respective control group (Table 2). 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) 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). Supplemented 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 period are presented in (Table 2). In general, feed consumption and feed conversion ratio was (P≤0.05) significantly improved as affected by all dietary supplementation at experimental period as compared to counterpart control group. Concerning the action of supplemental zinc, it was clear to note that there was no a significant action in feed consumption at experimental period as compared to un-supplemental diet group. The present result is in agreement with the finding of Simonová et al., (2008) 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) who 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).

c. Egg production and egg weight:

Effects of dietary supplementation during the hot climate of the Egyptian summer on egg production of Japanese quail laying hens are presented in (Table 2). It was clearly demonstrated that, egg production and egg weight of birds fed ginseng, methionine, vitamin E, folic acid and zinc were significantly (P≤0.05) higher at the whole experimental period as compared to un-treated control birds.

It is well known that, heat stress has been reported to reduce productivity and egg weight of laying hens flocks may also be affected by a many factors, including environmental stress, which is probably one of the most commonly occurring challenges in many production systems around of the world (Deng et al., 2012). Yan et al., (2011 a, b) observed that dietary supplementation with wild Ginseng adventitious root meal (basal diet + 1% and + 2% wild Ginseng adventitious root meal) increased ($P \leq 0.05$) egg production and egg weight in laying hens at 27 weeks of age. Abdalla et al., (2012) reported that Gimmizah layer hen fed diets supplemented with 0.380 % Methionine significantly increased egg production percentage and egg weight. Methionine daily intake of 12.60 mg /one gm egg was adequate for achieved the highest egg production and egg weight. Also, Ezzat et al.,(2011) observed that supplementation of Folic acid (1mg/kg diet) on Matrouh chickens from 24-36 weeks of age under Egyptian hot summer condition were significantly ($P<0.05$) improved egg production and egg weight compared to control group. Amutha et al. (2007) showed that high egg production and egg weight were attained by applying 100 mg zinc per kg feed to Japanese quail.

d. Egg mass:

supplemental of ginseng, methionine, vitamin E and folic acid to laying hen diets under hot environment stress condition achieved ($P \leq 0.05$) significantly improved egg mass at overall experimental period as compared with their corresponding control once (Table 2). In general, Vercese et al., (2012) reported that high environmental temperature had negatively affected bird performance consequent reduction in Japanese quail's egg weight and egg mass. The present result is in agreement with the finding of Azazi et al., (2011) observed that there was an improvement in egg mass due to feeding laying hens on diets supplemented with ginseng at early laying stage. Bunchasak, et al., (2012) showed that DL-Methionine supplementation increased egg mass. El-Sheikh and Salama (2010) who reported that vit. E supplementation at levels of 125, 250 mg/kg in Matrouh laying hens diets improved ($P<0.05$) egg mass. Ezzat et al.,(2011) reported that supplementation of Folic acid (1mg/kg diet) on Matrouh poultry strain from 24-36 weeks of age under Egyptian hot summer condition significantly ($P<0.05$) improved egg mass compared to control group. Also, Hassan et al., (2003) observed that supplementation of Zinc significantly ($P<0.05$) improved egg mass.

e. Egg quality:

Substantially, all dietary supplementation exhibited that all egg quality parameters given in Table (3) were not significantly affected compared to their counterparts in control group except yolk weight which significantly ($P \leq 0.05$) lower as compared with control one. It is worth noting that increased panting under heat stress conditions leads to increased carbon dioxide levels and higher blood pH (i.e.,alkalosis), which in turn hampers blood bicarbonate availability for egg shell mineralization and induces increased organic acid availability, also decreasing free calcium levels in the blood. This process is very important in breeders and laying hens, as it affects egg shell quality (Marder and Arad, 1989). However, although another study have attempted to characterize the physiological mechanisms associated to the egg quality decrease in heat stressed birds, there is no definitive knowledge, and several potential pathways are still under investigation, including changes of reproductive hormones levels and of intestinal calcium uptake (Ebeid, et al., 2009).

Yan et al., (2011 a, b) and Azazi et al., (2011) showed that there were no significant differences in egg shell thickness, egg shell breaking strength, egg shape index, yolk index values, albumin% and shell% due to feeding laying hens on diets supplemented with Ginseng as compared with the control diet, during period (24-48 weeks of age). At the same manner, Koreleski and Świątkiewicz (2011), when supplementing Gimmizah hen diet with different levels of Methionine (0.380, 0.451 and 0.489 % of diet), Abd El-Maksoud (2006) and Wahyuni, et al., (2011) have reported that egg quality were not influenced by vitamin E supplementation in laying diets under heat stress, Ezzat et al.,(2011) when showed that dietary Folate 0, 10, 20, or 30 mg/ kg in laying hens did not significantly affect egg quality, and Abd El-Samee (2005) when reported that supplementation of laying Japanese quail diets with Bioplex Zinc, did not affect egg quality.

f. Egg fertility and Hatchability percentages: Results cited in Table (4) showed that the fertility (%) and hatchability (%) of quail laying hen fed diets supplemented with ginseng, methionine, vit E, folic acid and zinc under hot environmental stress were significantly ($P \leq 0.05$) higher as compared with un-fed control once. Moreover, supplementation of the same additive achieved ($P \leq 0.05$) significantly improvement in infertility eggs ratio, early embryonic mortality and later embryonic mortality and as compared with their corresponding control once. As we known

previously that high ambient temperature coupled with high humidity decreases fertility resulting in low hatchability. Also, heat stress caused an increase in body temperature which has a negative effect on gamete formation and the fertilization process. This observation is in agreement with the finding of Azazi et al., (2011) who observed that fertility (%) and hatchability (%) were significantly increased by dietary ginseng supplementation (150 and 300 mg ginseng/Kg) compared with those of the control group. In this respect, Haider, (2007) observed the same result with extra supplementation of methionine, Wahyuni et al., (2011) with Vitamin E supplementation, Sirbu et al., (1981) with folic acid supplementation and also Abd El-Samee et al., (2012) when showed that supplementing laying Japanese quail diets with bioplex Zinc up to 40 mg/kg tended to improve egg fertility and egg hatchability significantly. Lin et al. (2004), who reported an improvement of 7,7 and 13,4% in fertility and hatchability of total eggs set, respectively, when Taiwan native pullets were given 80 mg/kg of supplemental Vet.E.

II – Male fertility characteristics:

a- Fresh semen Chemical analysis:

The results given in Table (5) indicated that, there were no significantly effects in fresh semen chemical analysis measured as calcium, phosphorus, albumin and cholesterol due to feeding Japanese quail laying hens on diets supplemented with ginseng, methionine, vitamin E, folic acid and zinc as compared with its value in facing control hens. However, seminal total proteins was increased significantly with the addition of methionine only and decreased significantly with the addition of ginseng, vitamin E, folic acid and zinc. Generally, seminal urea and Creatinine were decreased significantly by the addition of ginseng, methionine, vitamin E, folic acid and zinc. In this respect Amina-El Saadany (2007) reported that the addition of antioxidants (vit. E or vit. E plus Antox) to the sperm media significantly increased total lipids, cholesterol, and phospholipids concentrations, calcium, and phosphorus inorganic concentration. Zeidan et al., (2006) showed that seminal calcium, and total phosphorus concentrations were significantly higher of the summer heat-stressed NZW rabbit bucks injected with vitamin E (100 IU/ head). Kamel (2012) reported that Administration of Folic acid increased seminal plasma total proteins and Albumin. El-Speiy And El-Hanoun (2013) reported that supplementation the males with zinc sulphate recorded that seminal plasma lipid peroxidation as indicated by thiobarbituric acid-reactive substances was decreased and represented the highest value of testosterone hormone compared to those control and other supplemented groups.

b - Physical characteristics Fresh Semen:

Results in (Table 6) obviously showed that the supplementation of ginseng, methionine, vitamin E, folic acid and zinc to quail males diets caused ($P \leq 0.05$) significantly enhancement of mass sperm motility (Score), advanced sperm motility (%) and sperm-cell concentration at 18 wks old as compared to un-supplemental control diet. In the same time, dead spermatozoa (%), sperm abnormalities (%) and acrosomal damages (%) were ($P \leq 0.05$) significantly improved as affected by feeding quail males diet inclusion of above monitored feed additive compared with control diet. It is clear from the present results that administration of ginseng, methionine, vitamin E, folic acid and zinc improved semen characteristics and has positive effect on semen quality and quantity under environmental stress.

It is well known that semen volume, sperm concentration, number of live sperm cells and motility decreased when males were subjected to heat stress (McDaniel, et al., 2004). Supplementation with either 150 or 300 mg Ginseng / Kg feed improved semen quality and sperm cell concentration and decreased dead spermatozoa% and abnormal spermatozoa%, compared with those of control group. This may be due to believed exert immune-stimulatory, anti-fatigue and hepato-protective physiological effects (WU and Zhong, 1999 and Azazi et al., (2011). Also, Nizza et al., (2000) stated that supplementation with methionine significantly ($P<0.05$) improved the volume of semen and motility of sperm of rabbits. Khan et al., (2012) reported that vit. E addition increased ($P<0.05$) semen volume; sperm motility and egg fertility. Vit. E is naturally present in chicken and turkey sperm where it helps to maintain membrane integrity and sperm motility (Donoghue and Donoghue, 1997). Kamel (2005) showed that treated male rabbits with low, medium and high doses of Folic acid (40, 80,160 µg/kg of body weight) respectively, increased significantly ($P<0.05$) sperm concentration, sperm motility and normal sperm. However, dead sperm was decreased ($P<0.05$) compared to control group. Tharwat (1998) showed that, addition of Zinc at level of 100 mg/Kg significantly ($P<0.05$) increased the ejaculate volume, Mass motility, advanced motility and sperm concentration of semen than those of the control. He added that a certain local level of testicular Zinc may be required for the development of spermatozoa, since zinc is essential for DNA synthesis and cell division.

GENERAL DISCUSSION

Free radicals such as O_2 and HO are formed during conditions of heat stress, thus reducing membrane integrity because of peroxidation of butyric unsaturated Fatty Acid in the cell membrane (Feenster, 1985). Environmental stress increases mineral excretion (Smith and Teeter, 1987).

El-Husseiny and Creger (1981) reported significantly lower rates of retention of minerals such as Ca, Cu, Fe, K, Mg, Mn, Na, P and Zn in birds subjected to environmental stress. High environmental temperature significantly decreases the true digestibility of protein, amino acids (Zuprizal et al 1993), dry matter, crude protein and an ether extract in broiler quails (Sahin and Kucuk 2001). It was previously reported that the concentrations of antioxidant vitamins (vitamins A, C and E) in the serum and liver decrease with heat stress (Sahin, et al., 2002). Environmental stress increases the requirements of antioxidant materials, amino acids, vitamin E, folic acid and zinc, indicating that both of them should be supplemented in birds living in stressful condition.

The results of the present study provide some evidence that under such condition, somehow ginseng supplementation might have helped to respond to stress; yielding a better performance, perhaps attributed to the bioactive components, including saponins, antioxidants, peptides, polysaccharides, alkaloids, lignin, adaptogen and polyacetylenes (Jo et. al., 1995). Moreover, saponins, adaptogen and polysaccharides from ginseng could enhance immunity and perform a variety of functions, including immune modulation, antioxidant activities and improve health status (Zhang et al 2009). Also, adaptogen is improves resistance to environmental stress such as: heat, cold, infections, many forms of stress, exertion, and numerous other taxing circumstances (Bratman, 2000). Ginseng supplementation has been shown to increase energy, strengthen the immune system, give a positive sense of well being, and possibly. Because of all these proposed positive effects, ginseng may be a very important supplement for improving performance of organs body. It has been proposed that ginseng may also play a significant role in nitric oxide production in the body. Nitric oxide plays an important role in immune system function, sexual health, muscular strength and hypertrophy, as well as other factors; ginseng may therefore be a vital form of the supplementation (Friedl, et al., 2001).

Concerning, to yielding a better physical characteristics semen, perhaps attributed to increased testosterone level ($P<0.05$) and that is consistent with (Fahim et al., 1982). High testicular testosterone concentrations are required to maintain spermatogenesis (Ford et. al., 2000). Also, Hwang et al., (2010) indicate that ginseng improves the reduced feedback from the testes to the pituitary gland resulting in an increase in the amount of testosterone secreted from stimulates Leydig cells which may be degenerating and rejuvenation.

The results of the present study provide some evidence that under such condition, somehow Methionine supplementation might have helped to respond to stress; yielding a better performance, perhaps due to its ability to be an intermediate in the biosynthesis of cysteine, carnitine, taurine, lecithin, phosphatidylcholine, and other phospholipids. It is well-known that methionine can be catabolized to cysteine via the transmethylation transsullfuration pathway. Cysteine is indeed the limiting for Glutathione (gamma-glutamyl-cysteinylglycine, GSH) synthesis (Lyons et al., 2000). It acts as a precursor amino acid for glutathione in the protection of cells from oxidative damage and plays a vital role in detoxification (Reed, 1990). Glutathione (gamma-glutamyl-cysteinylglycine, GSH) is a tripeptide synthesized from glutamate, cysteine, and glycine in a series of two intracellular, ATP-dependent reactions. Glutathione is important in the context of cellular health and is known to play roles in oxidative and nitrosative stress as well as the detoxification of xenobiotics mediated through the glutathione-S-transferase system (Wu et al., 2004). Also, the body employs various antioxidant defense systems to attenuate the potentially deleterious effects of free radicals, one of the most important antioxidants in the body of mammals and birds in glutathione (Wu et al., 2004). Methionine has an important role to play in maintaining GSH concentrations within the body and have extremely important in maintaining the body's redox status and essential for the maintenance of cell health. In addition, the thiols group of methionine act as chelate lead and remove it from tissues (Patra et. al., 2001). In this context, it logical to suggest that methionine supplementation may contribute to the antioxidant status and it relates with special attention paid to GSH status. This means that an adequate quantity of methionine is necessary for most practical diets to obtain optimum performance. Therefore, it is common practice to supplement diets with synthetic methionine source such as DL- methionine (Liu et. al., 2004).

Concerning, to yielding a better physical characteristics semen, perhaps attributed to decrease semen homocysteine which is a defective amino acid formed from demethylation of methionine. Increased concentration of homocysteine blocks intracellular protein carboxyl methionine reactions results in inhibition of sperm motility (Sonmez et. al., 2007).

The results of the present study provide some evidence that under such condition, somehow vitamin E supplementation might have helped to respond to stress; yielding a better performance, perhaps due to its ability to have a protective role against oxidative stress by enhancing the level of endogenous antioxidants (Gore and Qureshi, 1997). Also, Vitamin E serves as a physiological antioxidant through inactivation of free radicals. Bollengier- lee et. al., (1998) may protect cells from damage of lipid peroxidation stimulated by heat stress, allowing regular yolk precursor formation and ovulation (Ciftci et. al., 2005). Vit E can reduce the negative effects of corticosterone (Tengerdy, 1989). Sahin et al. (2002) found that heat stress tended to elevate plasma corticosterone concentrations which were significantly reduced with vitamin E supplementation in a diet of Japanese quails. Moreover, Vit E improve the cell mediated immunity by protect the cell involving in immune response (Lymphocytes, Macrophages and plasma cells) against oxidative damage and enhance the function and proliferation of these cells through maintain the macrophage membrane integrity which needed for Phagocytosis (Gore and Qureshi, 1997) and decrease oxidative DNA damage in lymphocytes cells (Erf et. al., 1998). Consequently, the presence of vit E could partially interfere with oxidative protein denaturation and would improve digestibility of nutrients and feed efficiency (Ciftci et. al., 2005). Also, vitamin E supplementation offers a feasible way to reduce the losses in performance due to the negative effects of heat stress. Vitamin E is the major chain-breaking antioxidant in lipid phases such as cellular membrane or low density lipoproteins. Therefore, Vitamin E, acts as the primary antioxidant by quenching lipid peroxyl radicals (Gey, 1998). Vit E significantly improves egg production, this may be because: 1) enhancing synthesis of egg yolk precursors (vitellogenine and very low density lipoprotein) in the liver through its action as antioxidant which protect the liver from lipid peroxidation and damage to cell membrane and 2) facilitating the release of the previous precursors from the liver and increasing the circulating supply of them for yolk formation (Puthpon – Gsiripon et. al., 2001).

Concerning, to yielding better physical characteristics semen, perhaps attributed to reduces lipid peroxidation in seminal plasma and maintains an adequate viability of sperm to complete the fertilization process (Eid et al., 2006). Increased testes weight when ganders were fed with Vit. E (Surai and Ionov 1992). Vit.E supplementation in the diet resulted in an increase in the tocopherol concentrations of sperm and testicles. These effects were associated with a decrease in susceptibility to lipid peroxidation (Surai et al. 1998). Addition of Vit.E showed normal morphology and excellent motility spermatozoa (Ciftci et al., 2005).

The results of the present study provide some evidence that under such condition, somehow folic acid supplementation might have helped to respond to stress; yielding a better performance, perhaps attributed to be is an important co-enzyme in body and acts directly to produce antioxidant effects (Stanger, 2002). Folic acid prevented the oxidative stress by decreasing protein oxidation and increased GPX anti oxidant activity in the liver and serum (Ojeda et. al., 2009). Folic acid is required for remethylation of homocysteine to methionine. The effects of folic acid on the retention of nitrogen and minerals likely are attributable to the protection of the pancreas from oxidative stress (Stanger, 2002). Folic acid has been defined as an effective free-radical scavenger (Blundell et al 1996). The need for folic acid is greater for animals with greater growth or production rates because of its role in DNA synthesis (McDowell, 1989). Folic acid plays an important role in amino acid and DNA metabolism (McDowell, 1989) and its deficiency causes severe defects in DNA replication and repair (Tapiero et al., 2001). Folic acid deficiency lowers the concentrations of methyl tetrahydrofolate, the main methyl donor for methylation of homocysteine to methionine. Failures in remethylation also elevate the concentration of homocysteine (McDowell, 1989). Sahin and Kucuk (2003) showed that folic acid supplementation improved the performance variables. Folic acid is required in the methylation of homocysteine to form methionine and in the biosynthesis of amino acids and deoxynucleotides needed for DNA synthesis (Tapiero et al., 2001).

Concerning, to yielding a better physical characteristics semen, perhaps attributed to that folic acid might be vital to proper sperm development because it is for the production of DNA (Wallock et. al., 2001).

The results of the present study provide some evidence that under such condition, somehow Zinc supplementation might have helped to respond to stress; yielding a better performance, perhaps attributed to be is an important component of biological antioxidant systems and it is required for optimum performance, growth and modulation of the immune system; this is due in part to its role as a cofactor of various enzymes (Zago and Oteiza, 2001). Zinc is an essential microelement has significant role in the organism, probably because it is a co- factor of more than 200 enzymes (Sahin et. al., 2005), has numerous roles in some biological functions as well as protein metabolism (Forbes, 1984), DNA synthesis (Lieberman et. al., 1963), played crucial roles in positively modulating humoral and cellular immunity as evidenced by the DNA synthesis and the cell mediated immune response (Luecke et. al., 1978) and overall performance (Mohanna et. al., 1999). The reduced lipid peroxidation in Zn-supplemented birds might be due to the multifunctional roles of zinc, which include the induction of metallothionein, modulation of the transition elements and its relationship with the antioxidant vitamins such as vitamin A and E (Salgueri et al., 2000). Zinc is a cofactor of the main antioxidative enzyme CuZn-superoxide dismutase; it may play a key role in suppressing free radicals and in inhibiting NADPH-dependent lipid peroxidation (Prasad, 1997) as well as in preventing lipid peroxidation via inhibition of glutathione depletion (Gibbs et al., 1985). One of the proposed mechanisms of zinc's action is its capacity to displace transition metals (Fe, Cu) from binding sites. Zinc can compete with iron and copper to bind to the cell membrane and decrease the production of free radicals, thus exerting a direct antioxidant action (Tate et al., 1999). Zinc induces the production of metallothionein, an effective scavenger of hydroxyl radicals and it has been suggested that Zn-metallothionein complexes in the islet cells provide protection against immune-mediated free-radical attack (Burke and Fenton, 1985). Zinc has been associated with production of testosterone and its lack in the body lead to low sperm count and enhance alkaline phosphatase, resulting in improve the bone and egg shell formation (Nishi, 1996).

Concerning, to yielding a better physical characteristics semen, perhaps attributed to intracellular zinc can function as a temporary inhibitor for sperm lipid peroxidation, sperm oxygen uptake, sperm nuclear chromatin decondensation, sperm capacitation, acrosome reaction (Stephenson and Brackett, 1999). Zinc is involved intimately in many aspects of sperm morphology, physiology, and biochemistry (Lord and Averill, 2002). Zn ions act in terms of membrane stabilization, as well as the protective role of Zn as a cellular antioxidant (Prasad et al. 2004)

Conclusion: Supplements used herein provide the greatest performance in laying hens reared under hot environmental stress, and may offer a potential protective management practices to ameliorate or minimize the harmful effects of hot environmental stress. Consequently, it is of interest to firmly recommend these new aspects to maximize profit and sharply increase economic returns of Japanese quail laying hens in north of Africa countries during hot summer months.

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): Cumulative productive performance of Japanese quail laying hens fed diets supplemented with feed additive under hot environmental stress during the summer season (Means±S.E.)

Treatment Items	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
Body Weight(g)	286.07 ^{b} ±3.42	321.80 ±1.66	325.16 ^{a} ±4.98	333.52 ^{a} ± 3.39	326.35 ^{a} ±8.41	319.13 ^{a} ±13.81
F.consumption(g/hen/day)	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
F. Conversion (feed/mass)	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
Egg production (wk)	5.05 ^{b} ±0.12	5.91^{a} ±0.10	5.75^{a} ±0.04	5.69^{a} ±0.01	5.75^{a} ±0.06	5.63^{a} ±0.09
Egg weight (g)	13.17^{c} ±0.05	13.37 ^{ab} ±0.05	13.48 ^{a} ±0.08	13.36^{ab} ±0.02	13.40^{ab} ±0.05	13.28^{bc} ±0.03
Egg mass (hen/wk)	66. 81^{c} ±1.88	79. 06^{a} ±1.36	77. 82^{ab} ±0.67	75.94^{ab} ±0.18	77.29^{ab} ±0.86	75. 02^{b} ±1.11

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

Table (3): Egg quality of Japanese quail laying hens fed diets supplemented with feed additives under hot environmental stress during the summer season (Means±S.E.)

Treatment Items	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
Egg weight	14.16^{a} ± 0.27	14.25^{a} ±0.29	14.22^{a} ±0.27	13.97^{a} ± 0.20	14.24^{a} ± 0.27	14.13^{a} ± 0.24
Egg length	3.48^{a} ±0.14	3.53^{a} ±0.04	3.56^{a} ±0.05	3.43^{a} ±0.11	3.50^{a} ±0.11	3.53^{a} ±0.09
Egg wide	2.74^{a} ±0.02	2.76^{a} ±0.04	2.75^{a} ±0.02	2.75^{a} ±0.04	2.74^{a} ±0.02	2.73^{a} ±0.05
yolk high	14.38^{a} ±0.09	14.47^{a} ±0.19	14.44^{a} ±0.10	14.61^{a} ±0.20	14.55^{a} ±0.10	14.55^{a} ±0.11
Albumin weight	4.61^{a} ±0.08	4.61^{a} ±0.09	4.66^{a} ±0.06	4.77^{a} ±0.09	4.83^{a} ±0.05	4.77^{a} ±0.09
yolk diameter	2.86^{a} ±0.01	2.80^{ab} ±0.01	2.85^{a} ±0.01	2.75^{b} ±0.01	2.75^{b} ±0.01	2.76^{b} ±0.01
yolk weight	5.75^{a} ±0.06	5.27^{b} ±0.05	5.33^{b} ±0.04	4.86^{c} ±0.06	4.96^{c} ±0.04	5.03^{c} ±0.06
yolk color	6.66^{ab} ±0.18	6.88^{a} ±0.12	6.66^{ab} ±0.11	6.33^{ab} ±0.10	6.22^{b} ±0.28	6.55^{ab} ±0.18
Shell weight	1.92 ±0.06	1.83 ±0.06	1.92 ±0.06	1.77 ±0.06	1.85 ± 0.06	1.87 ±0.06
Shell thickness (mm)	0.24 ±0.02	0.24 ±0.01	0.24 ±0.01	0.24 ±0.02	0.24 ±0.04	0.24 ±0.02

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

Table (4): Fertility and hatchability percentages of Japanese quail laying hens fed diets supplemented with feed additives under hot environmental stress during the summer season. (Means ± S. E.)

Treatment Items	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
Fertility %	88.00^{b} ±2.5	92.83^{a} ±2.6	92.03^{a} ±2.5	92.87^{a} ±2.5	93.59^{a} ±2.6	92.93^{a} ±2.3
Hatchability %	67.60^{b} ±1.55	74.16^{a} ±1.52	75.83^{a} ±1.58	74.83^{a} ±1.18	77.06^{a} ±1.51	77.23^{a} ±1.68
Early embryonic Mortality %	12.03^{a} ±1.02	8.33^{b} ±1.11	5.83^{c} ±1.12	8.33^{b} ±1.17	5.29^{c} ±1.01	9.11^{a} ±1.07
Later embryonic Mortality %	8.33^{a} ±1.97	6.66^{b} ±1.97	4.16^{c} ±1.97	6.94^{b} ±1.97	5.30^{c} ±1.97	4.16^{c} ±1.97
Infertility eggs %	12.96^{a} ±2.25	6.66^{bc} ±2.27	7.50^{b} ±2.31	6.44^{bc} ±2.22	5.30^{c} ±2.52	6.94^{bc} ±2.42

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

Table(5): Semen chemical analysis of Japanese quail laying hens fed diet supplemented with feed additives under hot environmental stress during the summer season (Means±S.E.)

Treatment Items	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
Calcium (mg/dl)	0.16 ±0.06	0.12 ±0.09	0.09 ±0.06	0.08 ±0.09	0.12 ±0.06	0.09 ±0.06
Phosphor (mg/dl)	0.49 ±0.05	0.65 ±0.13	0.55 ±0.01	0.58 ±0.11	0.76 ±0.05	0.71 ±0.15
Albumin (g/dl)	0.16 ±0.03	0.17 ±0.04	0.16 ±0.03	0.13 ±0.05	0.13 ±0.03	0.15 ±0.06
Total protein (g/dl)	0.46^{b} ±0.07	0.37^{c} ±0.07	0.63^{a} ±0.07	0.27^{c} ±0.07	0.32^{c} ±0.07	0.34^{c} ±0.07
Cholesterol (mg/dl)	0.32 ±0.07	0.39 ±0.09	0.20 ±0.07	0.20 ±0.06	0.28 ±0.17	0.36 ±0.07
Urea (mg/dl)	0.04^{a} ±0.01	0.02^{b} ±0.01	0.02^{b} ±0.001	0.03^{ab} ±0.001	0.03^{a} ±0.01	0.03^{ab} ±0.01
Creatinine (mg/dl)	0.07^{a} ±0.02	0 $.02^{b}$±0.04	0.02^{b} ±0.02	0.01^{b} ±0.05	0.02^{b} ±0.03	0.01^{b} ±0.02

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

Table (6): Fresh Semen characteristics of Japanese quail males fed diets supplemented with feed additive under hot environmental stress during the summer season (Means ± SE).

Treatment Items	Control	Ginseng	Methionine	Vitamin E	Folic acid	Zinc
Mass sperm motility(Score)	2.50^{c} ±0.22	3.83^{ab} ±0.27	4.08^{a} ±0.23	3.33^{b} ±0.16	3.32^{b} ±0.11	4 $.00^{ab}$±0.22
Advanced sperm motility (%)	44.16^{d} ±1.53	55.83^{bc} ±4.36	68.33^{a} ±3.80	53.33^{c} ±1.70	53.33^{c} ±1.83	64.16^{ab} ±3.001
Dead spermatozoa (%)	21.50^{a} ±0.80	18.16^{b} ±0.74	15.83^{c} ±0.79	18.83^{b} ±0.91	19.16^{b} ±0.88	17.16^{bc} ±0.65
Sperm abnormalities (%)	20.66^{a} ±0.61	17.33^{c} ±0.54	14.00^{e} ±0.51	18.50^{bc} ±0.50	19.16^{b} ±0.54	15.50^{d} ±0.42
Acrosomal damages (%)	18.33^{a} ±1.08	13.66^{cd} ±1.16	11.33^{e} ±0.42	15.33^{bc} ±0.88	16.00^{b} ±1.16	12.33^{ed} ±0.55
Sperm-cell concentration (N $X10^{6}$/ ml)	621.67^{c}±17.65	681.66^{ab}±17.77	715.00^{a} ±12.58	695.00^{ab} ±20.77	656.67^{b}±20.23	696.66^{ab}±18.73

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

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الملخص العربى

تحسين الأداء الإنتاجي للسمان الياباني تحت ظروف 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 الخصوبة تحت اجهاد البيئة الحارة خلال فصل الصيف (مايو ويونيو ويوليو 2013) في مصر . وقد تم استخدام 216 طائر من السمان الياباني في عمر 6 أسابيع والتي وزعت عشوائيا إلى ٦ مجموعات متساوية كلا منها ٣٦ طائر كل 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) وذلك حتي عمر ٢٠ اسبوع من مايو إلي أغسطس أثناء فصل الصيف الحار ٣٥- ٣٨ درجة مئوية ودرجة الرطوبة نسبية ٧٥%.

وكانت النتائج كالأتي : -

- أظهرت نتائج أن 14 أسبوع من تغذية دجاج السمان الياباني البياض تحت ظروف إجهاد المناخ الحار علي علائق تحتوي علي الجينسنغ والميثيونين وفيتامين E وحامض الفوليك والزنك أن هناك تحسن معنوي ($P \leq 0.05$) في كل من وزن الجسم الحي واستهلاك العلف والكفائة التحويلية للغذاء وإنتاج وكتلة البيض ووزن البيضة و نسبة الفقس والخصوبة مع نظرائهم في المجموعة الضابطة .

- لم تتأثر معنويا خصائص جودة بيض السمان عن طريق تغذية دجاج السمان الياباني على لإضافات الغذائية باستثناء وزن الصفار الذي إنخفض معنويا ($P \leq 0.05$) بالمقارنة مع المجموعة الضابطة .

- البروتين الكلي للسائل المنوي زيادة معنويا ($P \leq 0.05$) مع إضافة الميثيونين فقط وانخفضت ($P \leq 0.05$) مع إضافة الجينسنغ، وفيتامين E، حامض الفوليك والزنك وذلك انخفضت اليوريا والكرياتينين المنوي معنويا ($P \leq 0.05$) خلال إضافة جميع إضافات الغذائية بالمقارنة مع المجموعة الضابطة.

- بالنسبة للخصائص الفيزيائية للسائل المنوي الطازج : أظهرت نتائج إن إضافات الغذائية للذكور السمان تسبب في زيادة معنويا ($P \leq 0.05$) في النسبة المئوية لكل من تعزيز القدرة على الحركة للحيوانات المنوية والحركية لامامية المتقدمة للحيوانات المنوية وتركيز خلايا الحيوانات المنوية بالمقارنة مع المجموعة الضابطة .

- وكذلك هناك زيادة معنوية ($P \leq 0.05$) في النسبة المئوية لكل من الحيوانات المنوية ميتة وتشوهات الحيوانات المنوية و وتشوهات رأس الحيوان المنوي بالمقارنة مع المجموعة الضابطة .

- يمكن أن نستنتج من هذه التجربة أن لإضافات الغذائية مثل الجينسنغ، الميثيونين، فيتامين E، حامض الفوليك والزنك لمدة ١٤ أسابيع يمكن أن تؤثر معنوية ($P < 0.05$) في كل من تحسين الأداء الإنتاجي (خصوبة الإناث) وخصائص السائل المنوي (خصوبة الذكور) عن طريق الحد من الآثار الجانبية لإجهاد ارتفاع درجة حرارة البيئة خلال أشهر فصل الصيف في بلاد شمال أفريقيا وخاصة في مصر.