Proc. 3rd All Africa Conf. Anim. Agric. & 11th Conf. Egyptian Soc. Anim. Prod., Alexandria, Egypt, 6-9 November 2000: 613-616

INFLUENCE OF EGG INJECTION BY VITAMIN E AND/OR SODIUM SELENITE ON HATCHABILITY AND SUBSEQUENT PRODUCTIVE PERFORMANCE OF JAPANESE QUAIL CHICKS

A.M.M. Hamdy

Animal Production Department, Faculty of Agriculture, Minia University, Minia, Egypt

SUMMARY

One thousand fertile eggs of Japanese quail, collected from one flock, through sequence of five days were performed. Eggs were in average of 12.7± 0.7 gm. All eggs were randomly divided into equal five groups. Eggs in group 1, were uninjected, those of group 2 were sham injected. While those of group 3,4 and 5 were injected by 0.2 ml saline solution / egg. Saline solution contained of 300 µg / 0.2 ml of Vit.E; or 2.5 µg /0.2ml of Se and by solution contained both, respectively.

All eggs were set in the same time in one incubator at 37-38 °C and 55% relative humidity. After hatching, chicks of each group were divided randomly into 4 replicates. All replicates were housed in one battery line and reared under standard husbandry practices. The experiment continued till three weeks of age.

Obtained results indicated that egg injection applied improved the hatchability percentage. These improvements were significantly ($P<0.5$) only when eggs received both of Vit.E and Se.

However, there was no significantly ($P>0.5$) effect of injections applied on percentages of dead embryo in prehatching stages. Moreover, obtained data indicated that, there was no significant ($P>0.5$) effect of injection on body weight and feed intake. While few significances appeared on feed conversion ratio. Values of mortality rate in post hatch period indicated that birds hatched from eggs injected by Vit. E and / or Se recorded significant ($P<0.5$) lower mortality rate when compared with those hatched from noninjected or sham injected eggs. The lowest value of mortality was obtained in bird's group that hatched from eggs injected by Se alone or with Vit. E.

It could be concluded that, egg injection by Vit. E and Se, significantly improved hatchability, and livability during posthatch period.

Keywords: Egg injection, vitamin E, sodium selenite, hatchability, productive performance

INTRODUCTION

It is now well accepted that soluble growth factors have critical roles to play in the control of growth and differentiation during embryonic development. In 1997, Sanders and Wride, studied some factors affecting the embryonic developments, and suggested that the possible functions in overall pattern formation and embryonic induction to controls at the cellular level of morphogenesis, including phenotypic transformation, cell adhesion, cell proliferation and cell death. It is also accepted that free radicals can cause metabolic disturbances and cell injury in many ways. A reactive free radical formed close to DNA may produce a change in the molecular structure resulting in a mutation or cytotoxicity (Collins *et al.*, 1994). Reactive free radicals may cause, profound changes in enzyme activity, and damage cells by lipid peroxidation of polyunsaturated fatty acids. This is by far, the most important damage produced by free radicals in the animal cells.

Vitamin E (Vit. E), is a term used to describe two compounds: tocopherols and tocotrienols. Vit. E, is through its intra-membrane antioxidant properties, may protect tissue membranes from lipid peroxidation caused by free radical attack. It could, therefore, reduce the associated loss of integrity of function of cell membranes and associated increased cellular permeability and play a role in improving the livability (Lee *et al.*, 1998).

Trace minerals such as zinc, copper, iron, manganese, selenium and iodine are essential nutrients required in small amount for normal growth and development of the avian embryo (Richards, 1997). Thus, it is crucial to the survival of the embryo that the requisite amount of each essential trace mineral be available at the appropriate time during its growth and development within the egg.

The objectives of the present study were to determine the influence of injecting eggs by vitamin E (Vit.E) and / or sodium selenite (Na_2SeO_3) on hatchability, dead embryos and productive performance of Japanese quail chicks.

MATERIALS AND METHODS

Eggs

One thousand fertile eggs of Japanese quail, collected from one flock, through sequence of five days were performed. Eggs were in average of 12.7± 0.7 gm. All eggs were stored at –17 °C and 50-60% relative humidity till the start of the experiment.

Experimental Procedure

At the beginning of the experiment, all eggs were randomly divided into equal five groups. Eggs in group 1, were uninjected, those of group 2 were sham injected. While those of group 3,4 and 5 were injected by 0.2 ml saline solution / egg. Saline solution contained of 300 µg / 0.2 ml of Vit.E; or 2.5 µg/ 0.2 ml of Se and by solution contained both , respectively. These doses were based on and calculated as recommended by NRC (1994). For the egg injections, 0.2 ml of solution was injected per egg at day 0 of incubation, just before incubation, using a separate syringe with needle for each individual egg.

Aseptic egg injection

Egg injection mechanism was done according to the method explained by Robel (1993 a,b). Egg injections were performed in a sanitized clean room with a particle-free environment using filtered, high efficiency particulate air, and personnel were aseptically equipped. A 2% iodine tincture was applied to the injection site on the large end of the egg. A very slight indentation was made in the swabbed shell area using a sharp sterile punch. The force used to make the indentation was of a minor degree to avoid the formation of hairline cracks in the shell. The punch site exactly accommodated the microfine, 28-gauge sterile needle that was locked to a 1-ml sterile insulin syringe. The needle was carefully inserted through the indentation site to a depth of 6 to 8 mm, and 0.2 ml of solution was injected over the inner eggshell membrane. The puncture was sealed with a small drop of fast-drying wax.

Eggs of each group were divided into four replicates each of 50. Each tray loaded by 250 eggs. Each tray of the incubator included 50 eggs presenting each group to avoid place effect in the incubator. The four trays were set in the same time in one incubator at 37-38 °C and 55% relative humidity. The incubator was fumigated before setting the trays and eggs were fumigated after 8 hrs. of incubation. The eggs were turned after each 4 hrs. for the first 24 hrs. and then every two hrs. up to day 15^{th} of incubation. At day 15^{th} of incubation the four trays were transferred to one hatcher set at 37.3-37.5 °C and 80-90% relative humidity. At day 18^{th}, the trays were taken off from the hatcher. Within each group hatched chicks were counted, leg banded and weighed individually to the nearest 0.1 gm. Percentages of hatchability were then calculated. Dead embryos were counted and expressed as a percentage from the basic number within each egg replicate (50). Dead embryo was concerned as that the not complete developed and without feathers at day 18^{th}. Within each group, the rest of 100% of incubated eggs (completed but not hatched chicks) was also counted and analyzed.

After hatching, chicks of each group were divided randomly into 4 replicates. All replicates were housed in one battery line and reared under standard husbandry practices with *ad lib.* feed of 24 % crude protein and 2950 Kcal ME/Kg. Water and light were provided continuously. The experiment continued till three weeks of age.

Body weight was recorded at hatch and weekly then after for each replicate. Weekly feed intake was determined and feed conversion was calculated. Dead birds were counted weekly and expressed as a percentage from the basic number within each replicate.

Statistics

Obtained data other than mortality rate and hatchability were subjected to ANOVA (SAS, 1992). If probability (P values)<0.5 were obtained, significant differences among groups were analyzed using Duncan's multiple range test (Duncan, 1955). Percentage data of mortality rate and hatchability were transformed to arcsine value for the analysis of variance.

RESULTS AND DISCUSSION

Hatchability and dead embryos

Obtained data reveal that egg injection improved the hatchability percentage (Table 1). These improvements were significantly ($P<0.05$) only when eggs received both of Vit.E and Se. These results are in good agreements with those reported by Gore and Qureshi (1997), they speculated that Vit. E prevents oxidation of unsaturated lipids materials within cell, thus protection the cell membrane from oxidative damage. Moreover, obtained results are supporting the conclusion of Latshaw *et al.* (1977). They concluded that, the addition of sodium selenite to laying diets, improved ($P<0.05$) egg production,

fertility and hatchability. They also, added that the effectiveness of Se is dependent on the form of which supplement to the diet; is it in sodium selenite, selenonethionine or seleno-cystine form.

Obtained data on dead embryo and completed but not hatched chicks in prehatching stages are shown in Table 1. The analyzed values indicate that there was no significant (P>0.05) effect of injections applied of the dead embryos. However, in recent years intensive selection for rapid growth, body conformation, and feed efficiency may have augmented the safety level required to sustain hatchability. Selection of formal size of egg and controlling the incubation conditions may lead to chicks of good quality.

Table 1. Percentages of hatchability and dead embryo as resulted from egg injection by vitamin E and /or sodium selenite

Item	G1	G2	G3	G4	G5
Hatchability %	58.4±2.2^{b}	57.6±2.5^{b}	59.2±2.7^{b}	59.8±2.0^{b}	62.7±2.4^{a}
Dead embryo %	32.7±1.9^{a}	34.3±2.7^{a}	31.8±2.2^{a}	33.4±1.6^{a}	30.8±1.3^{a}
Completed but not hatched chicks %	8.9±2.0^{a}	8.1±2.7^{a}	9.0±2.5^{a}	6.8±1.8^{a}	6.5±1.9^{a}

Least squares means in the same row with no common superscript are differ significantly (P<0.5).
G1: Control non injected eggs. G2: Sham injected eggs G3: Eggs injected by Vit. E
G4: Eggs injected by sodium selenite (Na_2SeO_3) G5: Eggs injected by both Vit. E and (Na_2SeO_3)

Growth performance

Data in Table 2 show the body weight, feed intake, feed conversion and mortality percentages during the first three weeks after hatch. Obtained data indicated that, there was no significant (P>0.05) effect of injection on body weight and feed intake. While few significances appeared on feed conversion ratio. From these results, it seems that increasing body weight and decreasing feed intake were going in one direction, which lead to improving feed conversion. Birds hatched from egg injected by Se or both of Vit. E and Se recorded better feed conversions till week 2. While these differences are completely disappeared at week 3.

Data on mortality percentages are shown in Table 2. Obtained values indicated that birds hatched from eggs injected by Vit. E and / or Se recorded significant (P<0.05) lower mortality rate when compared with those hatched from noninjected or sham injected eggs. Moreover, the lowest value of mortality was obtained in bird's group, which hatched from eggs injected by Se alone or with Vit. E. Differences in this percentage values probably reflect the effect of injection applied Hereagain, the mechanisms of Vit. E and Se, protection of liver or other organs against oxidative damage and maintaining more normal function of cellular processes regulating growth and increase livability.

It could be concluded that, egg injection by Vit. E and Se, significantly improved hatchability, and livability during posthatch period.

Table 2. Least squares means (± SE) of hatch weight (H.W), body weight (B.W), feed intake (F.I) gm/ bird, feed conversion (F.C) gm feed/gm body gain and mortality rate of chicks hatched from injected eggs by vitamin E and / or sodium selenite

Item	G1	G2	G3	G4	G5
H.W (gm)	8.2±0.2^{a}	8.4±0.2^{a}	8.4±0.1^{a}	8.3±0.2^{a}	8.5±0.1^{a}
B.W at wk 1	16.8±0.5^{a}	16.8±0.6^{a}	17.9±0.5^{a}	18.3±0.5^{a}	18.8±0.6^{a}
B. W at wk 2	31.6±1.8^{a}	32.4±1.8^{a}	32.7±1.7^{a}	34.6±1.8^{a}	35.4±1.6^{a}
B W at wk 3	75.8±3.2^{a}	78.5±3.7^{a}	82.2±3.0^{a}	83.8±5.4^{a}	86.6±5.2^{a}
F.I at wk. 1	38.5±1.5^{a}	39.8±1.7^{a}	37.6±1.4^{a}	37.6±2.0^{a}	36.2±1.5^{a}
F.I at wk. 2	62.6± 2.4^{a}	64.3± 2.8^{a}	61.5± 2.3^{a}	56.5± 2.0^{a}	54.9± 2.2^{a}
F.I at wk.3	114.3±4.8^{a}	118.5±5.6^{a}	117.8±5.9^{a}	104.9±6.2^{a}	106.5±5.5^{a}
F.C at wk.1	4.5±0.1^{a}	4.7±0.1^{a}	4.0±0.1^{a}	3.7±0.1^{b}	3.5±0.1^{b}
F.C at wk.2	4.2±0.1^{a}	4.1±0.2^{a}	4.1±0.2^{a}	3.5±0.2^{b}	3.3±0.2^{b}
F.C at wk.3	2.5±0.3^{a}	2.6±0.3^{a}	2.4±0.3^{a}	2.2±0.2^{a}	2.1±0.3^{a}
Mortality % at wk. 1	5.6±0.5^{a}	5.8±0.6^{a}	3.5±0.3^{b}	3.7±0.4^{b}	3.0±0.3^{c}
Mortality % at wk .2	2.1±0.2^{a}	2.3±0.3^{a}	2.1±0.2^{a}	1.5±0.2^{b}	1.2±0.2^{b}
Mortality % at wk. 3	0.5±0.01^{a}	0.6±0.01^{a}	0.5±0.01^{a}	0.5±0.01^{a}	0.4±0.01^{a}

Least squares means in the same row with no common superscript are differ significantly (P<0.5).
G1: Control non injected eggs. G2: Sham injected eggs G3: Eggs injected by Vit. E
G4: Eggs injected by sodium selenite (Na_2SeO_3). G5: Eggs injected by both Vit. E and (Na_2SeO_3).

REFERENCES

Collins,A., S.Duthie, and M. Ross, 1994. Micronutrientsd and oxidative stress in the aetiology of cancer. Proceedings of the Nutrition Society, 53:67-75.

Duncan, D.B., 1955. Multiple range and multiple F test. Biometrics, 11:1-42.

Gore, A.B., and M.A. Qureshi, 1997. Enhancement of humoral and cellular immunity by vitamin E after embryonic exposure. Poultry Sci., 76:984-991.

Halliwell, B., and J.M.C. Gutteridge, 1989. Free radicals in biology and medicine, 2nd edn (Oxford, UK, Clarenton Press).

Latshaw, J.D., J.F. Ort and C.D. Diesem, 1977. The selenium requirements of the hen and effects of a deficiency. Poultry Sci., 56:1876-1881

Lee, S.B., M.A. Mitchell, D.B. Utomo, P.E.V. Williams and C.C. Whitehead. 1998. Influence of high dietary vitamin E supplementation on egg production and plasma characteristics in hens subjected to heat stress. British Poultry Sci., 39:106-112.

National Research Council, 1994. Nutrient requirements of poultry. 9th rev.ed. National Academy Press. Washington.

Richards, M.P.,1997. Trace mineral metabolism in the avian embryo. Poultry Sci., 76:152-164.

Robel, E.J., 1993 a. Evaluation of egg injection of folic acid and effect of supplemental folic acid on hatchability and poult weight. Poultry Sci., 72:546-553.

Robel.E.J.1993 b. Evaluation of egg injection method of pantothenic acid in turkey eggs and effect of Supplemental pantothenic acid on hatchability. Poultry Sci., 72:1740-1745.

Sanders, E.J., and M.A. Wride, 1997. Roles for growth and differentiation factors in avian embryonic development. Poultry Sci., 76:111-117.

SAS Institute,1992. Guide for personal computer. SAS Institute, Inc. Cary, NC.