

**DIETARY INCLUSION OF VITAMIN E AND SELENIUM ON EGG
PRODUCTION, EGG QUALITY AND ECONOMICS OF
JAPANESE QUAIL LAYERS**

P. Chitra¹, S. C. Edwin² and M. Moorthy³

Department of Poultry Science
Veterinary College and Research Institute, Namakkal - 637 001

Received : 20th September 2012

Accepted: 17th April 2013

ABSTRACT

This study was conducted to assess the effect of dietary supplementation of vitamin E and selenium on productive performance of Japanese quail layers. This trial was conducted in 210 female Japanese quail birds from seven to twenty six weeks of age. Experimental birds were randomly divided into seven groups viz. T1- Control: Basal diet (standard Japanese quail ration), T2 Basal diet with Vitamin E 150mg/kg, T3 Basal diet with Vitamin E 300 mg/kg, T4 Basal diet with selenium 0.3mg/kg, T5 Basal diet with selenium 0.6mg/kg, T6 Basal diet with combination of Vitamin E 150mg/kg and selenium 0.3mg/kg, T7 Basal diet with combination of Vitamin E and selenium 0.6mg/kg. Dietary supplementation with the different levels of Vitamin E and selenium indicated significantly improved body weight, better feed efficiency and livability when compared to unsupplemented group. During the laying period the data on hen housed egg production and hen day egg production showed significant increase in egg production from 7 to 26 weeks of age by supplementation of Vitamin E and Selenium in the Japanese quail

Key words: vitamin E, selenium, egg production, feed efficiency, economics

Part of the Ph. D., thesis submitted by the first author to the Tamil Nadu Veterinary and Animal Sciences University, Chennai-600 051.

1. Assistant Professor (AH), Dept. of Veterinary and Animal Sciences, TNAU, Coimbatore.
Email: drpchithupsc@gmail.com
2. Professor and Head, 3. Associate Professor, Dept. of Poultry Science, VC&RI, Namakkal

INTRODUCTION

Vitamin E is an excellent biological chain breaking antioxidant in biological membranes, which prevents free radicals induced oxidative damage by trapping reactive oxyradicals (Packer, 1991). Vitamin E included into animal feed to improve performance, strengthen immunological status, improve the quality of egg and to increase the vitamin E content of food of animal origin and thus increase the vitamin E intake of humans (Flachowsky, 2000).

Poultry cannot synthesize vitamin E, therefore, vitamin E requirements must be met from dietary sources (Chan and Decker, 1994). Incorporation of vitamin E into poultry diets has been shown to provide oxidative stability and increase the quality of their eggs and reduce the development of off-flavors while increasing egg production (Cherian *et al*, 1996).

Selenium is a required nutrient for poultry. NRC reported that selenium is an essential component of selenium dependent glutathione peroxidase (GSH-Px) an enzyme involved in cellular anti-oxidant protection. GSH-Px plays a central role in antioxidant defence in the cell by removing hydrogen peroxide and lipid hydroperoxide is formed during metabolism and superoxide radical dismutation. By considering the anticipated fast growth of Japanese quail production in rural and urban areas as an alternate in addition to

agriculture and chicken production, it was decided to conduct a trial on the effect of dietary inclusion of vitamin E and selenium on egg production performance and to find out the relative economy of Japanese quail.

MATERIALS AND METHODS

The trial was conducted in 210 seven week old female Japanese quails from a single hatch from 7 to 26 weeks of age. These birds were wing banded, weighed individually and distributed to seven treatment groups with three replicates of ten females in each.

The quails were reared in cages during their entire experimental period adopting standard management practices and quails were fed with weighed quantity of feed *ad libitum* and had free access to wholesome water. Sixteen hours photo period was provided daily throughout the experimental period. The experiment was approved by the Institutional Animal Ethical Committee.

The quail diets were formulated as per the standard prescribed by Shrivastav and Panda (1999) except the vitamin E and selenium level. Feed ingredients used for diet formulation were analyzed for vitamin E and selenium content in addition to proximate composition. Vitamin E and selenium were incorporated into the basal diet either independently or simultaneously in the basal quail diet to form seven experimental diets.

Dietary inclusion of Vitamin E and Selenium of Egg

Treatment groups	Experimental diet	No. of birds/replicate
T ₁	Basal diet (control)	10
T ₂	Basal diet + vitamin E 150 mg/kg	10
T ₃	Basal diet + vitamin E 300 mg/kg	10
T ₄	Basal diet + selenium 0.3 mg/kg	10
T ₅	Basal diet + selenium 0.6 mg/kg	10
T ₆	Basal diet + vitamin E 150 mg/kg + selenium 0.3 mg/kg	10
T ₇	Basal diet + vitamin E 300 mg/kg + selenium 0.6 mg/kg	10

The ingredients and nutrient composition of quail layer diet are presented in Table 1.

During the laying period, the individual bird body weight and total feed consumption in each replicate group were recorded at the end of every 28 days period. Egg production and mortality if any, were recorded daily. Based on these data, hen day (per cent) and hen housed (number) egg production, feed efficiency in terms of quantity of feed consumed per dozen eggs and quantity of feed consumed per kilogram egg mass and livability percentage were calculated.

For egg quality studies, at the end of every 28th day laying period, all the eggs laid from all treatment groups were collected for three consecutive days, weighed individually

with 0.01g accuracy. Based on these data, mean egg weight and egg mass were worked out. From these, six eggs per treatment were randomly picked up from each day's collection and subjected to measure egg quality parameters such as shape index, albumen index, yolk index, yolk colour, Haugh unit and shell thickness. The shape index was determined by measuring the length and width of the egg by using vernier caliper. Egg shell was broken and the albumen and yolk height were measured with spherometer, whereas the length and width of albumen and yolk was measured by using vernier caliper. The albumen and yolk index were determined as per Heiman and Carver

(1936). The shell thickness was measured at three points on the equator using screw gauge.

All the parametric data obtained in this study were subjected to analysis of completely randomised design (CRD) for statistical significance as per the methods of Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The analysis of data on dietary vitamin E and selenium supplementation on the mean body weight of Japanese quail at 26th week of age showed a significant difference (Table 2) among treatment groups. The lowest body weight at 26th week (313 g) of age was observed in unsupplemented (control) group. The inclusion of vitamin E and selenium in Japanese quail diet at different levels showed improved body weight of Japanese quail when compared to unsupplemented group. Similar findings were observed in broilers and layers by Swain *et al* (2000), Aravind *et al.* (2001), Ganpule and Manjunatha (2003), Nageshwar *et al.* (2003) and Sahin *et al.* (2003).

The analysis of overall hen housed egg production of Japanese quail layers showed highly significant ($P < 0.01$) difference among treatment groups in all the periods up to 22 weeks of age. But the differences were significant ($P < 0.05$) during 22 to 26 weeks of age.

In the overall study period from 7 to 26 weeks of age, the birds in group T₆ (125.87 eggs)

recorded the highest hen housed egg production followed by birds in group T₃ (121.33 eggs) and T₇ (119.50 eggs), which are statistically comparable. The birds in group T₅ (117.27 eggs), T₂ (116.87 eggs) and T₄ (114.61 eggs) had comparable hen housed egg production among them and also with groups T₃ and T₇. The birds in control group T₁ (107.65 eggs) recorded the lowest hen housed egg production compared to vitamin E and selenium supplemented groups.

The hen day egg production of Japanese quail due to dietary vitamin E and selenium supplementation showed highly significant ($P < 0.01$) difference among treatment groups during 7-26 weeks of age. Similar findings of increase in egg production due to vitamin E and selenium supplementation were observed in layers by El-Latif (1999), Ganpule and Manjunatha (2003) and Sahin *et al.* (2003).

Different levels of dietary vitamin E and selenium supplementation did not show any significant difference in overall mean feed consumption (Table 2). Lowest overall mean feed consumption was observed in 300mg vitamin E and 0.3mg selenium supplemented group (36.63g) and highest feed consumption was observed in control group (37.29g). Similar findings were noticed by Galobart *et al.* (2001), Paton *et al.* (2002), Ganpule and Manjunatha (2003) and Sahin *et al.* (2003). The feed efficiency in Japanese quail showed highly significant difference ($P < 0.01$) among treatment groups.

Different levels of dietary vitamin E and selenium supplementation did not show any significant difference in egg quality (Table 3). The shape index, albumen index, yolk index, yolk colour, Internal Quality Unit (IQU) and shell thickness did not differ significantly due to supplementation of vitamin E and selenium in the basal diet. Similar observations were reported earlier by Sahinet al. (2003).

Feed cost per kg layer diets, feed cost per egg produced and net profit per egg produced due to supplementation of different levels of vitamin E and selenium are presented in Table 4. Addition of vitamin E and Selenium increased the feed cost proportionate to the level of inclusion. The beneficial effects of vitamin E and selenium as increased egg production, body weight had curtailed the increase in feed cost. This is in accordance with the findings of Kennedy et al. (1991). Hence the inclusion of 300mg vitamin E and 0.3mg Selenium can be suggested to get maximum profit in Japanese quail birds.

REFERENCE

- AOAC, 2000. Official methods of analysis, Association of Official Analytical Chemists, 18thed., Washington.
- Aravind, K.L., C.V. Gowdh, B.P. Manjunath, A.Y. Rajenderaand S.P. Ganpule, 2001. Influence of dietary level of selenium and vitamin E on growth immunity and carcass traits in broiler chickens. *Indian J. Poult. Sci.*, **36**: 58-62.
- Chan, K. M. and E. A. Decker. 1994. Endogenous skeletal muscle antioxidants. *Crit. Rev. Food Sci. Nutr.*, **34**:403-426.
- Cherýan, G., F. H. Wolfe and J. S. Sým. 1996. Feeding dietary oils with tocopherols. Effects on internal qualities of eggs during storage. *J. Food Sci.*, **61**:15-18.
- El-Latif, S.A.A., 1999. Nutritional interrelationships of vitamin E and selenium on laying Japanese quail. *Egyptian J. Nutr. feeds*, **2** : 711-718. Cited in *Poult. Abstr.*, (2000) **26(9)** 2416.
- Flachowsky, G. 2000. Vitamin E-transfer from feed into pig tissues. *J. Appl. Anim. Res.*, **17**:69-80
- Galobart, J., A.C. Barroeta, M.D. Baucells, L. Cortinas and F. Guardiola, 2001. a-tocopherol transfer efficiency and lipid oxidation in fresh and spray dried eggs enriched with w-3 polyunsaturated fatty acids. *Poult. Sci.*, **80** : 1496-1505.
- Ganpule, S.P. and B.P. Manjunatha, 2003. Antioxidant nutrition starts with breeders. *Feed mix*, 11: 14-16. Cited in *Poult. Abstr.*, (2004) **30(4)** 925.
- Heiman, V and Carver, J. S. 1936. *Poult. Sci.*, **58**: 141-148.

- Kennedy, D.G., E.A. Goodall, S.G. McIlroy, D.W. Bruce and D.A. Rice, 1991. The effects of increased vitamin E supplementation on profitable commercial broiler production. *Acta Veterinaria Brno*, **60** :127-135. Cited in *Poult. Abstr.*, (1992) **17(8)** 1865
- Nageshwara, A.R., V. Ramasubba Reddy and M. Ramakota Reddy, 2003. Effect of E-Care-Se-Herbal on the performance and immune response in broilers. *Indian J. Poult. Sci.*, **38** : 115-120.
- Packer, L., 1991. Productive role of vitamin E in biological systems. *American J. Clinical Nutr.*, **53**: 1050-1055.
- Paton, N.D., A.H. Cantor, A.J. Pescatore, M.J. Ford and C.A. Smith, 2000. Effect of dietary selenium source and level of inclusion on selenium content of incubated eggs. *Poult. Sci.*, **79** : 40.
- Sahin, N., K. Sahin and M. Onderci, 2003. Vitamin E and selenium supplementation to alleviate cold-stress associated deterioration in egg quality and egg yolk mineral concentrations of Japanese quails. *Biol. Trace Elem. Res.*, **96** : 179-189.
- Shrivastav, A.K. and B. Panda, 1999. A review of quail nutrition research in India. *World's Poult. Sci. J.*, **58**: 333-345.
- Snedecor, G.W. and W. G. Cochran, 1994. *Statistical methods*. 8th Iowa State University Press / Ames, Iowa.
- Swain, B.K. and T.S. Johri, 2000. Effect of supplementation of combination of different levels of selenium and vitamin E on relative weight of some organs and serum enzyme level in broilers. *Indian J. Poult. Sci.*, **35**: 66-69

* Calculated values

- ¹ Manufactured by M/s. GlaxoSmithkline, Mumbai. One gram of vitamin AB₂D₃K supplement contained 82500 IU of vitamin A, 50 mg of vitamin B₂, 12000 IU of vitamin D₃ and 10 mg of vitamin K.
- ² Manufactured by M/s. Jubilant Organosys Ltd. Gujarat, India.
- ³ Manufactured by M/s. Neospark Drugs and Chemicals Private Ltd., Hyderabad. One gram of trace mineral mixture contained 54 mg of manganese, 52 mg of zinc, 20 mg of iron, 2 mg of iodine and 1 mg of cobalt.
- ⁴ Manufactured by M/s. Tetragon Chemie Pvt. Ltd., Bangalore. One gram biocare contained 0.4 mg of biotin.
- ⁵ Manufactured by M/s. Sumitomo Chemical Company Ltd., Tokyo, Japan.

Table 1. Ingredients and nutrient composition of experimental Japanese quail layer diet (on DM basis)

Ingredient(per cent)	Layer > 6 weeks
Maize	53.75
Pearl millet	—
Soybean meal	26.14
Deoiled groundnut cake	11.00
Dicalcium phosphate	1.66
Shell grit	7.00
Salt	0.45
	100
Vitamin AB ₂ D ₃ K ¹	10
Choline chloride 60 % ²	100
Trace mineral mixture ³	100
Biocare ⁴	30
Methionine ⁵	30

	Layer > 6 Weeks
Nutrients (per cent)	Ingredients (per cent)
Drymatter	90.72
Crude protein	19.03
ME (kcal/kg)*	2700
Crude fibre	4.85
Ether extract	3.89
Calcium	3.01
Available phosphorus	0.45
Lysine*	1.02
Methionine*	0.33
Vitamin E (mg/Kg)	14.76
Selenium (mg/Kg)	0.094

Table 2. Effect of different levels of vitamin E and selenium supplementation on performance of Japanese quail during 7-26 weeks

Treatment group	Body Weight (g) at 26 th Week	Mean hen-housed egg number/ bird (7-26 Weeks)	Mean per cent hen-day egg production (7-26 Weeks)	Feed consumption (g/bird/day) (7-26 Weeks)	Feed efficiency (kg of feed / dozen eggs) (7-26 Weeks)	Egg Weight (g) (7-26 Weeks)	Egg mass (kg) per bird (7-26 Weeks)
T ₁	313.04±3.42 ^a	107.65±2.39 ^A	78.07±1.61 ^A	37.29±0.13	0.58±0.011 ^E	12.78±0.03	2.66±0.02 ^A
T ₂	318.23±5.01 ^{ab}	116.87±0.17 ^B	83.95±0.10 ^{BC}	36.87±0.05	0.53±0.001 ^{BCD}	12.80±0.12	3.00±0.02 ^{BC}
T ₃	325.63±4.95 ^b	121.33±2.07 ^{BC}	87.19±1.50 ^{CD}	36.71±0.07	0.51±0.010 ^{AB}	12.94±0.12	3.15±0.02 ^{CD}
T ₄	316.22±4.47 ^{ab}	114.61±1.06 ^B	82.45±0.43 ^{AB}	36.99±0.15	0.54±0.005 ^{CD}	12.79±0.10	2.92±0.04 ^B
T ₅	322.38±4.38 ^{ab}	117.27±1.11 ^B	84.60±0.56 ^{BC}	36.86±0.12	0.53±0.004 ^{BCD}	12.80±0.04	3.01±0.02 ^{BC}
T ₆	331.35±3.19 ^c	125.87±0.92 ^C	90.43±0.70 ^D	36.63±0.07	0.49±0.002 ^A	13.08±0.09	3.30±0.01 ^D
T ₇	326.79±3.41 ^b	119.50±2.19 ^{BC}	86.52±1.24 ^{BCD}	37.11±0.17	0.52±0.008 ^{BC}	12.91±0.16	3.07±0.08 ^{BC}

^{A-D} Means within a column with no common superscript differ highly significant (P<0.01)

Table 3. Mean egg quality traits of Japanese quails as influenced by dietary supplementation vitamin E and selenium

Treatment groups	Egg Weight (g) (7-26 Weeks)	Shape index values (7-26 Weeks)	Albumen index values (7-26 Weeks)	Yolk index values (7-26 Weeks)	Internal quality unit (IQU) (7-26 Weeks)	Shell thickness(mm) (7-26 Weeks)	Yolk colour values (7-26 Weeks)
T ₁	12.78±0.03	77.93±0.42	0.130±0.001	0.445±0.002	91.11±0.21	0.189±0.001	5.28±0.06
T ₂	12.80±0.12	79.050.52	0.133±0.002	0.453±0.003	92.41±0.32	0.190±0.001	5.29±0.04
T ₃	12.94±0.12	79.080.30	0.136±0.001	0.461±0.001	92.51±0.16	0.192±0.002	5.34±0.05
T ₄	12.79±0.10	79.400.52	0.134±0.003	0.455±0.001	92.10±0.47	0.189±0.001	5.30±0.02
T ₅	12.80±0.04	79.090.37	0.134±0.002	0.456±0.003	92.37±0.37	0.190±0.003	5.38±0.01
T ₆	13.08±0.09	79.420.43	0.139±0.001	0.468±0.002	92.81±0.20	0.193±0.002	5.40±0.07
T ₇	12.91±0.16	79.160.29	0.135±0.002	0.458±0.002	92.19±0.16	0.192±0.001	5.34±0.06

NS – Non significant

Table 4. Effect of different levels of vitamin E and selenium supplementation on cost effectiveness of Japanese quail

Treatment Groups	Body Weight(g) 26 th Week	Mean hen- housed egg production per quail (7-26 Weeks)	Feed cost/kg (Rs.)	Total feed consumption(kg)	Total feed cost(Rs)	Net profit per egg over feed cost (Rs)*
T ₁	313.04±3.42 ^a	107.65	9.50	5.01	47.56	0.46
T ₂	318.23±5.01 ^{ab}	116.87	9.60	5.16	49.55	0.48
T ₃	325.63±4.95 ^b	121.33	9.70	5.14	49.85	0.49
T ₄	316.22±4.47 ^{ab}	114.61	9.65	5.13	49.49	0.47
T ₅	322.38±4.38 ^{ab}	117.27	9.80	5.13	50.29	0.47
T ₆	331.35±3.19 ^c	125.87	9.75	5.13	50.01	0.50
T ₇	326.79±3.41 ^b	119.50	10.00	5.10	50.99	0.47

* - Egg cost – 90 paise/egg