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Effect of Vitamin E and Selenium feed supplements on production performance and egg quality in WL layers

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Abstract
An investigation was made on 250 layers aged 55 weeks to assess the effect of herbal products on feed consumption, egg production and profitability. The experimental layers were randomly divided in five groups with 50birds in each and were housed in identical management and environmental conditions. Dietary treatments were prepared by addition of Standard layer ration (T1) (CTRL), AV/VSP/15 (M/s Ayurvet Ltd.) 200g/ton (T2), brand-A, 200 g/ton of feed (T3), brand-B, 200 g/ton of feed(T4), brand- C, 200 g/ton of feed(T5)in the basal diet. Feed intake, egg production and mortality were recorded throughout the observation period of 55 to 65 weeks. Feed per unit of egg production, hen day percentage, were calculated. The results obtained showed that the performance of T2 was better when compared to other groups in aspects of feed efficiency per dozen eggs produced, feed consumption, feed conversion ratio, keeping quality of egg and egg quality traits.

Keywords: Layers, feed supplements, egg production, egg quality traits

1. Introduction
Vitamins and minerals are vital nutrients that are involved in both metabolic and physiological process, which are critical for human and animal health and animal feed production. It has been well-documented that in formulating feed, nutritionists have to take into account several factors including stress management and immunity enhancement (Linge, 2005; Moradi Kor *et al*., 2012).

Vitamin E, a fat soluble vitamin, functions as a chain breaking antioxidant which prevents free radical induced oxidative damage by trapping reactive oxyradicals in biological membranes (Packer, 1991; Salman *et al*., 2007). Vitamin E is essential for growth performance, health and maintenance of tissue integrity in poultry. Vitamin E, a fat-soluble vitamin, is an intracellular anti-oxidant for all cells. It prevents oxidation of unsaturated lipids within cells and protects cell membrane from oxidative damages (Halliwell and Gutteridge, 1999).

Selenium is an essential component of selenium dependent glutathione peroxidese enzymes, which are antioxidant enzymes that destroy free radicals produced during normal metabolic activity (Payne and Southern, 2005). Selenium has a pro-found impact on immune function, health and productivity and is associated with protein in animal tissues (Wang and Bao-Hua, 2008). On the other hand, Se deficiency is a global problem related to an increasing susceptibility of animals and humans to various diseases (Heindl *et al*.,2010). Selenium is the only trace element that is necessary for the growth and efficiency of animals. It is an important essential mineral for the health of people and animals and one of the anti-oxidants, which improve the ability of the organism to protect itself. Several animal studies have also shown that vitamin E supplementation affects lipoprotein metabolism by reducing serum triacyl glycerols (Oriani *et al*., 1997) and total cholesterol, and increasing HDL-cholesterol levels. Selenium and vitamin E are inter-related; hence complete protection of living cells requires both vitamin E and selenium in the diet.

In view of the importance of the vitamin E and selenium in the performance of the commercial layers this study is designed to access the comparative efficacy of different vitamin E and selenium supplements available in the market during the post peak production period of commercial layers.

2. Materials and Methods

A flock of 250 commercial layers of 55 - 65 wks age were divided into 5 identical groups randomly with 50 birds in each group All the groups were housed in a Californian cage house randomly with standard and identical management, nutritional and environmental conditions. As per standard NRC requirements, layer ration was formulated to meet the nutrient requirements of birds, which was offered to all the five groups of birds. Feed and water was offered *ad libitum* throughout the experimental period. Dietary treatments were classified as Standard layer ration (T1) (CTRL), AV/VSP/15 (*M/s Ayurvet Ltd.*) 200 g/ton (T2), brand A-200 g/ton of feed (T3), brand B, 200 g/ton of feed (T4), brand C, 200 g/ton of feed (T5) in the basal diet.

During the study period the number of eggs produced in each treatment was recorded on daily basis for calculating the % hen day egg production and feed consumption per unit of egg production. To estimate the egg quality traits four eggs per treatment were collected every three weeks period and the egg weights, shell weights, albumin and yolk weights were taken following the standard procedures. The length, width and height of yolk and albumin were measured using the sphearometer and Digital Vernier Callipers and yolk index, albumin index were calculated using the following formulae.

$$\text{Shape index} = \frac{\text{width of egg (mm)}}{\text{Length of egg (mm)}} \times 100$$

$$\text{Albumin index (Heiman \& carver)} = \frac{\text{Average height of albumin (mm)}}{\text{Average width of albumen (mm)}} \times 100$$

$$\text{Yolk index (Funk, 1948)} = \frac{\text{Height of yolk}}{\text{avg width of yolk}} \times 100$$

Statistical Analysis

Data were subjected to standard statistical analysis (Snedecor and Cochran, 1994).

3. Results

The results of the present study revealed that there was an improvement in the performance of commercial layer by using herbal vit E and selenium supplements during the post study period. The results obtained are given and discussed below.

3.1 Weekly Feed Consumption: The weekly feed consumption was found to be lower in the birds supplemented With Vit E and Selenium supplements compared to the birds fed standard layer ration.

Table 1: Weekly Feed Consumption in Kgs. ($P< 0.05$)

TRMT	Age in weeks										
	55	56	57	58	59	60	61	62	63	64	65
T1	7.29^{d}	7.29^{d}	7.29^{d}	7.27^{d}	7.27^{d}	7.30^{d}	7.29^{d}	7.28^{d}	7.28^{d}	7.29^{d}	7.29^{d}
T2	6.50^{a}	6.50^{a}	6.49^{a}	6.51^{a}	6.47^{a}	6.47^{a}	6.45^{a}	6.48^{a}	6.48^{a}	6.47^{a}	6.47^{a}
T3	6.87^{c}	6.89^{c}	6.90^{c}	6.90^{c}	6.89^{c}	6.92^{c}	6.92^{c}	6.92^{c}	6.92^{c}	6.92^{c}	6.92^{c}
T4	6.73^{b}	6.73^{b}	6.74^{b}	6.77^{b}	6.77^{b}	6.77^{b}	6.74^{b}	6.74^{b}	6.74^{b}	6.77^{b}	6.77^{b}
T5	6.68^{b}	6.68^{b}	6.68^{b}	6.68^{b}	6.68^{b}	6.69^{b}	6.70^{b}	6.70^{b}	6.69^{b}	6.69^{b}	6.69^{b}
SEM	0.002	0.003	0.000	0.000	0.002	0.003	0.001	0.001	0.003	0.002	0.001

3.2 Hen Day Egg Production at Different Periods of Laying: The results of the % hen day egg production at different periods of laying (P>0.05) depicted in Table-2, show that T2 has better performance throughout the study period ie from 55 to 65 wks of production.

Table 2: % Hen Day Egg Production at Different Periods of Laying ($P>0.05$)

TRMNTS	Age in weeks										
	55	56	57	58	59	60	61	62	63	64	65
T1	76.4	76.3	75.8	76.0	75.6	75.3	75.0	75.0	73.6	73.2	72.1
T2	79.7	81.5	81.1	81.6	81.5	81.4	81.7	81.6	81.0	81.0	80.8
T3	77.1	77.1	78.2	78.6	78.5	78.4	77.9	77.8	77.2	77.3	77.1
T4	75.1	75.1	76.1	76.5	76.8	76.4	76.5	76.4	76.4	76.4	76.1
T5	76.8	76.7	76.8	77.2	77.5	77.8	77.4	77.3	77.4	77.1	76.8
SEM	0.500	0.205	0.205	0.230	0.205	0.206	0.200	0.231	0.225	0.234	0.301

3.2 Feed Efficiency per Dozen Eggs Produced

The results of the feed efficiency per dozen eggs produced at different periods of laying depicted in Table-3, show that T2 has better performance ie from 55 to 65 wks of production and the value gradually decreased towards 65 wks of age showing a better FCR.

Table 3: Feed Efficiency per Dozen Eggs Produced ($P>0.05$)

TRMNT	Age in weeks										
	55	56	57	58	59	60	61	62	63	64	65
T1	1.91	1.91	1.91	1.91	1.91	1.96	1.97	1.96	1.99	1.99	2.0
T2	1.93	1.86	1.82	1.82	1.78	1.76	1.75	1.75	1.75	1.75	1.75
T3	1.93	1.89	1.86	1.86	1.86	1.81	1.81	1.80	1.80	1.80	1.80
T4	1.92	1.89	1.88	1.88	1.88	1.82	1.82	1.81	1.81	1.81	1.81
T5	1.92	1.89	1.88	1.88	1.88	1.86	1.86	1.84	1.84	1.84	1.84
SEM	0.500	0.205	0.205	0.230	0.205	0.206	0.200	0.231	0.225	0.234	0.301

3.3 Egg Quality Traits

The trends in the egg quality traits (table 4) showed a better egg weight, albumin weight in T2 at 55-65 wks of age.

Table 4: Egg Quality Traits (*P*>0.05)

Age (Wks	Egg weight (gms)					Albumin weight (g)				
	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
55-60	61	62	60	59	59	36.67	39.9	40.6	39.0	39.6
61-65	59.7	63.7	61	58	58	42.32	47.3	44.6	43.9	43.9
SEM	0.09	0.12	0.1	0.10	0.10	2.10	2.13	2.22	2.14	2.17

The trends in the egg quality traits (table 5) showed a better yolk weight, albumin index in T2 at 55-65 wks of age.

Table 5: Egg Quality Traits (*P*>0.05)

Age (Wks	Yolk weight (g)					Albumin index (%)				
	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
55-60	17.33	18.33	17.0	18.0	19.0	0.69	0.63	0.64	0.60	0.65
61-65	17.33	18.33	16.33	14.0	14.33	0.73	1.69	0.52	0.58	0.60
SEM	0.70	0.80	0.85	0.91	1.22	0.85	0.14	0.09	0.10	0.19

The albumin: yolk ratio was better in T3, and better shell thickness in T2 as shown in Table 6.

Table 6: Egg Quality Traits (*P*>0.05)

Age	Albumin: yolk					Shell thickness (mm)				
Wks	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
55-60	2.12	2.30	2.22	2.1	2.0	0.22	0.28	0.23	0.32	0.21
61-65	2.56	2.61	2.80	2.41	2.31	0.47	0.48	0.39	0.37	0.37
SEM	0.32	0.14	0.11	0.19	0.15	0.12	0.20	0.11	0.11	0.11

3.4 Concentrations of serum biochemical variables

The concentrations of the serum biochemical variables like total protein, albumin, globulin, albumin: globulin, AST, calcium, phosphorus, glucose, cholesterol were estimated and the values obtained indicated the efficacy of T2 compared to the other treatments.

Table 7: Concentrations of Serum Bio Chemical Variables (*P*>0.05)

Treatment	Total protein (g/dl)	ALT (U/L)	AST (U/L)	Ca (mg/dl)	Phosphorus (mg/dl)	Glucose	Cholesterol (mg/dl)
T1	7.6	22	161	6.51	2.61	182	2.91
T2	7.92	23	162	6.98	2.47	181	2.32
T3	7.81	24	161	6.62	2.53	182	2.51
T4	7.74	22	161	6.51	2.46	181.6	2.49
T5	7.76	22	162	6.49	2.62	182.3	2.55
SEM	0.44	0.1	0.27	0.27	0.72	0.41	0.012

3.5 Alfa Tocoferal and Selenium Content of Egg Yolk and Albumin

The vitamin E and selenium content in egg yolk and albumin showed that there is increased deposition of vitamin E in eggs when feed is supplemented with vitamin and selenium. Among the supplemented groups T2 showed higher values.

Table 8: Alfa Tocoferal and Vitamin E Content of Egg Yolk and Albumin (*P*< 0.05)

Treatment	Tocoferal (ppm)	Yolk Se conc(ng/g)	Albumin Se (ng/g)
T1	384.40^{d}	258.89^{c}	114.22^{d}
T2	440.80^{a}	448.85^{a}	246.09^{a}
T3	432.81^{c}	441.62^{b}	236.83^{b}
T4	438.7^{a}	439.72^{b}	188.72^{c}
T5	437.1^{b}	440.32^{b}	192.89^{c}
SEM	0.001	0.000	0.001

4. Discussion

Organic selenium compounds perform a key role in biological processes. They are more active than inorganic salts. They are part of proteins and include Se- Met and selenocysteine (Se-Cys). Se-Met exists in two isomer forms, d and l, and was identified in plant proteins (Schrauzer 2000) [12]. This form makes up to 50% of the total Se content in vegetarian food and higher organisms are unable to synthesize it (Schrauzer 2000) [12]. Se in its organic form shows higher bioavailability (75.7%) than Se bound in the inorganic form (49.9%) (Mahan *et al*. 1999) [6].

4.1 Selenium and poultry yield: The effects of dietary vitamin E (0, 125, and 250 mg/kg), Se (0, 0.5, and 1 mg/kg), or their different combinations under either thermos neutral or heat stress conditions were studied by Habibian *et al*. (2013) [5]. Body weight and feed intake were not influenced significantly by dietary vitamin E and Se, whereas feed conversion was improved significantly by 125 mg/kg vitamin E. Mohiti Asli *et al*. (2007) [7] reported that diet inclusion of vitamin E did not significantly affect on Egg weigh and FCR. In contrast to the above-mentioned reports, Attia *et al*. (2010) [2] stated that addition of organic and inorganic Se improved the productive and reproductive performance of Gimmizah breeding hens. As there is a relation between Se and vitamin E in the sense that vitamin E "spares" the need of Se, it may be deduced that a positive effect on chicken yield indicators may be manifested even in the case of an insufficient supply of both these substances. The need for Se decreases inversely to vitamin E levels, which documents the sparing effect of vitamin E on the need for Se (Toulova *et al*. 1977), or Se deficiency increases the need for vitamin E (De Almeida *et al*. 2012) [3]. In the case of egg-laying hens fed diets supplemented with vitamin C, sodium selenite or selenized yeast, Skrivan *et al*. (2013) [14] noted significantly increased laying performance; however, vitamin C significantly decreased feed intake and egg production. Scheideler and Froning (1996) [11] supplemented layer (Babcock B-300) with 50 mg/kg Vitamin E in the diet and observed 2% improvement in egg production during peak production. The results of present study are in agreement with the finding of Nasiroleslami and Torki (2011) [8] who demonstrate that the diet supplemented by vitamin E have beneficial effect on performance of laying hens during the period of 71 to 81 week of age. Ziaei *et al*. (2013) [10] suggested that the combination of vitamin E and selenium at a

level of 250 and 0.75 mg/kg diet, respectively can improve production performance and immune responses of laying hens.

4.2 Egg quality: Levels of Se and α-tocopherol in eggs of egg-laying hens fed diets enriched with Se-Met, sodium selenite, and vitamin E were studied by Skrivan *et al*. (2010b) [13]. Supplementation of either form of Se significantly increased the Se concentration in egg yolks and whites, with a more pronounced effect caused by Se-Met. Supplementation of Se- Met significantly increased α-tocopherol content in eggs. A moderate decrease in yolk cholesterol was observed in hens fed Se-Met and α-tocopherol. Egg weight and egg mass significantly increased and the feed conversion ratio was significantly improved due to Se supplementation compared with hens fed the control diet. In addition, the levels of organic and inorganic Se and their interaction significantly decreased plasma cholesterol concentration. Yolk selenium concentration significantly increased due to Se supplementation and the greatest increase was recorded by a group fed a high-level (0.40 mg) organic Se diet (Attia *et al*. 2010) [2]. Similar findings are noticed in the current study.

5. Conclusion

The present investigation suggested that the vitamin E and selenium herbal feed supplements when added to the layer diet, can improve production performance and immune responses of laying hens. In addition, improving performance, egg quality and immune responses of laying hens by vitamin E and selenium supplementation is relatively a novel result, so the antioxidative effect of vitamin E and selenium could be the subject of further investigations.

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