



Role of vitamin E and selenium in egg production, fertility and hatchability of native ducks

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ABSTRACT

An experiment was conducted to study the effect of dietary vit E and Se on egg production, fertility and hatchability of native ducks in intensive system of management. Basal diet mixed with 0.5g vitamin E and 50 ppm selenium per 100 kg feed constitutes the feed of treatment group against only basal diet to control group that continued for 12 weeks of experiment period. Eggs produced were incubated for production of ducklings. Egg production, fertility and hatchability were recorded. Blood serum samples were estimated for total protein, total cholesterol and GOT at eighth week. The study revealed significant improvement of egg production, fertility and hatchability for the treatment group. Biochemical parameters of blood showed no significant difference between treatment and control. Thus it may be concluded that dietary supplementation of vitamin E and selenium to the laying native ducks is beneficial for egg production, fertility and hatchability.

Key words: Duck, Fertility, Hatchability, Vitamin E, Selenium

Vitamin E is located in spermatozoa and provides antioxidant protection especially in stress conditions (Surai 2002). Vitamin E provides additional protection in case of fatty acid manipulation of the semen (Surai *et al.* 2000, Zinini *et al.* 2003 and Carolini *et al.* 2005). Again selenium is considered to be the chief executive of antioxidant defense system. It is their integral part of at least 25 seleno-proteins expressed in various tissues of human and animals. Selenium supplementation is known to affect the antioxidant defenses of chicken spermatozoa (Surai *et al.* 1998). Cockerels fed on a basal diet containing 0.28 ppm selenium showed 57.90% normal spermatozoa against 89.40% with diet containing additional 0.20 ppm Se (Edens 2002). However, information regarding supplementation of vit E and Se to duck diet and their effect on reproductive performances are scanty. Therefore, an experiment was planned with a view to study the effect of dietary vit E and Se on egg production, fertility and hatchability of native ducks in intensive system of management.

MATERIALS AND METHODS

The experiment was conducted in the duck research unit Regional Centre, Central avian Research Institute, Bhubaneswar.

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Adult duck management: Almost same body weight ducks (46-week-old layers) were taken for experiment and retained in a common holding pen for 2 weeks after which they were randomly introduced (10 females, 3 males) into treatment pens supplied with feeders and drinkers. Feed and water were provided *ad lib.* to all the birds during the research period. The 6 treatment pens were divided into 2 blocks of 3 pens for better management of fertile egg production.

Feed prepared for all the birds was the wheat based balanced diet (layer) having 18% CP and 2650 kcal ME per kg. Treatment group received 5g of premix (0.5g vit.E and 50 ppm selenium)/100 kg feed. Water dispensers were cleaned and freshwater supplied daily for all birds. No photoperiodic intervention was done. Experiment was conducted for 12 week period during which eggs were collected for fertility and hatchability test. Blood samples (2.5 ml) from male and female birds of treatment and control group were collected on eighth week of experiment. Serum separated by centrifugation were estimated for total protein, total cholesterol and glutamic oxaloacetic transaminase (GOT) by modified IFCC method (1986) with available kit.

Egg management: All eggs were sequentially coded according to pen, treatment and oviposition date; then stored at 16 °C and 65% RH for up to 5 days after which they were put in the incubator. Incubated eggs were candled on day 0 of incubation for viability (cracked/not cracked shell), on day 10 for fertility and on day 24 for embryo survival; then retained in hatcher till day 29 for hatchability. Viable eggs were incubated at 99.5 °F and 88.0 °F (wet bulb) whereas

the same in hatcher was 99.0 °F and 92.5 °F (wet bulb).

Data analysis: Production performance was calculated in percentage from the proportion of number of eggs laid in a week to the hen days. A test of difference of proportion was conducted to know existence of significant difference in the production level between control and treatment group. The mean of biochemical parameters for control and treatment were analyzed by student's 't' test (Snedechor and Cochran 1980).

RESULTS AND DISCUSSION

Egg production (Table 1) during the period of study revealed significant ($P<0.01$) increase from second week till the end of experiment for treatment group whereas it followed almost a decreasing trend in control. Leeson and Summers (2002) suggested decrease in egg production with deficiency of vit E in layer ration of chicken which supports the present finding.

Fertility % (Table 2) of eggs for treated group showed significant ($P<0.05$) improvement over control. Dietary vitamin E (150 IU/kg) supplementation improves male reproductive performance in Japanese quail (Biswas *et al.* 2005) has been established and its deficiency adversely affected the fertility of male Japanese quail (Wilson *et al.* 1962). Similarly, reports of improved fertility in chicken with vitamin E added diet was evident (Latshaw and Osman 1974). Selenium supplementation affects the antioxidant defenses of chicken semen (Surai *et al.* 1998). Cockerels fed with additional 0.2 ppm selenium in the form of selenite over the basal diet (containing 0.28 ppm) showed 89.4% of normal spermatozoa against 57.9% in basal diet (Edens 2002). Organic selenium also improves fertility and more importantly duration of fertility (Agate *et al.* 2000). Further, observations in female chicken revealed the effectiveness of dietary supplementation of vitamin E, Se or both to sustain fertility in ageing flocks (Breque *et al.* 2003). Reports regarding supplementation of vitamin E, Se or both to duck diet and its effect on fertility are not available. The present study is perhaps the first report on this relationship. Therefore, the improvement in fertility of duck observed in the current study may be compared with other avian species described

above and such increased fertility might be attributed to the beneficial effect of vit E and Se either on the semen quality of male duck or on the female reproductive ability or both.

Hatching % (Table 2) of eggs (FES and TES) significantly ($P<0.05$) improved in treatment group. Improved antioxidant defenses during embryonic development could increase hatchability in avian species as hatching process is considered to be a time of oxidative stress. Antioxidants like vitamin E can be transferred from diet to egg and consequently to the developing embryo (Surai 2002), which is species specific and the highest transfer of α -tocopherol was observed in chicken than turkey, goose and duck (Surai *et al.* 1998). Information regarding transfer of Se from the diet to egg and then on to developing embryo in avian species is scanty. However, selenium in maternal diet affects Se concentration in tissues of postnatal quail and its concentration in tissues dropped dramatically within first 2 weeks of post hatch (Surai 2006). Also as a result of dietary Se supplementation, the Se concentration in the egg yolk, albumin, shell, shell membrane and perivitelline membrane was significantly increased (Pappas *et al.* 2005). Further, it is observed that Se supplementation in organic form positively affects hatchability (Renema 2004, Renema and Sefton 2004, Sefton and Edens 2004). Our findings of improved hatchability of ducks in treatment group finds support of the above observations and favors the fact that transfer of dietary vitamin E and Se to egg definitely play major role for the success of hatchability.

Blood serum biochemical profile (Table 3) with respect to total protein, total cholesterol and GOT in different sexes revealed no significance between treatment and control. Earlier studies with ducklings (Dermers and Alary 1966) and rats (Inez *et al.* 1965) indicated that a significant increase in plasma cholesterol resulted when the diets were deprived of vitamin E to which Chen *et al.* (1971) also agreed. In the present study, since the diet of treated group received an extra amount of vitamin E and Se over control, therefore, the result obtained may not be comparable.

However, more study may be required to ascertain the effect of vitamin E and Se on biochemical parameters of

Table 1. Percentage (week wise) egg production for adult native ducks treated with vitamin E and Se

Weeks	Control			Tretment			Sig
	Eggs laid	Total days	Production %	Eggs laid	Total days	Production %	
1	84	210	40	108	210	51.42	*
2	79	210	37.85	120	210	57.14	**
3	81	210	38.57	156	210	74.28	**
4	72	210	34.28	131	210	62.38	**
5	64	196	32.85	130	210	61.90	**
6	62	196	31.42	130	203	64.04	**
7	54	189	28.57	146	203	71.92	**
8	54	189	28.57	114	203	56.15	**

* $P<0.05$; ** $P<0.01$.

Table 2. Summary of mortality for native ducks eggs and hatchlings treated with dietary vitamin E and Se during the period of analysis

Status of eggs and hatchlings	Treatment			
	Control		Treatment (0.5g vit. E and 50 ppm Se)	
	Number	%	Number	%
Eggs collected	550		1035	
Viable	541	98.36	1009	97.49
Fertile	402	74.31	912	90.39
Survived	393	97.76	890	97.58
Hatched	290	72.14 (FES) 53.60 (TES)	743	81.47 (FES) 73.64 (TES)

Table 3. Mean ($\pm$ SE) of biochemical parameters in control and treatment group compared within sex

Attributes	Total protein (g/dl)		Total cholesterol (mg/dl)		GOT (U/L)	
	Male	Female	Male	Female	Male	Female
Sex						
Control	6.33	6.03	176.42	186.75	76.90	98.11
Treatment	5.98	6.01	192.43	195.88	94.18	127.43
Significance	NS	NS	NS	NS	NS	NS

NS, Nonsignificant.

ducks. Presently, it may be concluded that dietary vitamin E and selenium has much beneficial effect on production and reproductive performances of native indigenous ducks under intensive system of management.

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