



## Effect of Antioxidants on Physio-biochemical and Hematological Parameters in Broiler Chicken at High Altitude

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**ABSTRACT :** The present study was carried out on broilers to study the effect of oral administration of vitamin E and selenium (E-care Se) on growth performance, haematological and biochemical parameters for a period of 42 days (6 weeks). A total of 90 one-day-old broiler chicks were divided into three equal groups: T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. Group T<sub>1</sub> was maintained as control and was fed only with the basal diet throughout the experimental period. Two experimental diets, T<sub>2</sub> and T<sub>3</sub>, were formulated to contain an additional 100 g (150 IU vitamin E/kg+0.5 mg Se/kg) and 200 g (300 IU vitamin E/kg+1.0 mg Se/kg) of E-care Se which was the source of vitamin E and selenium. Body weight was significantly ( $p < 0.05$ ) higher in antioxidant-treated groups compared to the control group. There were no significant differences in feed conversion ratio (FCR). Blood samples were collected from the jugular vein for haematological (TEC, Hb, PCV and ESR) and biochemical (GOT and GPT) study. Body weight was increased significantly in both treated groups compared with the control group and highest body weights were recorded in group T<sub>2</sub>. TEC, PCV and Hb content increased significantly ( $p < 0.01$ ) in the treated groups as compared to the control group, but ESR, GOT and GPT values decreased significantly ( $p < 0.01$ ) in both treated groups as compared to the control group. The result reveals that use of antioxidants (vitamin E and selenium) is an effective way of getting the best result in terms of body weight gain and haemato-biochemical profiles in broiler birds at high altitude. (**Key Words :** Antioxidants, Vitamin E, Selenium, High Altitude, Broiler Chicken)

### INTRODUCTION

North western part of Himalaya shows varied climatic and topographic features. This part exhibits extreme cold and dry climate for most of the year, which hinders the growth and productivity of biomass. Vegetation cover is very scarce in areas like Ladakh, Kargil, Drass and Lahaul-Spiti in India. In winter, the temperature falls to  $-35^{\circ}\text{C}$  and the altitude varies from 10,000 to 12,000 feet from mean sea level (MSL). The atmospheric oxygen pressure is 30% short of MSL. This type of cold arid and desert like condition doesn't suit to poultry birds for their natural habitat. The term "Poultry" now includes a number of avian species such as chicken, duck, turkey, geese, guinea-fowl, quail, ostrich and emus domesticated for economic purpose. However, chicken accounts for more than 90% of the total poultry population of the world. Chicken and ducks are reared for egg and meat production, turkey, guinea fowl, geese, ostriches and emus etc are maintained only for meat purpose. The growth of poultry industry in India has been

phenomenal in last two decades, and has reached a stage of self-sufficiency and sophistication. However, the picture is very grim in cold arid part of Himalaya. Here, still it is a backyard venture with very little number of birds. The non-existence of any commercial hatchery, problem in transportation of day old chicks and unavailability of poultry feed acts as the major obstacle in growth and popularization of poultry farming in this region.

Antioxidant plays an important role in both nutrition and production performance in poultry. Deficiency of antioxidants causes various diseases in poultry such as retarded growth, weakness, ruffled feather, blindness, xerophthalmia etc (Hill et al., 1961), encephalomalacia, exudative diathesis for vitamin E, polyneuritis, curled toe paralysis, perosis, impairment of food utilization for selenium (Swain, 1996). Dietary supplementation of vitamin E at levels of higher than the NRC (1994) recommendations for poultry enhanced the immune response (Lin et al., 2004) and general performance (Guo et al., 2001). Higher doses of vitamin E (150 ppm) positively influenced the productive performance in quail but vitamin E in at lower doses (15 ppm) did not have any positive effects (Biswas et al., 2008).

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A number of studies to investigate the effects of supplementing diets with vitamin E and selenium on biochemical and hematological parameters of chickens, turkeys and quails in plain area but studies on high altitude are very limited. Therefore, the present study was undertaken to examine the effects of antioxidants (vitamin E and selenium) on physio-biochemical and hematological parameters in broiler chicken at high altitude above 11,500 ft mean sea level (MSL).

## MATERIALS AND METHODS

### Housing and rearing of birds

Ninety (90) day old broiler chicks were randomly divided into nine groups of 10 chicks each (3 dietary treatments×3 replicates). The experiment had a randomized design (Snedecor and Cochran, 1994). Chicks were placed in solar poultry house with mesh floor and reared under uniform husbandry conditions (14 h light/day and 25-32°C) and provided with standard broiler ration. The same technicians provided feed, water, and collected data from the birds during the course of the experiment. The experiment followed the guidelines of 'Institutional Animal Ethics Committee' (DIHAR, Leh, India).

### Formulation of experimental diets

The basal diet (T<sub>1</sub>) contained crude protein (CP) 210 g/kg, 2,900 Kcal/kg ME, 30 g/kg total calcium and 5.0 g/kg total phosphorus (Table 1). Two experimental diets T<sub>2</sub> and T<sub>3</sub> were formulated to contain an additional 100 g (150 IU vitamin E/kg+0.5 mg Se/kg) and 200 g (300 IU vitamin E/kg+1.0 mg Se/kg) of antioxidants respectively. E-care Se was the source of vitamin E and selenium (Tetragon Chemie Pvt. Ltd., Bangalore, India).

### Production performance

Body weights of each chick and feed consumption of each group were recorded weekly starting from one day of age and weight was recorded to the nearest 0.1 kg. Mortality was recorded and growth performance was evaluated in terms of live-weight gain and feed conversion ratio (FCR).

### Hematological parameter

The blood sample were collected from jugular vein for measurements of total erythrocyte count (TEC), hemoglobin (Hb), packed cell volume (PCV), erythrocyte sedimentation rate (ESR), glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT). A number of sterile test tubes containing anticoagulant (4% sodium citrate) at a ratio of 1:10 were taken. For preparation of serum samples, about 2 ml of

**Table 1.** Composition of the basal diet

Ingredients	
Composition (g/kg)	
Maize	590
Soybean	200
De-oiled rice bran (DORB)	75
Fish meal	60
Limestone	25
Oyster shell	15
Marble chips	20
Dicalcium phosphate	10
Sodium chloride	5
Amount (g/kg)	
DL-methionine	0.150
Choline chloride	0.300
Mineral mixture <sup>1</sup>	0.125
Vitamin A, B <sub>2</sub> , D <sub>3</sub> , K <sup>2</sup>	0.040
Vitamin B complex <sup>3</sup>	0.050
Calculated composition	
Crude protein (g/kg)	210
Crude fibre (g/kg)	23.5
Total calcium (g/kg)	30.0
Total phosphorus (g/kg)	5.0
ME (Kcal/kg)	2,900
Vitamin E (IU/kg)	15.0
Selenium (mg/kg)	0.20

<sup>1</sup> Each g of mineral mixture contained: 200 mg of FeSO<sub>4</sub>·7H<sub>2</sub>O, 20 mg of CuSO<sub>4</sub>·5H<sub>2</sub>O, 200 mg of MnSO<sub>4</sub>·H<sub>2</sub>O, 150 mg of ZnSO<sub>4</sub>·7H<sub>2</sub>O, 1 mg of KI.

<sup>2</sup> Each g of vitamin A, B<sub>2</sub>, D<sub>3</sub>, K (Spectromix, Ranbaxy) provided: vitamin A (retinol) 540 mg, vitamin B<sub>2</sub> (riboflavin) 50 mg, vitamin D<sub>3</sub> (cholecalciferol) 400 mg, vitamin K (menadione) 10 mg.

<sup>3</sup> Each g of B-Complex provided: vitamin B<sub>1</sub> (thiamine) 2 mg, folic acid 10 mg, pyridoxine HCl 4 mg, Cyanocobalamin 10 µg, nicotinamide 12 mg.

blood was collected without anticoagulant in the sterile glass test tubes. The tubes containing blood were placed in a slanting position at room temperature for clotting. The tubes were then placed in the refrigerator at 4°C over night. Serum was then collected and was centrifuged at 1,000 rpm for 15 minutes to get rid of unwanted substances. The serum was then stored in the screw capped serum vial and preserved at -20°C until use. The hematological studies were performed within two hours after the blood collection as per technique described by Shastry (1983). GOT and GPT were estimated by Reitman and Frankel (1957) method.

### Statistical analysis

The data were analyzed using statistical software package developed at the computer centre of the Institute following standard procedure for ANOVA (Snedecor and

**Table 2.** Growth performance of growing broiler (0 to 6 weeks of age) fed on diets supplemented with antioxidants (*E-care Se*) (N = 30, SEM)

Dietary treatment	Antioxidant (E-care Se) (mg/kg)	Body weight gain (g/bird)		Feed conversion ratio (FCR)		Cumulative feed intake (g)	Mortality
		0-3 wks	0-6 wks	0-3 wks	0-6 wks		
T1	0	445±3.00 <sup>a</sup>	945±7.00 <sup>a</sup>	1.85±0.02	2.35±0.06	2,220.75±09.25	06/30
T2	100	480±4.00 <sup>b</sup>	995±8.00 <sup>b</sup>	1.55±0.02	2.15±0.05	2,139.25±08.12	02/30
T3	200	490±4.00 <sup>b</sup>	1005±9.00 <sup>b</sup>	1.60±0.01	2.20±0.04	2,211.00±08.15	02/30
				NS	NS	NS	

Mean values bearing the same superscripts in a column do not differ significantly ( $p < 0.05$ ).

NS = Non significant.

Cochran, 1994) and Duncan's multiple range tests (Duncan, 1955) by comparing means for significant differences.

## RESULTS AND DISCUSSION

### Production performance

Broiler treated with different levels of antioxidants supplement showed an increased body weight gain than control group (T<sub>1</sub>). The body weight was increased significantly ( $p < 0.05$ ) in all the treated groups in comparison to control (Table 2). The feed conversion ratio (FCR) was not significant ( $p > 0.05$ ) among the control and treated group. The increased rate of body weight gain in the treated groups might be due to an increased feed intake (Table 2), feed consumption, utilization, digestion, absorption and metabolism of supplied feed nutrient specially protein essential for their health and body weight gain. The increased body weight in group T<sub>3</sub> is also in agreement with the earlier reports of Villar-Patino et al. (2002) who reported that weight gain and feed efficiency increased statistically with antioxidant supplementation. The highest weight was recorded always in group T<sub>3</sub>. This finding is supported by the above mentioned researchers. The better performance might be due to the synergistic action of both of them on the physiological system of the birds.

### Hematological parameters

All the hematological values are presented in Table 3. The mean values of TEC in all treated groups were increased significantly ( $p < 0.01$ ) than control group. The

highest TEC value was recorded in group T<sub>3</sub> (3.25±0.07) and lowest in group T<sub>1</sub> (2.75±0.08) millions/mm<sup>3</sup>. The mean values of hemoglobin increased significantly ( $p < 0.01$ ) in all the treated groups and the highest was recorded in group T<sub>3</sub> (11.25±0.31) and lowest in control group T<sub>1</sub> (09.35±0.17). The mean value of PCV also increased significantly ( $p < 0.01$ ) in all the treated groups. The highest value was recorded in group T<sub>3</sub> (30.62±1.08) and lowest in control group T<sub>1</sub> (25.75±0.75). The mean value of ESR decreased significantly ( $p < 0.01$ ) in all the treated groups and greatly decreased in treated group T<sub>3</sub> (1.75±0.09). The increased level of total erythrocyte count, hemoglobin content and packed cell volume might be due to the effects on hemopoietic organs. There are some vitamins such as vitamin E, vitamin B<sub>12</sub>, pantothenic acid, folic acid and biotin etc which are essential for normal growth of the haemopoietic organs and erythropoiesis. The hematological parameters of present finding resembles to that of Dukes (1955), who reported that the number of erythrocytes and other components of blood varied due to the influence of age, environment, exercise, nutritional status and climate.

### Biochemical parameters

The serum GOT and GPT levels are also presented in Table 3. GOT concentration was decreased in treated group's comparison to control group but the values of treated group T<sub>2</sub> was not significantly ( $p > 0.05$ ) decreased than the control group T<sub>1</sub>. All the values of GOT in groups T<sub>2</sub> and T<sub>3</sub> were decreased significantly ( $p < 0.01$ ) than the control group (T<sub>1</sub>). The decreased GOT level in present finding is in close agreement with the report suggested by

**Table 3.** Effect of antioxidants (E-care Se) on haemato-biochemical parameters in broilers chicken at high altitude (N = 30; Mean±SEM)

Dietary treatment	Antioxidant (E-care Se) added (mg/kg)	TEC (million/mm <sup>3</sup> )	Hb (g/dl)	PCV (%)	ESR (mm in 1st h)	GOT (n mole/min/mg protein)	GPT (n mole/min/mg protein)
T1	0	2.75±0.08 <sup>a</sup>	09.35±0.17 <sup>a</sup>	25.75±0.75 <sup>a</sup>	2.52±0.10 <sup>b</sup>	56.12±2.10 <sup>b</sup>	5.27±0.22 <sup>b</sup>
T2	100	3.15±0.04 <sup>b</sup>	11.19±0.22 <sup>b</sup>	30.55±1.02 <sup>b</sup>	2.08±0.12 <sup>ab</sup>	46.23±2.15 <sup>ab</sup>	3.75±0.25 <sup>a</sup>
T3	200	3.25±0.07 <sup>b</sup>	11.25±0.31 <sup>b</sup>	30.62±1.08 <sup>b</sup>	1.75±0.09 <sup>a</sup>	44.15±1.75 <sup>a</sup>	3.45±0.32 <sup>a</sup>

Mean values bearing the same superscripts in a column do not differ significantly ( $p < 0.01$ ).

Swain and Johri (2000) and Kumar and Rawat (1976). GPT concentration was decreased in all the treated groups in comparison to control group. All the values of treated groups were significantly ( $p < 0.01$ ) decreased than the control group. This present finding is strongly supported by the work of Sahin et al. (2001), Kumar and Rawat (1976) and Pravbhakaran et al. (1996).

### CONCLUSION

Therefore, it may be concluded that antioxidants (vitamin E and Se) may be used with basal diet to get best result in terms of body weight gain, physio-biochemical and hematological profiles on broilers chicken at high altitude.

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