Pakistan Vet. J., 25(4): 2005

EFFECT OF VITAMIN C SUPPLEMENTATION ON THE PERFORMANCE OF DESI, FAYOUMI AND COMMERCIAL WHITE LEGHORN CHICKEN EXPOSED TO HEAT STRESS

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ABSTRACT

Sixty layers (50 weeks of age) each of native Desi, Fayoumi and commercial White Leghorn (Nick Chick) were kept in wire cages following completely randomized design for 8 weeks during summer season (June and July). The birds of each type were divided into two groups i.e. with and without supplementation of vitamin C with three replicates assigned to each layer group (10 birds in each replicate). The vitamin C (C-vit fort) was added at the rate of 5 ml/5 liter in drinking water throughout the experimental period in respective layer group. The results indicated that the mean egg production, egg weight and egg shell thickness improved (P<0.05) with supplementation of vitamin C in all layers. The average feed consumption of three types of layers was also improved (P<0.05) with supplementation of vitamin C. The blood picture showed that the concentration of ascorbic acid was higher (P<0.05) in groups supplemented with vitamin C. However, the concentrations of blood enzymes (ALP, SGPT and SGOT) were lowered (P<0.01) with vitamin C supplementation in all types of layers. Based on the findings of the present study, it was concluded that vitamin C supplementation was effective in improving performance of layers under heat stress conditions.

Key words: Desi, Fayoumi, commercial White Leghorn, vitamin C, egg production, enzymes.

INTRODUCTION

The tropical environment of Pakistan poses a great threat to the production performance of the poultry. Severe hot summer season imposes severe stress on birds, which leads to poor performance and high mortality among chicken (Njoku, 1986). Heat stress occurs when birds have difficulty in balancing body heat production and body heat loss. At high environmental temperatures, birds rely on different mechanisms to regulate their body temperature within a zone of comfort, the thermo neutral zone (Simon, 2003).

During summer, egg production generally falls to as low as 30% (Yaqoob, 1966). High temperature seems to be the main factor which lowers the productive performance of layers. Under environmentally normal keeping conditions for layers, biosynthesis of ascorbic acid in the renal medulla and cortex meets the physiological requirements of birds and does not require supplementation of vitamin C in the feed (Cheng *et al.*, 1990). However, due to changes in the environmental conditions, layers demand supplementation of vitamin C in the feed (Sahota, 1988; Rashid and Ahmed, 1991; Rao *et al*., 2004). There is limited information on the effect of supplementation of vitamin C on the performance of local layer breeds during summer season.

This study was planned to observe the effect of vitamin C supplementation in the water on the performance of local native Desi, Fayoumi and commercial White Leghorn (Nick-Chick) layers during summer season (June and July).

MATERIALS AND METHODS

Sixty birds (50 weeks of age) each of native Desi, Fayoumi and commercial White Leghorn (Nick-Chick) type were randomly picked up from the flocks kept at Breeding and Incubation Section, Poultry Research Institute, Rawalpindi, Pakistan. The birds of each type were randomly divided into two groups i.e. with and without supplementation of vitamin C with three replicates assigned to each group (10 birds in each replicate). The experimental birds were kept in double sided flat deck laying cages. In this experiment, 90 cages were used with density of two birds in each cage. Desi, Fayoumi and commercial White Leghorn layers were kept in three rows/replicates of each group (with and without supplementation of vitamin C) comprising 5 cages in one replicate following completely randomized design. All the layers were cage numbered.

The vitamin C (C-vit fort) was added at the rate of 5 ml/5 liter (one ml contained 1.5 mg ascorbic acid) in drinking water throughout the experimental period of 8 weeks. *Ad libitum* feeding and watering was done in feeders and drinkers specified for the cage system and were identical for all experimental units. The layers were provided 17 hours light. The composition of commercial ration is given in Table 1. The temperature and relative humidity inside the shed were recorded daily (Table 2). The following data were recorded:

- Weekly egg production per cage unit
- Weekly feed consumption per cage unit
- Weekly feed efficiency ratio (feed per dozen eggs)
- Weekly egg weight per cage unit
- Weekly shell thickness per cage unit
- Mortality, if any, in all groups

Table 1: Composition of commercial layers ration

Ingredients	Quantity (%)
Wheat	25.0
Rice broken	20.0
Maize	9.0
Rice polishing	9.0
Cotton seed meal	9.0
Rape seed meal	2.0
Soyabean meal	2.5
Corn-gluten meal (60%)	5.0
Fish meal	7.5
Bone meal	1.3
Vitamin mineral premix	0.2
Molasses	3.0
Limestone	6.5
Nutrients composition	
Crude protein (%)	16
Metabolizable energy (Kcal/kg)	2700
Calcium (%)	3.5
Phosphorus (%)	1.0

Table 2: Average weekly maximum and minimum ambient temperature and relative humidity during experimental period

Weeks	Temperature (ºC)		Relative humidity (%)
	Maximum	Minimum	
1st	40 ± 0.34	26 ± 1.00	33 ± 1.40
2nd	40 ± 0.10	27 ± 0.80	45 ± 3.30
3rd	42 ± 0.26	30 ± 0.75	50 ± 2.25
4th	39 ± 0.58	30 ± 0.10	57 ± 3.00
5th	37 ± 0.71	26 ± 1.0	60 ± 3.10
6th	39 ± 4.40	27 ±1.25	61 ± 2.70
7th	37 ± 0.75	28 ± 0.56	71 ± 3.60
8th	36 ± 3.00	27 ± 0.50	80 ± 5.25

Five blood samples of each group (with and without supplementation of vitamin C) of Desi, Fayoumi and commercial White Leghorn layers were collected at the end of experiment. Serum was separated and stored at -4ºC till used for analysis. Ascorbic acid level in the serum was determined by 2,6-dichloro phenol indophenol (DCPIP) titration method (Varley *et al*., 1980). The activities of alkaline phosphatase (ALP), serum glutamate pyruvate transaminase (SGPT) and serum glutamate-oxaloacetate transaminase (SGOT) were determined by methods described by Bergmeyer and Wanlefeld (1980). The data thus collected were subjected to completely randomized design (Steel and Torrie, 1984). Duncan’s multiple range test was applied for multiple means comparisons.

RESULTS AND DISCUSSION

Desi, Fayoumi and commercial White Leghorn layers given supplemented vitamin C produced greater ($P<0.05$) number of eggs compared to layers without supplemented vitamin C (Table 3). However, non-significant difference in egg production was found between Desi and Fayoumi layers (either supplemented or non-supplemented with vitamin C). These results reveal that vitamin C supplementation is effective in ameliorating the stressful conditions during summer as indicated by improved egg production in vitamin C supplemented groups. These results are in agreement with the findings of Slinger (1985), who reported that supplementation of vitamin C in feed improved egg production of layers during acute stress or under high environmental temperature.

The average feed consumption of three types of layers with supplemented vitamin C was higher ($P<0.05$) than those of non-supplemented layers (Table 3). These results are in accordance with the findings of Njoku and Nwazota (1989), who reported that vitamin C supplementation in feed improved feed consumption by layers under stress conditions. They explained that such improvement in feed intake was probably due to its effect on basal metabolic rate of layers. The groups supplemented with vitamin C showed better feed conversion efficiency ($P<0.05$) than non-supplemented groups (Table 3). These results are supported by the findings of Pardue *et al.* (1983), Njoku (1986) and Njoku and Nwazota (1989), who reported that vitamin C supplementation improved feed conversion ratio in chickens kept under naturally prevailing summer temperatures.

The mean egg weight in layers supplemented with vitamin C was higher ($P<0.05$) than non-supplemented groups (Table 3). This indicates that vitamin C was effective in improving egg weight consistently in layers during summer. These results are in accordance with the findings of Lazer *et al.* (1983) and Slinger (1985), who reported that vitamin C supplementation increased egg weight under high temperature and relative humidity. The mean shell thickness of eggs in layers

Table 3: Average egg production, feed consumption, feed efficiency, egg weight and egg shell thickness in layers with or without vitamin C supplementation

Parameters	Desi		Fayoumi		Nick-Chick	
	Without vitamin C	With vitamin C	Without vitamin C	With vitamin C	Without vitamin C	With vitamin C
Egg production (hen house basis)	50.61[c]	54.04[b]	49.50[c]	53.28[b]	55.04[b]	60.71[a]
Feed consumption (kg)	7.49[c]	8.12[b]	7.48[c]	8.11[b]	8.15[b]	8.77[a]
Feed efficiency (feed/dozen eggs)	2.61[a]	2.41[b]	2.62[a]	2.44[b]	2.40[b]	2.23[c]
Egg weight (gm)	51.39[c]	53.38[b]	51.15[c]	53.25[b]	54.15[b]	56.251[a]
Egg shell thickness (mm)	0.333[b]	0.355[a]	0.332[b]	0.353[a]	0.334[b]	0.360[a]

Mean values with different superscripts in the same row differ significantly ($P<0.05$) with each other.

Table 4: Average blood ascorbic acid, alkaline phosphatase, serum glutamate pyruvate transaminase and serum glutamate oxalate transaminase levels in layers with or without vitamin C supplementation

Parameters	Desi		Fayoumi		Nick-Chick	
	Without vitamin C	With vitamin C	Without vitamin C	With vitamin C	Without vitamin C	With vitamin C
Ascorbic acid (mg/100 ml)	1.03[b]	1.23[a]	1.06[b]	1.25[a]	1.04[b]	1.26[a]
ALP (u/l)	998.52[c] ± 94.95	969.20[d] ± 95.35	1061.01[a] ± 84.89	1047.81[b] ± 95.52	1061.15[a] ± 88.38	1031.24[b] ± 88.97
SGPT (u/l)	965.46[c] ± 10.37	960.00[d] ± 11.83	984.05[a] ± 10.49	976.63[b] ± 10.80	980.77[a] ± 11.76	975.50[b] ± 8.19
SGOT (u/l)	939.17[d] ±11.09	934.23[c] ± 9.14	953.99[c] ± 12.11	945.29[b] ± 11.84	949.61[a] ± 10.65	943.33[b] ± 10.84

Mean values with different superscripts in the same row differ significantly ($P<0.01$) with each other.

supplemented with vitamin C was higher ($P<0.05$) than those of non-supplemented groups (Table 3). Similar results were reported by Cheng *et al.* (1990) and Rashid and Ahmed (1991), who stated that vitamin C supplementation improved egg shell thickness in heat stressed birds. Vitamin C is necessary for the maintenance of normal collagen metabolism, whereas collagen formation is required for normal structure of bones, egg shells, muscles etc (McDonald *et al.*, 1992).

The average blood ascorbic acid values in groups of all layers supplemented with vitamin C was higher ($P<0.01$) than those of non-supplemented groups (Table 4). These findings are in accordance with those of Cheng *et al.* (1990), who reported that the concentration of blood ascorbic acid dropped when layers were exposed to heat stress and it increased when vitamin C was supplemented. The activities of blood enzymes (ALP, SGPT and SGOT) in groups of all layers supplemented with vitamin C was lower ($P<0.01$) than those of groups without vitamin C (Table 4). Similarly, Chakraborty and Sadhu (1983) and Takeda and Hara (1985) reported that vitamin C supplementation decreased serum enzymes levels. According to Bhatti *et al.* (2003) and Bhatti and Dil (2005), alteration in serum enzymes activity under stress conditions occur due to malfunctioning of liver, as degenerating and necrotic cells leak enzymes from cytoplasm.

Based on the findings of the present study, it may be stated that vitamin C supplementation is effective in improving performance of layers under heat stress conditions.

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