Short Note

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Effect of Vitamin-C Supplementation on Growth Performance of Broiler Chicken under Heat Stress Condition

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ABSTRACT

An experiment was conducted to investigate the effect of vitamin-C supplementation on growth performance of broiler chicken under heat stress condition. A total of 180 day-old broiler chicks (Vencobb) were divided into three groups with three replications each comprising of 20 birds and reared on deep litter system. Birds in each group were fed broiler diet *ad libitum* and supplemented with Vitamin-C dissolved in drinking water at a dose of 0, 30 and 50 mg/bird/day for groups T_1, T_2 and T_3; respectively. The average maximum temperature was 35.3°C and minimum temperature was 25.5°C during the experimental period of six weeks with overall average temperature of 33.2°C and 26.1°C, respectively. Similarly, the relative humidity varied between 57.3 to 90.8 per cent during the experimental period with overall average maximum and minimum relative humidity of 83.4 and 73.1 per cent, respectively. The results of weekly body weight gain revealed that the group supplemented with vitamin-C (T_2 and T_3) recorded significantly higher body weight gains over control. The body weight gain of the birds improved with higher dose of vitamin-C. Vitamin-C supplementation did not significantly ($P<0.01$) increase feed intake and feed conversion ratio among the groups during first week. However, from 2nd week onwards birds in group T_2 showed higher trend in feed consumption and feed conversion ratio as compared to other groups.

Keywords : Vitamin-C, broiler, growth performance, feed intake, feed conversion ratio

INTRODUCTION

Broiler farming in India has taken a rapid stride, because of gradual change in food habits of our people; enhancement of purchasing power of wider action of people, continuous rise in price of mutton. It has now taken the shape of broilers industry. Its return is quick and remunerative. The poultry industry is one of the fastest growing sectors in the country. Today poultry industry is witnessing series of problems such as various disease outbreaks, harsh climatic conditions, high cost of feeding and day by day decreasing profit margin. Compared to other domestic animals, broiler chickens are more susceptible to changing environmental conditions. In particular, high ambient temperatures depressed feed intake, weight gain and increased mortality rates among broilers. A possible approach to counteracting the negative effects of heat stress among chickens could be the supplementation of birds with Vitamin-C. Vitamin-C plays a major role in the biosynthesis of corticosterone, a primary glucocorticoid hormone involved in gluconeogenesis to enhance energy supply during heat stress. However, under critically high ambient temperatures, the production of Vitamin-C in broilers is inadequate for optimum performance. The success of broiler production depends on maximum weight gain within minimum period and which can be fulfilled by proper nutritional and managemental practices. So as to increase the growth performance of the birds various nutrients are to be incorporated in the diet. Keeping in view the importance of the vitamin-C, a study was conducted to know the effect of vitamin-C supplementation on growth performance of broiler chicken.

The present study was conducted on 180 day-old commercial broiler chicks (Vencobb) for a period of six weeks at Bihar Veterinary College, Patna. The chicks were divided into three

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groups with three replications each comprising of 20 birds and reared on deep litter system. Birds in each group were fed broiler diet *ad libitum* and supplemented with Vitamin-C dissolved in drinking water at a dose of 0, 30 and 50 mg/bird/day for groups T_1, T_2 and T_3; respectively. During whole experimental period, hygienic and sanitary conditions were maintained. The feed was given after 8 hours of arrival of chicks. The starter ration was given up to age of 3 weeks of age whereas finisher ration was given from 4 to 6 week of age. The birds were fed according to the plan of the experiment up to 6 weeks of age. The house was provided with adequate ventilation and continuous light for 24 hours. The water troughs were filled with water after maintaining required concentration of Vitamin-C per bird at a dose of 0, 30 and 50 mg/bird/day for three groups respectively. After consumption of required experimental dose of Vitamin-C, chicks were provided *ad libitum* water. The feeding troughs were filled with half, 3 times daily in order to stimulate feed consumption and prevent feed wastage. Body weight, feed intake were recorded weekly up to six weeks and from these data live weight gain, feed conversion ratio were calculated. Data were analysed in completely randomized design (CRD) with simple analysis of variance (ANOVA) technique following the procedure of Snedecor and Cochran (1994).

Result indicates that the average maximum temperature (Table-1) was 35.3°C and minimum temperature was 25.5°C during the experimental period of six weeks with overall average temperature of 33.2°C and 26.1°C, respectively. Similarly, the relative humidity varied between 57.3 to 90.8 per cent during the experimental period with overall average maximum and minimum relative humidity of 83.4 and 73.1 per cent, respectively. Birds perform well within a relatively wide range of temperatures. Whether they are broilers, layers or turkeys, this range extends between 10 and 27°C. The highest growth rate of broilers occurs in the range of 10-22°C while maximum feed efficiency is at about 27°C (Kampen, 1984). Charles (2002) reviewed the literature on the optimum temperature for performance and concluded that for growing broilers it is 18-22°C. It is known, however, that what is ideal for growth is not ideal for feed efficiency. The overall optimum range mainly depends on the market value of the product produced, relative to feed cost. As the price ratio widens, the best temperature falls, and vice versa. When their body temperature rises above 42°C, mortality begins to occur (Daghir, 1995).

Table 1 : Average weekly Maximum-Minimum Temperature and Relative humidity during the experimental period

Week	Temperature		Humidity	
	Maximum	Minimum	Maximum	Minimum
1	35.3	25.7	73.3	57.3
2	33.5	26.6	82.1	75.4
3	31.6	25.1	87.0	80.7
4	34.1	27.0	81.7	73.4
5	31.0	25.5	90.8	80.3
6	33.6	26.5	85.6	71.6
Overall	33.2	26.1	83.4	73.1

Results of average weekly body weight (Table-2) indicated that group supplemented with vitamin-C (T_2 and T_3) recorded significantly higher body weights over control. The body weight of the birds improved with higher dose of vitamin-C. The findings observed in the present study are in agreement with those recorded by Pardue *et al.* (1985), Nakaya *et al.* (1986), Raja and Qureshi (2000) and Sahin *et al.* (2003).

Table 2: Average body weight (g) of broiler birds raised under effect of different level of Vitamin-C supplementation.

Weeks/ Treatment	T_1		T_2		T_3	
	Mean± SE	CV (%)	Mean±SE	CV%	Mean±SE	CV%
1st	108.01±0.71	5.06	110.49±0.75	5.28	109.39±0.67	4.76
2nd	246.69±0.49 ^{a}	1.51	259.95±0.53 ^{b}	1.57	249.64±0.60 ^{c}	1.85
3rd	502.01±0.43 ^{a}	0.64	530.91±0.55 ^{b}	0.79	536.99±0.44 ^{c}	0.63
4th	792.17±0.47 ^{a}	0.44	834.71±0.49 ^{b}	0.43	861.69±0.47 ^{c}	0.41
5th	1015.84±0.56 ^{a}	0.40	1069.16±0.5^b	0.35	1194.52±0.47 ^{c}	0.29
6th	1315.26±0.53 ^{a}	0.29	1420.95±0.4^b	0.22	1556.65±0.45 ^{c}	0.23

Values bearing same superscripts in a row did not differ significantly.

Table 3 : Average body weight gain (g) of broiler birds raised under effect of different level of Vitamin-C supplementation.

Weeks/ Treatment	T_1		T_2		T_3	
	Mean± SE	CV (%)	Mean±SE	CV%	Mean±SE	CV%
1st	55.26±0.67 [a]	9.44	57.81±0.84 [a]	11.20	56.48±0.73 [a]	10.18
2nd	136.43±0.83 [a]	4.63	150.10±0.92 [b]	4.75	138.07±0.90 [c]	4.93
3rd	255.09±0.64 [a]	1.89	270.31±0.74 [b]	2.11	287.43±0.75 [c]	1.99
4th	290.17±0.67 [a]	1.72	303.73±0.56 [b]	1.39	324.76±0.66 [c]	1.54
5th	223.56±0.88 [a]	2.90	234.38±0.50 [b]	1.59	332.85±0.74 [c]	1.67
6th	299.21±0.75 [a]	1.81	351.79±0.67 [b]	1.41	362.13±0.68 [c]	1.41

Values bearing same superscripts in a row did not differ significantly.

The results of weekly body weight gain (Table-3) revealed that the group supplemented with vitamin-C (T_2 and T_3) recorded significantly higher body weight gains over control. The body weight gain of the birds improved with higher dose of vitamin-C. The findings observed in the present study are in agreement with Pardue and Thaxton (1986), Edrise *et al.* (1986), Kutlu and Forbes (1993), Blaha and Kreosna (1997), Shoukry (2002), Vathana *et al.* (2002), Mehmet *et al.* (2005), Nagra *et al.* (2005), Kadim *et al.* (2008) and Onu (2009). However, Stilborn *et al.* (1988) and Sosnowka *et al.* (2003) found no beneficial effect of supplementation of vitamin-C on body weight gain of broilers.

Further, the average daily feed intake during the experimental period was ranged from 13.66±0.17g in first week to 131.54±0.27g in sixth week (Table-4). On statistical analysis, it was observed that vitamin-C supplementation did not significantly ($P<0.01$) increase feed intake among the groups during first week. However, from 2nd week onwards birds in group T_2 showed higher trend in feed consumption as compared to other groups. The amount of feed consumed during 6th week highest in T_3 (131.54±0.27g/bird/day) group as compared to T_1 (122.95±0.38g/bird/day) and T_2 (130.16±0.27g/bird/day) groups. The results of the present study showed that the group supplemented with vitamin-C (T_2 and T_3) recorded significantly higher feed intake over control. The feed consumption of the birds improved with higher dose of vitamin-C. The findings observed in the present study are in agreement with those recorded by Nakaya *et al.* (1986), Pardue and Thaxton (1986), McKee and Harrison (1995), Sahin *et al.* (2003), Farooqi *et al.* (2005), Mehmet *et al.* (2005) and Kadim *et al.* (2008). However, Abdel Raheem and Ghaffar (2004) recorded no any effect of vitamin-C supplementation on feed consumption of birds.

Table 4 : Average feed intake (g/bird/day) of broiler birds raised under effect of different level of Vitamin-C supplementation.

Weeks/ Treatment	T_1		T_2		T_3	
	Mean± SE	CV (%)	Mean± SE	CV (%)	Mean± SE	CV (%)
1st	13.66±0.17	9.44	14.32±0.21	11.23	14.15±0.18	10
2nd	44.89±0.27	4.61	48.18±0.30	4.83	41.96±0.37	6.8
3rd	63.78±0.17	1.99	65.78±0.20	2.32	68.57±0.19	2.13
4th	75.82±0.33	3.15	76.55±0.18	1.68	80.73±0.18	1.64
5th	89.15±0.25	1.95	91.65±0.17	1.42	106.97±0.25	1.8
6th	122.95±0.31	1.83	130.16±0.27	1.51	131.54±0.27	1.48

Results of feed conversion ratio (Table-5) revealed that no improvement in feed conversion ratio was observed among the groups up to first week of age. However 2nd week onwards best feed conversion ratio was observed in T_3 group as compared to other groups. At the end of 6th week, best feed conversion ratio was recorded in T_3 (2.54) group as compared to T_2 (2.59) and T_1 (2.88). In the present study, group supplemented with vitamin-C (T_2 and T_3) recorded higher feed conversion ratio over control. The feed conversion ratio of the birds improved with higher dose of vitamin-C. The findings observed in the present study are in agreement with those recorded by Pardue *et al.* (1985), Edrise *et al.* (1986), Blaha and Kreosna (1997), Raja and Qureshi (2000), Vathana *et al.* (2002), Nagra *et al.* (2005), Kadim *et al.* (2008) and Onu (2009). However, Stilborn *et al*. (1988) reported no improvement in feed conversion ratio of the broiler birds supplemented with vitamin-C.

The results of the study indicated that the supplementation of vitamin-C showed significant improvement in live body weights and weekly body weight gain from 2nd week to the 6th weeks. No difference in body weight gain was observed during the first week. Birds in Group T_3 (50mg/bird/day) were heaviest followed by group T_2 (30mg/bird/day) and lightest in group T_1. Vitamin-C supplementation did not significantly increased the feed intake among groups. However, from 2nd week onwards, birds in group T_3 (50mg/bird/day) had best feed conversion ratio in comparison with those of groups T_2 (30mg/bird/day) and control. Further research should focus on other higher dose levels of vitamin-C than 50mg/bird/day to arrive at the most appropriate level of vitamin-C for the broiler chickens.

Table 5 : Weekly Feed Conversion Ratio (FCR) of broiler birds raised under effect of different treatments of Vitamin-C supplementation

Weeks	Group		
	T_1	T_2	T_3
1st	1.73	1.74	1.76
2nd	2.30	2.25	2.03
3rd	1.75	1.70	1.67
4th	2.83	1.76	1.74
5th	2.79	2.74	2.25
6th	2.88	2.59	2.54

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