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Vitamin C and electrolyte supplementation to support growth and meat yield of broilers in a hot humid environment

M. T. Ali, M. A. R. Howlider, A. K. Azad and M. S. Rahman
Department of Poultry Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract

The study was aimed at determining the effects of Vitamin C and electrolyte on growth and meat yield of broilers in a hot humid environment. A total of 60 straight run day old Cobb 500 broilers were reared up to 35 days of age and fed *ad libitum* on a starter diet up to 12 days and thereafter, on a grower diet. The broilers were divided into 4 treatment groups. One group (15 broilers) without Vitamin C and electrolyte supplementation was considered as control. In other three groups were provided 135ppm Vitamin C, 1250ppm electrolyte and 135ppm Vitamin C + 1250ppm electrolyte in drinking water respectively as supplement. Feed intake, body weight, feed conversion and survivability were similar in broilers that received different levels of Vitamin C and electrolyte supplementation in drinking water. Feed cost per broiler and per kg broiler increased due to the addition of Vitamin C and electrolyte. Dressing yield, breast meat, total meat and wing meat were ($P<0.05$) higher in broilers that received Vitamin C in drinking water than those of control, electrolyte and Vitamin C + electrolyte supplemented groups. No differences ($P>0.05$) were found in breast: dark meat, thigh meat, drumstick meat and abdominal fat which could be attributed to either Vitamin C or electrolyte supplementation. It implies that deficiency of Vitamin C may be related to reduce meat yield of broilers in a hot humid environment. However, further experiment using several doses of Vitamin C with large number of broilers may be conducted to confirm the appropriate doses of supplementation.

Keywords: Vitamin C, Electrolyte, Broiler growth, Meat yield

Introduction

High temperature is a major limitation to growth and meat yield of broilers in tropical countries of the world (Howlider and Rose, 1987 and Arjona *et al.,* 1988). Reduced feed intake, growth rate, feed conversion, survivability, dressing yield, breast meat and total meat and increased abdominal fat are the immediate consequences of rearing broilers in a hot humid environment (Geraert, 1998). Depleted performance and decreased profitability of broiler are aggravated when high temperature is associated with high relative humidity (Charles *et al.,* 1978). Broiler with higher growth rate suffer more at elevated house temperature than that of slow growing broilers (Bohren *et al.,* 1982). Summer mortality and reduced performance of the flock causes Tk. 1028 millions of loss per year to the poultry industry in Bangladesh (Islam *et al.*, 2009). This situation demands an economic and efficient means to improve the thermo-tolerance of broilers in hot humid environment. Though vitamin C is not a dietary requirement, the requirement is increased at higher temperature. So, extra supplementations of vitamin C is needed to meet up additional requirements (Asaduzzaman, 2000).

Electrolyte supplementation has been reported to maintain acid base balance and thus improve performance of broiler rearing in a hot environment (Balnave and Gorman, 1993). Supplementation of Vitamin C and electrolyte in poultry diet is not normally practiced in Bangladesh. The essentialities of Vitamin C and electrolyte have been received attention of the nutritionists very recently. It is not quite known as to whether significant benefits or cost effective production could be derived if broiler diet are supplemented with Vitamin C and electrolyte during heat stress. The current study was aimed at to investigate the effects of Vitamin C and electrolyte supplementation on growth and meat yield of broilers in a hot humid environment.

Material and Methods

The experiment was conducted at Bangladesh Agricultural University poultry farm, with 60 Cobb 500 straight run day old broilers up to 35 days of age. The chicks were procured from the dealer of Kazi Farms Limited, at Shadeshi Bazar, Mymensingh. Commercial poultry feed Quality Feeds Limited, was brought from Sreepur, Gazipur. They were fed *ad libitum* on a basal starter diet (containing11% moisture, 245g/kg crude protein, 50g/kg fat, 40g/kg crude fibre, 14g/kg lysine, 6.5g/kg methionine, 12g/kg calcium, 7.5g/kg available phosphorus and 15.11 MJ metabolizable energy) up to 12 days of age. Thereafter, they

were fed on a grower diet (containing 11% moisture, 240g/kg crude protein, 50g/kg fat, 40g/kg crude fibre, 14g/kg lysine, 6g/kg methionine, 12g/kg calcium, 7.5g/kg available phosphorus and 14.65 MJ metabolizable energy) on *al libitum* basis. Sixty day old broilers were divided into 4 treatment groups having 3 replications in each and 5 chicks per replication. One group of chicks was maintained as control, second group received 135ppm Vitamin C, third group received 1250ppm electrolyte and fourth group received 135ppm Vitamin C + 1250ppm electrolyte respectively as supplement. Four treatments were distributed in a Completely Randomized Design (CRD). Data were collected on body weight, feed consumption and survivability for each replication. Temperature and relative humidity were recorded every 4 hours. The minimum, maximum and mean of temperature were 24^0C, 34^0C and 29^0C. While the minimum, maximum and mean of relative humidity were 70%, 96% and 83% throughout the experimental period. The body weight gains and feed conversion of broilers in each replication were calculated. At the end of the experiment, 1 male and 1 female broiler weighing average of each replication were selected and slaughtered. The birds were scalded, eviscerated and dissected to determine meat yield following the procedure of Jones (1984). Before statistical analysis, data on all meat yield parameters were converted into percentage of respective live weight.

Data were statistically analyzed in a Completely Randomized Design (CRD). Significant differences among treatments if any were identified using Least Significant Difference (Genstat 5 procedure, 1997).

Results and Discussion

Table 1 shows the results of growth performance of broiler. The data in this table indicate that the feed intake, live weight, feed conversion and survivability did not differ statistically (P>0.05) due to addition of either Vitamin C or electrolyte in drinking water. However, feed cost per broiler and feed cost per kg broiler increased (P<0.01) for the addition of Vitamin C and electrolyte. Additional feed cost /broiler and per kg broiler were 17.06, 10.40 and 27.80% and 20.92, 9.96 and 33.79% higher in Vitamin C, electrolyte and Vitamin C + electrolyte supplemented groups, respectively over the control

Similar (P>0.05) feed intake recorded in broilers received different levels of Vitamin C and electrolyte contradict some previous findings (Vathana *et al*. 2002; Takahashi and Akiba, 2000; Tanveer *et al*. 2005; Saha *et al.* 2000 and Branton *et al*. 2004). They showed that supplementation of Vitamin C and electrolyte in drinking water or feed @ 500-3150 ppm and 300-350 meq/kg increased feed intake. However, the result was in agreement with Taweli and Kassab (1990). They showed that administration of VitaminC in feed did not change feed intake. It was assumed that supplementation of Vitamin C and electrolyte together in drinking water was not useful in respect of feed intake. There was no difference (P>0.05) in body weight gain among broilers received different levels of Vitamin C and electrolyte in drinking water (Table 1). This result was differed from those of Lohakare *et al*. 2005; Villar-Patino *et al*. 2002; Pirompud *et al*. 2005; Rezaei *et al*. 2004 and Tanveer *et al*. 2005. Earlier workers observed that addition of Vitamin C and electrolyte in drinking water or feed @ 300-1500 ppm and @ 130-1000 meq/kg improved body weight. Doan (2000) and Bonsembinate *et al*. (2002) agreed with the result of the current study. They showed that addition of Vitamin C and electrolyte in drinking water or feed did not alter growth of broilers. No difference (P>0.05) was found in feed conversion for broilers receiving Vitamin C and/or electrolyte through drinking water (Table 1). This result was dissimilar with Mirsnamsollahi *et al*. 2003; Tanveer *et al*. 2005; Soleiman, and Zulkifli 2010 and Draslarova *et al*. 2000; Raja and Qureshi, 2000. They concluded that addition of Vitamin C and electrolyte in drinking water or feed @150-500 ppm and 500 meq/kg improved feed conversion of broilers. Whereas, Villar-Patino *et al*. (2002) showed that Vitamin C in diet lowered feed conversion. Despite similar feed intake, live weight and feed conversion observed in groups received Vitamin C and electrolyte increased feed cost/broiler by 17.06, 10.40 and 27.80% in Vitamin C, electrolyte & Vitamin C + electrolyte supplemented groups respectively than that of control. Feed cost/kg broiler was increased by 20.92, 9.96 and 33.79% in Vitamin C, electrolyte and Vitamin C + electrolyte supplemented groups respectively than the control. Profit/broiler and per kg broiler were 1.5 and 0.5% higher in electrolyte supplement groups over the control. This may have been due to lower cost of electrolyte. Profit/broiler and per kg broiler were 4.7 & 6.6 and 1.6 & 2.09% lower in Vitamin C and Vitamin C + electrolyte supplement groups respectively over the control. Highest cost in Vitamin C receiving group might have resulted lower profitability.

Table 1. Growth performance of broilers supplied Vitamin C and electrolyte in drinking water in a hot humid environment

Variable	Treatments				SED	Level of significance
	0	135 ppm Vitamin C	1250 ppm Electrolyte	135 ppm Vitamin C +1250ppm Electrolyte		
Initial weight (g/broiler)	53.20	52.23	53.60	53.00	0.78	NS
Feed intake (g/broiler)	3047.00	3009.00	3004.00	2977.00	53.2	NS
Live weight (g/broiler)	1737.00	1683.00	1740.00	1657.00	74.2	NS
FCR (g feed/g gain)	1.757	1.793	1.727	1.797	0.0716	NS
Feed cost Tk/broiler	81.65^{d}	95.58^{b}	90.14^{c}	104.35^{a}	1.427	**
Feed cost Tk/kg broiler	47.11^{c}	56.99^{b}	51.80^{b}	63.03^{a}	2.210	**
Profit/broiler	30.25^{c}	11.74^{b}	32.70^{a}	7.25^{b}	1.23	**
Profit/kg broiler	17.42^{b}	6.98^{c}	18.50^{a}	4.38^{c}	0.98	**
Mortality (%)	0	0	0	0	0.02	NS

NS=P>0.05, **=P<0.01, SED= Standard Error Deviation. All SED's are against 8 error degrees of freedom; ^{abc}mean values in the same row bearing different superscripts are significantly different.

Dressing yield, total, breast and wing meat were higher in groups received Vitamin C in drinking water than those obtained on control, electrolyte and Vitamin C + electrolyte supplemented groups (Table 2). No significant difference (P>0.05) in the proportion of breast: dark meat, thigh meat, drumstick meat and abdominal fat were obtained for the administration of Vitamin C, electrolyte and Vitamin C + electrolyte. Higher dressing yield, total meat, breast and wing meat yield were observed (Table 2) in broilers receiving Vitamin C (135 ppm) coincide with Pisarski *et al*. 2003; Lohakare *et al*. 2004; Mbajiorgu *et al*. 2007 and Bonsembinate *et al*. 2002. They showed that supplementation of Vitamin C through feed or water increased breast meat, dressing yield as well as total meat yield. Total meat yield was 14.08 and 3.88% higher in Vitamin C and electrolyte, but 0.54% lower in Vitamin C + electrolyte supplied groups over the control. Dressing yield was 6.71 and 3.33% higher in Vitamin C and electrolyte, but 1.55% lower in Vitamin C + electrolyte supplied groups than the control. Breast and wing meat yield were 16.09 and 8.34% higher in Vitamin C supplied groups over control. In Vitamin C receiving groups, females had 0.8 and 0.9% higher wing and total meat yield than that of males. On the other hand, wing and total meat yield were 0.42 and 4.24% higher in males received electrolyte. Drumstick bone yield was 1.8 and 1.7% higher in the Vitamin C and electrolyte consuming groups respectively.

Table 2. Meat yield characteristics of broilers at different treatments

Variable	Treatments				SED	Level of significance
	0	135ppm VitaminC	1250ppm Electrolyte	135ppmVitamiC+ 1250ppmElectrolyte		
Live weight (g/broiler)	1858	1725	1917	1850	87.6	NS
Dressing yield (%)	64.52	68.85	66.67	63.52	1.585	*
Total meat (%)	35.08	40.02	36.44	34.89	1.238	**
Breast meat (%)	17.03	19.77	17.10	17.10	0.691	**
Breast : Dark meat	0.94	0.98	0.89	0.97	0.056	NS
Thigh meat (%)	8.27	9.25	9.07	8.27	0.587	NS
Drumstick meat(%)	5.56	5.84	5.87	5.12	0.419	NS
Wing meat (%)	3.66	3.96	3.55	3.03	0.257	*
Abdominal fat (%)	1.08	0.87	1.14	0.88	0.196	NS

NS=P>0.05; *= P<0.05; **= P<0.01; all SED's are against 16 error degrees of freedom.

From the apparent results, it was concluded that Vitamin C and electrolyte sometimes may not be useful in improving growth performance. The data imply that some improvement in meat yield of broiler may be obtained for the supplementation of Vitamin C in drinking water. In this current study, broilers were sold alive. Therefore, quantification of increased meat yield was not possible. So, further investigation is needed by selling dressed broiler instead of alive.

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