EFFECTS OF ASCORBIC ACID AND ACETYLSALICYLIC ACID SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKS EXPOSED TO HEAT STRESS

Bilal Anwar, Shakil Akhtar Khan, Asim Aslam, Azhar Maqbool, Kashif Aziz Khan

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B. Anwar, S. A. Khan, A. Aslam, A. Maqbool[1] and K. A. Khan
Department of Pathology, [1]Department of Parasitology,
University of Veterinary and Animal Sciences, Lahore-54000, Pakistan

ABSTRACT

A total of 100, day-old broiler chicks were randomly divided into 5 equal groups and kept under elevated temperature (93-97°F) to see the effect of ascorbic acid and acetylsalicylic acid on the feed conversion ratio (FCR), immune status and ratio of weight of bursa, thymus and spleen to body weight. Heat stress increased the FCR but decreased the immune response and ratio of bursa, thymus and spleen to body weight of the birds. Ascorbic acid and acetylsalicylic acid supplementation during heat stress had beneficial effects on FCR, immune status and ratio of bursa, thymus and spleen to body weight. Grossly, bursa, thymus and spleen of heat stressed birds were atrophied but in ascorbic acid and acetylsalicylic acid supplemented birds these organs were not atrophied. No specific histopathological changes were observed in all groups.

Key words: Ascorbic acid, acetylsalicylic acid, heat stress, chicks

INTRODUCTION

Heat stress is one of the most important factors adversely affecting overall poultry production in the tropics. In Pakistan, temperature remains well beyond the higher side of thermoneutral zone for the greater part of the year and adverse effects of heat make poultry production a difficult and uneconomical pursuit (Yaqoob, 1966). It is generally agreed that heat stress reduces body weight (Lecui *et al.*, 1998), immune response (Savic *et al.*, 1993) and also causes mortality (Ridell, 1997).

Different therapeutic agents are used to mimimize the harmful effects of heat stress on the performance of broiler chicks. These include ascorbic acid (Cier *et al.*, 1992), vitamins B-complex (Bashir *et al.*, 1998), vitamin E (Williams, 1996), acetylsalicylic acid (Stilborn *et al.*, 1988), sodium chloride (Smith, 1994), potassium chloride, potassium carbonate, ammonium chloride (Teeter and Smith, 1986) and sodium bicarbonate (Branton *et al.*, 1986).

The purpose of the present study was to determine the role of combined ascorbic acid and acetylsalicylic acid (Sb-Asper-C) treatment in minimizing the negative effects of heat stress on the performance of broiler chicks.

MATERIALS AND METHODS

One hundred day-old broiler chicks were divided into five groups, designated as A, B, C, D and E, containing 20 birds each, on 14th day of age. Group A acted as control and was neither subjected to heat stress nor supplemented with Sb-Asper-C. This group was kept at 90, 85, 80, 75, 70 and 65°F during 1st, 2nd, 3rd, 4th, 5th and 6th week of age, respectively. Groups B and C were subjected to 93-97°F environmental temperature without and with supplementation of Sb-Asper-C, respective-ly, only during 3rd and 4th week of age. Birds of these two groups were kept at 90, 85, 70 and 65°F during 1st, 2nd, 5th and 6th week of age, respectively. Groups D and E were subjected to 93-97°F environmental temperature without and with supplementation of Sb-Asper-C, respective-ly, only during 5th and 6th week of age. These groups were kept at 90, 85, 80 and 75°F during 1st, 2nd, 3rd and 4th week of age, respectively. All the birds were vaccinated against Newcastle disease (ND) virus (Lasota strain) on days 1 and 14.

Feed conversion ratio (FCR) was calculated on 42nd day of age. Geometric mean haemagglutination inhibition (GMHI) titres were determined on days 1, 14, 28 and 42 (Thayer and Beard, 1998). Five birds from each group were slaughtered on days 28 and 42 of age

for pathological examination of bursa, thymus and spleen. Bursa/body weight ratio (BBWR), thymus/body weight ratio (TBWR) and spleen/body weight ratio (SBWR) were also calculated on days 28 and 42 (Lecui *et al.,* 1998). The data thus collected was analysed statistically applying one-way analysis of variance (Steel and Torrie, 1982).

RESULTS AND DISCUSSION

In this study, the birds of group A which were not exposed to heat stress had better FCR than birds of groups B, C, D and E which were exposed to heat stress (Table 1). It shows heat stress apparently increased the FCR. This finding is similar to Pardue *et al.* (1985) and Sahota *et al.* (1998), who reported that heat stress increased FCR. On the other hand, Stilborn *et al.* (1988) reported that FCR was not affected by heat stress.

The group C, which was subjected to heat stress and supplemented with Sb-Asper-C only during 3rd and 4th week of age, had better FCR (1.44) than group B (1.57), which was subjected to heat stress only and was not given any supplementation (Table 1). Similarly, the group E, which was subjected to heat stress and supplemented with Sb-Asper-C only during 5th and 6th week of age, had better FCR (1.59) than group D (1.90) which was subjected to heat stress only and was not given any supplementation. It appears that improvement in FCR of birds of C and E groups was due to ascorbic acid and acetylsalicylic acid supple-mentation. Our findings are not supported by those of Stilborn *et al.* (1988), who reported that ascorbic acid and acetylsalicylic acid had no beneficial effect on FCR. Sahota *et al.* (1992) and Njokue (1986) reported that ascorbic acid improved FCR. Similarly, Sharma and Bhatti (1998) reported that asprin improved FCR in pullets exposed to heat stress.

The GMHI titre against ND virus on days 28 and 42 of group A, which was not exposed to heat stress, was higher than groups B, C, D and E, which were exposed to heat stress (Table 1). It indicates that heat stress reduced the immune response, which is supported by Mikec (1990) and Savic *et al.* (1993). However, Muneer *et al.* (1998) reported that at high temperature immune response of broiler chickens was increased.

On days 28 and 42, the GMHI titre of group C, which was subjected to heat stress and supplemented with Sb-Asper-C only during 3rd and 4th weeks of age, was higher ($p<0.05$) than group B which was subjected to heat stress only (Table 1). Similarly, GMHI titre of group E, which was subjected to heat stress along with Sb-Asper-C supplementation during 5th and 6th weeks of age, was higher ($p<0.05$) than group D which was subjected to heat stress only. This higher GMHI titre was probably due to supplementation of ascorbic acid and acetylsalicylic acid. These finding are similar to those of Tuekam *et al.* (1994), who observed a positive correlation between antibody titre and ascorbic acid supplementation.

On day 28, the mean value of BBWR of group B, which was exposed to heat stress, was significantly lower ($P <0.05$) than group A that was not exposed to heat stress (Table 2). The differences in BBWR among all other groups were non-significant. On day 28, there was no difference in TBWR and SBWR among birds of five groups (Table 2). Guyton and Hall (1997) also reported that heat stress increased cortisol secretion, which in turn caused atrophy of lymphoid tissue.

The mean SBWR of group D was not significantly different form group A on day 28 but it was significantly lower than group A on day 42 due to atrophy of spleen. This might be due to more predisposition of spleen to heat stress during 5th and 6th week of age. On day 42, the mean value of TBWR of group D, which was exposed to heat stress, was significantly lower ($P<0.05$) than group A, which was not exposed to heat stress (Table 2). This finding is similar to that of Lecui *et al.* (1998). On the other hand, Muneer *et al.* (1998) reported that mean thymic weight was increased at high temperatures.

These results indicate that on day 28, only the bursa of group B, while on day 42, only the thymus and spleen of group D showed atrophy. The bursa of all other groups was normal in size. No change in colour

Table 1: Feed conversion ratio (FCR) and geometric mean haemagglutination inhibition (GMHI) titre against Newcastle disease virus in birds of five groups

Groups	FCR on day 42	GMHI titre (log 2) on day 1	14	28	42
A	1.40	5.25 [a]	7.0 [a]	7.38 [a]	4.75 [a]
B	1.57	5.25 [a]	7.0 [a]	5.25 [b]	3.88 [b]
C	1.44	5.25 [a]	7.0 [a]	6.38 [c]	4.13 [a]
D	1.90	5.25 [a]	7.0 [a]	7.31 [d]	2.50 [c]
E	1.59	5.25 [a]	7.0 [a]	7.35 [a]	3.0 0 [d]

Mean values having different superscripts within a column differ significantly ($P<0.05$).

Table 2: Mean (+ S E) organ:body weight ratio on days 28 and 42 in birds of five groups

Day	Organs	Group A	Group B	Group C	Group D	Group E
28	Bursa	$1.512^{a} \pm 0.145$	$0.995^{b} \pm 0.086$	$1.307^{ab} \pm 0.204$	$1.505^{a} \pm 0.145$	$1.508^{a} \pm 0.145$
	Thymus	$3.467^{a} \pm 0.497$	$2.989^{a} \pm 0.309$	$3.056^{a} \pm 0.338$	$3.458^{a} \pm 0.499$	$3.463^{a} \pm 0.498$
	Spleen	$0.698^{a} \pm 0.054$	$0.517^{a} \pm 0.055$	$0.548^{a} \pm 0.106$	$0.692^{a} \pm 0.056$	$0.695^{a} \pm 0.055$
42	Bursa	$0.597^{a} \pm 0.136$	$0.488^{a} \pm 0.071$	$0.536^{a} \pm 0.046$	$0.306^{a} \pm 0.073$	$0.419^{a} \pm 0.110$
	Thymus	$1.902^{a} \pm 0.174$	$1.573^{a} \pm 0.236$	$1.737^{a} \pm 0.231$	$0.778^{b} \pm 0.064$	$1.351^{ab} \pm 0.246$
	Spleen	$0.829^{a} \pm 0.102$	$0.709^{a} \pm 0.107$	$0.780^{a} \pm 0.066$	$0.399^{b} \pm 0.103$	$0.648^{ab} \pm 0.101$

Mean values bearing different superscripts within a row differ significantly ($P<0.05$).

and consistency was seen. There were no haemorrhages and congestion in bursa, thymus and spleen of any group.

No histological changes were observed in bursa and spleen of any group on day 28 or 42. On the other hand, Shubai *et al.* (1999) observed oedema, atrophy and necrosis on microscopic examination of bursa and spleen of heat stressed chickens. On day 28 and 42, no histological changes were observed in thymus. Similarly, Shubai *et al.* (1999) observed no histopathological change in thymus of heat stressed birds.

This study indicated that ascorbic acid and acetylsalicylic acid (Sb-Asper-C) supplementation during heat stress had beneficial effects on FCR, serum antibody development and ratio of weight of bursa, thymus and spleen to body weight of heat-stressed birds. It is concluded from this experiment that the Sb-Asper-C (containing ascorbic acid and acetylsalicylic acid) has expressed itself as an anti-heat stressor and an immunopotentiating agent under heat stress conditions in broiler chicks.

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