EFFECT OF DIETARY VITAMIN SUPPLEMENTS ON PRODUCTIVITY AND PHYSIOLOGICAL PARAMETERS OF BROILER CHICKENS EXPOSED TO ELEVATED AMBIENT TEMPERATURE

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Introduction

Room temperature is a component of microclimate and has a significant effect on the productivity and health of broiler chickens, and thus on the profitability of poultry production. It is generally assumed that rearing temperature should be approximately 33°C on the first day and be gradually decreased to approximately 20°C at 6 weeks of age (Leenstra and Cahaner, 1991).

Too low or too high ambient temperature is highly undesirable during rearing of broiler chickens. Elevated temperature reduces the intake of feed and body weight of broilers (Özkan et al., 2003).

Balnave and Brake (2002) and Whitehead and Keller (2003) report that nutritional modifications can be used to influence productivity, health and physiological processes occurring in the body of broilers reared in elevated ambient temperatures.

Therefore, the aim of this study was to determine the effect of supplementing vitamins C and E to feed on productivity and physiological indicators of broilers exposed to elevated ambient temperature between 18-21 and 37-40 days of age.

Material and methods

A total of 540 broiler chickens were allotted to 3 groups.

In groups I and II, at 18-21 and 37-40 days of age, temperature in the rearing area of the chickens was 10°C higher than recommended (Leenstra and Cahaner, 1991).

In group III (control), birds were reared under recommended thermal conditions (Leenstra and Cahaner, 1991).

Birds were fed standard diets, and from 1 to 21 days of age group II received a dietary supplement of vitamin C (40 mg/1 kg feed) and vitamin E (70 mg/1 kg feed).

The experimental groups were kept in batteries of cages in separate, air-conditioned rooms.

Throughout the experiment, individual body weight and mortality of the chickens were monitored. Prior to and after the application of the treatment factor, 10 birds from each group were measured for rectal temperature and blood samples were taken to determine the levels of haematocrit, glucose and the immunoglobulin complex.

The results were analyzed statistically using variance analysis and significant differences were estimated with Duncan's multiple range test.

Results

No statistically significant differences were found between the groups in body weight of the birds or in feed conversion per kg body weight (Tab. 1). The only effect of supplementing feeds with vitamins C and E was that broiler mortality decreased in group II compared to broilers in group I and in the control group (Tab. 1).

In group I a statistically significant, and in group II a significant and highly significant increase in rectal was observed after the experimental factor was applied (Tab. 2).

In group I, heamatocrit was found to decrease significantly on day 21, and glucose level to increase both at 21 and 40 days of rearing (Tab. 3). In group I, there was also a highly significant decrease in the level of immunoglobulins after the application of the treatment factor on day 21 of age. In group II, there was a statistically significant decrease in the level of immunoglobulins at 21 days of rearing only (Tab. 3).

Discussion

High rearing temperature of broiler chickens is detrimental to their productivity (Temim et al., 2000). Sosnowka-Czajka et al. (2003) report that ascorbic acid offsets the negative effects of stress factors on the avian body and may help to improve performance. Williams (1997) claims that vitamin E is the best feed supplement that eliminates the negative effects of heat stress in poultry. However, our study did not confirm the effect of vitamin supplements on body weight of chickens or on feed conversion. Faria et al. (1999) also failed to confirm the effect of vitamin C on improved productivity of chickens kept at elevated ambient temperature. However, we observed a beneficial effect of vitamins C and E on health status of the birds.

In birds of both group I and II, a significant increase in rectal temperature was found after the application of the experimental factor, while biochemical parameters of blood were observed to change mainly in group I, in which elevated ambient temperature and a feed supplemented with no vitamins were used. The observed changes in biochemical indicators are the response of an organism to heat stress and are in agreement with the findings of Whitehhead and Keller (2003). The increased rectal temperature under heat stress points to body hyperthermia and excessive adaptative limit of the thermoregulatory system to maintain stable internal temperature. This is supported by the studies of Sosnowka-Czajka and Herbut (2001).

Conclusion

The dietary supplements of vitamin C (40 mg/kg) and vitamin E (70 mg/kg) in the present trial did not increase the tolerance of broilers to high ambient temperatures and failed to offset the negative effects of hypertension. Broiler chickens from group II, although they were given a feed supplemented with vitamins C and E, did not maintain constant rectal temperature after the treatment factor was applied. A greater stability of blood biochemical components was observed in group II compared to group I.

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Tab. 1. Production results of 42-day-old broiler chickens

Item	Group		
	I	II	III
Body weight (g)	2145.57 ± 30.83	2125.91 ± 34.36	2178.26 ± 25.93
Feed conversion per kg weight gain (g)	1881.67 ± 27.00	1821.67 ± 27.86	1886.67 ± 31.48
Mortality (%)	5.55	2.22	3.33

Tab. 2. Rectal temperature (°C) of broiler chickens

Day of rearing	Group		
	I	II	III
18-X	41.36 ± 0.08 a	41.57 ± 0.07 a	41.51 ± 0.05
21-Y	41.78 ± 0.12 b	41.95 ± 0.09 b	41.39 ± 0.12
37-X	41.72 ± 0.07 a	41.68 ± 0.08 A	41.51 ± 0.13
40-Y	42.28 ± 0.11 b	42.35 ± 0.14 B	41.30 ± 0.08

Tab. 3. Serum levels of haematocrit, glucose and immunoglobulins in broiler chickens

Item	Day of rearing	Group		
		I	II	III
Haematocrit (%)	18-X	34.00 ± 0.79 a	31.71 ± 1.08	33.00 ± 0.90
	21-Y	30.86 ± 0.63 b	33.71 ± 0.42	34.14 ± 0.74
	37-X	31.00 ± 0.85	31.71 ± 0.99	30.71 ± 0.52
	40-Y	30.57 ± 1.07	31.29 ± 0.86	31.43 ± 1.76
Glucose (mmol/l)	18-X	12.32 ± 0.42 a	13.05 ± 0.37	14.19 ± 0.62
	21-Y	14.38 ± 0.74 b	14.77 ± 0.42	14.07 ± 0.40
	37-X	13.22 ± 0.79 a	14.79 ± 0.38	14.49 ± 0.45
	40-Y	15.37 ± 0.73 b	15.01 ± 0.53	14.35 ± 0.36
Immunoglobulins (g/l)	18-X	13.56 ± 0.34 A	12.64 ± 0.23 a	12.44 ± 0.16
	21-Y	12.03 ± 0.19 B	11.54 ± 0.30 b	12.19 ± 0.27
	37-X	11.67 ± 0.31	12.04 ± 0.23	11.90 ± 0.36
	40-Y	11.47 ± 0.24	11.59 ± 0.38	11.50 ± 0.32

X – before the treatment factor was applied
Y – after the treatment factor was applied
a,b – VALUES IN COLUMNS MARKED WITH DIFFERENT LETTERS DIFFER SIGNIFICANTLY ($P \leq 0.05$)
A,B – VALUES IN COLUMNS MARKED WITH DIFFERENT LETTERS DIFFER HIGHLY SIGNIFICANTLY ($P \leq 0.01$)