Effects of dietary sodium bicarbonate on some physiological parameters in Hisex Brown layers reared under high environmental temperature

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Laying hens use evaporative cooling through panting as an important tool in heat dissipation in high ambient temperatures. Excessive hyperthermic panting can cause respiratory alkalosis (Kohne and Jones 1975), and during thermal stress the sodium:chloride ratio in blood plasma will decrease resulting in blood alkalosis. In order to balance this ratio a dietary sodium source not containing chloride such as sodium bicarbonate ($NaHCO_3$) can be used to alleviate the adverse effects of heat stress (Branton *et al*. 1986). This study evaluated the effects of a dietary $NaHCO_3$ supplement on red blood cells (RBC), packed cell volume (PCV), heterophil to lymphocyte ratio (H/L), haemoglobin (Hb), total plasma protein, plasma glucose and total uric acid.

Four diets containing 0, 0.5, 1.0 and 1.5% $NaHCO_3$ were given for four weeks to 50–week old Hisex Brown layers (40 birds per diet) reared in an environment with daytime temperatures in the range of 32–38°C. Blood samples were collected from the brachial vein of 10 birds in each treatment. RBC (Table 1) was significantly lower ($P<0.05$) in the control treatment compared to those with added sodium bicarbonate The addition of 1 and 1.5% $NaHCO_3$ had no effects on PCV, Hb and total plasma protein, but all were significantly greater with the 0.5% inclusion. The addition of $NaHCO_3$ significantly reduced plasma glucose and plasma uric acid of birds in comparison to those fed the control diet.

These findings indicate that when Hisex Brown layers are reared in high temperatures, there are positive physiological responses to the inclusion of $NaHCO_3$ in their diet. It can be concluded that 0.5% $NaHCO_3$ was sufficient to induce favourable changes that counteract the adverse effects of cyclic heat stress.

Branton, S.L., Reece F.N. and Deaton, J.W. (1986). The use of ammonium chloride and sodium bicarbonate in acute heat stress of broilers. *Poultry Science* 65, 1659–1663.

Kohne H.J. and Jones J.E. (1975). Acid–base balance, plasma electrolytes and production performance of adult turkey hens under conditions of increasing ambient temperature. *Poultry Science* 54, 2038–2045.

Table 1 Blood picture of Hisex Brown layers in high ambient temperature given a diet without and with additions of $NaHCO_3$

	Treatments			
	Control (C)	**C+0.5% $NaHCO_3$**	**C+1% $NaHCO_3$**	**C+1.5% $NaHCO_3$**
RBC[1] (million/m^3)	2.45 ± 0.02 ^{C}	2.74 ± 0.03 ^{A}	2.53 ± 0.02 ^{B}	2.53 ± 0.04 ^{B}
PCV[2] (%)	29.8 ± 1.04 ^{B}	36.50 ± 0.87 ^{A}	30.39 ± 0.96 ^{B}	31.22 ± 0.88 ^{B}
Hb[3] (g/100 mL)	8.0 ± 0.41 ^{B}	11.83 ± 0.58 ^{A}	9.17 ± 0.47 ^{B}	9.06 ± 0.65 ^{B}
H/L ratio	0.34 ± 0.01 ^{A}	0.26 ± 0.01 ^{D}	0.30 ± 0.01 ^{B}	0.28 ± 0.01 ^{C}
Plasma glucose (mg/100 mL)	194.2 ± 2.20 ^{A}	175.4 ± 2.50 ^{B}	180.4 ± 2.20 ^{B}	179.8 ± 2.40 ^{B}
Plasma protein	2.7 ± 0.07 ^{B}	3.0 ± 0.03 ^{A}	2.8 ± 0.03 ^{B}	2.8 ± 0.03 ^{B}
Plasma uric acid (mg/100 mL)	10.8 ± 0.30 ^{A}	7.3 ± 0.30 ^{C}	8.4 ± 0.30 ^{B}	8.2 ± 0.50 ^{BC}

[1] Red blood cell (RBC), [2] Packed cell volume (PCV), [3] Haemoglobin (Hb)
Values in the same rows having different superscript are significantly different (*P*<0.05)