INFLUENCE OF FASTING DURATION ON BODY TEMPERATURE AND SURVIVAL OF BROILERS EXPOSED TO ACUTE HEAT STRESS

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Story in Brief

Two experiments were conducted to investigate the effect of feed consumption and ambient temperature on the broiler's body temperature and ability to survive acute heat stress. Feed was withdrawn at various times from 24 hours prior to heat stress initiation to 4 hours after the onset of heat stress. Fasting chickens prior to acute heat stress increased survival with greater survival being exhibited by birds fasted for longer periods of time. Fasting birds after the onset of heat stress had no effect on survival. Feed consumption was associated with elevated body temperature. These data indicate that feed restriction from 0 to 24 hours prior to the onset of life threatening acute heat stress reduces mortality, while feed restriction after the onset of acute heat stress has limited value.

(Key Words: Fasting, Body Temperature, Heat Stress, Survival.)

Introduction

One consequence of high ambient temperature and relative humidity stress is the dramatic reduction of broiler survival, presumably due to hyperthermia. Total body heat load during thermal stress is a combination of heat from the environment and metabolic heat produced as a result of food consumption. Fasting broilers prior to or during heat stress could reduce total heat load and hence increase survival. Kohne et al. (1973) fasted adult female turkeys 24 hours prior to the onset of acute heat stress and determined that fasting enhanced survival time by 10 minutes. These researchers suggested that turkeys with feed available ad libitum have a lower lethal body temperature than their fasted counterparts. McCormick et al. (1979) found that chicks fasted for 24, 48 or 72 hours prior to heat stress initiation showed increased survival when exposed to 6 hours of acute heat stress.

The objective of this study was to determine the influence of feed withdrawal time on body temperature and survival of broiler chickens exposed to acute heat stress.

Materials and Methods

Arbor Acre x Vantress chicks were raised on rice hull litter and fed a corn-soybean meal starter diet for the first six weeks post-hatching. On the first day of the sixth week, birds were sexed, weighed and randomly allotted to treatments within an environmental chamber under continuous lighting. Six chicks (3 males, 3 females) were housed in each wire floored battery compartment and compartments were randomly assigned to treatment groups (10 replicates per treatment). Week six

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was used to adapt birds to test rations (Table 1) and to gradually alter environmental conditions to cycle between 26.6 and 35 C. These growth-limiting conditions were maintained until the first day of week seven, when the upper limit of the cycling temperature was increased to 38.8 C such that survival was threatened. Water consumption from a continuously available common source was monitored. Body temperature was monitored by inserting the probe of an electronic thermometer into the cloaca for 30 seconds.

The first experiment evaluated the relationship between fasting duration prior to stress initiation and the chicken's ability to survive acute heat stress. Birds were fasted for 24, 12, 6 or 0 hours prior to life threatening heat stress (38.8 C and 55% relative humidity). Percent survival, feed consumption and water consumption were recorded for 24 hours after the initiation of heat stress.

In order to further define the effect of feed withdrawal on broiler survival, additional fasting times were evaluated in the second experiment. Feed was removed at 12, 6 and 3 hours prior to the onset of heat stress, at heat stress initiation, and at 2, 3 and 4 hours after. Body temperature was measured at 3 hours before the onset of heat stress and at 2 and 4 hours after. Percent survival, feed consumption and water consumption were monitored as before.

Table 1. Composition of the grower ration used in experiments 1 and 2.

Ingredient	Numerical Name[1]	%
Ground Corn	4-02-931	57
Soybean Meal (44%)	5-04-604	22
Fish Meal (Menhaden)	5-02-009	9
Tallow	4-08-127	5
Ground Alfalfa	1-00-023	2.7
Dicalcium Phosphate	6-01-080	2.5
Calcium Carbonate	6-01-069	.9
Vitamin Mix[2]	--	.4
Salt	6-14-013	.3
Trace Mineral Mix[3]	--	.1
D-L-Methionine	--	.1

[1]Atlas of Nutritional Data on United States and Canadian Feeds.

[2]Mix contained Vit. A, 3,527,360 I.U.; Vit D_3, 1,322,760 I.U.; Vit E, 11,905 I.U.; Vit B_{12}, 3.5 mg; Riboflavin 2,205 mg; Niacin 6614 mg; d-Panthothenic Acid, 7055 mg; Choline, 176,368 mg; Menadione, 291 mg; Folic Acid, 441 mg; Pyridoxine, 882 mg; Thiamine, 882 mg; d-Biotin, 44 mg per Kg.

[3]Mix contained Manganese, 12.0%; Zinc, 8.0%; Iron, 6.0%; Copper, 1.0%; Iodine, .1%; Calcium, 18%.

Results and Discussion

Fasting birds prior to acute heat stress increased survival (Table 2). The earlier the time of fasting commenced, the greater the survival in both experiments. Feed consumption (Table 3) was invariably greater when feed continued to be present. Thus, though broilers will reduce

Table 2. Effects of feed withdrawal time on broiler ability to survive acute heat stress (experiments 1 and 2).

Time of feed withdrawal relative to stress initiation[1]	Ambient temperature at feed withdrawal	Survival (%) Experiment 1	Survival (%) Experiment 2
not withdrawn	--	51.6^{b}	45.2^{d}
4 hr after	38.8	--	48.7^{cd}
3 hr after	36.6	--	49.0^{cd}
2 hr after	35.0	--	48.7^{cd}
0	32.2	--	60.2^{bc}
3 hr before	26.7	--	67.7^{ab}
6 hr before	26.7	80.0^{a}	70.0^{ab}
12 hr before	26.7	86.7^{a}	81.7^{a}
24 hr before	26.7	92.0^{a}	--

[1]Heat stress was defined as an environment providing 32.2 C and 55% relative humidity.

[abcd]Means within an experiment with unlike superscripts differ ($P<.05$).

Table 3. Effects of feed withdrawal time on broiler feed and water consumption 24 hr prior to acute heat stress exposure.

Duration of Feed withdrawal Relative to Stress Initiation[1]	Cumulative Feed Consumption (g)/chick Exp. 1	Cumulative Feed Consumption (g)/chick Exp. 2	Cumulative Water Consumption (g)/chick Exp. 1	Cumulative Water Consumption (g)/chick Exp. 2
not withdrawn	192^{a}	181^{a}	1021	820
4 hr after	--	133^{b}	--	705
3 hr after	--	117^{b}	--	673
2 hr after	--	113^{b}	--	688
0	--	100^{bc}	--	620
3 hr before	--	85^{bc}	--	537
6 hr before	117^{b}	71^{bc}	643	560
12 hr before	67^{c}	42^{c}	545	567
24 hr before	0^{d}	--	454	--

[1]Heat stress was defined as an environment providing 32.2 C and 55% relative humidity.

[abcd]Means within a column with unlike superscripts differ ($P<.05$).

feed consumption in response to long-term heat stress, their ability to adapt to acute stress appears limited. Voluntary water consumption decreased with increasing fasting time and also with reduced feed consumption, despite its continuous availability. Feed consumption was associated with elevated body temperature (Table 4) and appeared additive with high environmental temperature.

The data reported in this study suggest that feed consumption and elevated ambient temperature increase body temperature of broilers and that the effects of feed consumption and high environmental temperature on body temperature are additive. Although it appears that fasting lowers body temperature, reduces water consumption and increases the ability of broiler chickens to survive acute heat stress, it must be recognized that other metabolic alterations such as ketoacidosis may be involved.

Table 4. Effects of feed withdrawal on broiler body temperature (C) in experiment 2.

Time of Feed withdrawal relative to stress initiation	Body temperature measurement relative to heat stress[1]		
	3 hr before	2 hr after	4 hr after
not withdrawn	40.3^{fg}	41.3^{cd}	42.6^{a}
4 hr after	40.2^{g}	41.3^{cd}	42.5^{a}
3 hr after	40.2^{g}	41.3^{cd}	42.4^{a}
2 hr after	40.4^{efg}	40.7^{e}	41.7^{b}
0 hr	40.3^{fg}	40.6^{ef}	41.7^{b}
3 hr before	40.3^{fg}	40.6^{ef}	41.6^{bc}
6 hr before	39.8^{hi}	40.4^{efg}	41.2^{d}
12 hr before	39.6^{i}	40.1^{gh}	40.6^{ef}

[1]Chamber surroundings 3 hr before, 2 hr after and 4 hr after the onset of acute stress were 26.7, 35 and 38.8 C respectively with relative humidity maintained at 55%.

^{abcdefghi}Means with unlike superscripts differ ($P<.05$).

Literature Cited

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