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Effect of fluctuating hot temperatures on performance and immunity in finishing pigs.

Abstract

Housing pigs in a thermal stress environment reduced gain, intake and feed efficiency. Cell mediated immunity responses were lower under the constant heat stress as well as when the temperature was lowered to a thermal neutral temperature for only 4 hours daily. Daily cooling to thermal neutral for 4, 8, or 16 hours improved growth performance. Antibody responses were not altered by temperature fluctuations.; Swine Day, Manhattan, KS, November 10, 1983

Keywords

Swine day, 1983; Kansas Agricultural Experiment Station contribution; no. 84-174-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 442; Swine; Fluctuating hot temperatures; Peformance; Immunity

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EFFECT OF FLUCTUATING HOT TEMPERATURES ON PERFORMANCE AND IMMUNITY IN FINISHING PIGS.

Michael A. Jensen, Frank Blecha[1] and Robert H. Hines

Summary

Housing pigs in a thermal stress environment reduced gain, intake and feed efficiency. Cell mediated immunity responses were lower under the constant heat stress as well as when the temperature was lowered to a thermal neutral temperature for only 4 hours daily. Daily cooling to thermal neutral for 4, 8, or 16 hours improved growth performance. Antibody responses were not altered by temperature fluctuations.

Introduction

Thermal heat stress and its effect on performance and immune response can be a serious summertime problem. However, heat stress conditions are rarely encountered 24 hours a day. A cooler period daily may allow the animal to compensate for the effects of the heat stress period.

Procedure

Eighty crossbred barrows were used to assess the influence of diurnal changes in hot temperatures on growth performance, phytohemagglutinin (PHA) skin-test reactions, antibody responses to sheep erythrocytes (SRBC) and total and differential leukocyte numbers. After a 3-day adjustment period, 160 pound barrows were started on 28-day trials at 5 different thermal treatments. These included 2 constant dry bulb temperatures of 20 C and 35 C and three daily fluctuating environments of 16 h at 20 C and 8 h at 35 C; 8 h at 20 C and 16 h at 35 C; 4 h at 20 C and 20 h at 35 C. A 16% sorghum-soybean diet and water were supplied ad libitum. Feed intake and growth performance were measured weekly. In vivo cellular immunity was evaluated weekly by measuring the PHA-induced increase in flank skin thickness. All pigs were injected intraperitoneally with 5 ml of a 40% SRBC suspension at the start and on day 14 of each trial. Heparinized blood samples (5 ml) were obtained weekly for determination of SRBC antibody titers and total and differential leukocyte numbers.

Results and Discussion

Average daily intake, gain and efficiency were poorer ($P<.04$) in pigs exposed to constant 35 C than in those exposed to the constant 20 C treatment (Fig. 1). However, daily cooling to 20 C for 4, 8 or 16 h also resulted in better ($P<.04$) growth performance and feed efficiency those pigs housed in the constant

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hot temperature. PHA skin-test reactions were decreased (P<.02) and lymphopenia tended (P<.10) to occur in pigs exposed to the two hottest environments (Figs. 2, 3 & 4). Antibody titers to SRBC were not altered by thermal treatments (Fig. 5). These data suggest that 4, 8 or 16 h of daily cooling offsets heat-induced decreases in growth performance and feed efficiency and that very hot environments suppress *in vivo* cellular immunity in finishing pigs.

Figure 1

EFFECT OF FLUCTUATING HEAT STRESS ON INTAKE, GAIN AND EFFICIENCY

Daily Hours at 35 C	Daily Intake (lbs)	Daily Gain (lbs)	F/G
0	6.80	1.89	3.59
8	6.01	1.89	3.17
16	5.90	1.50	3.94
20	5.39	1.61	3.36
24	4.29	0.73	5.91

Fig. 2

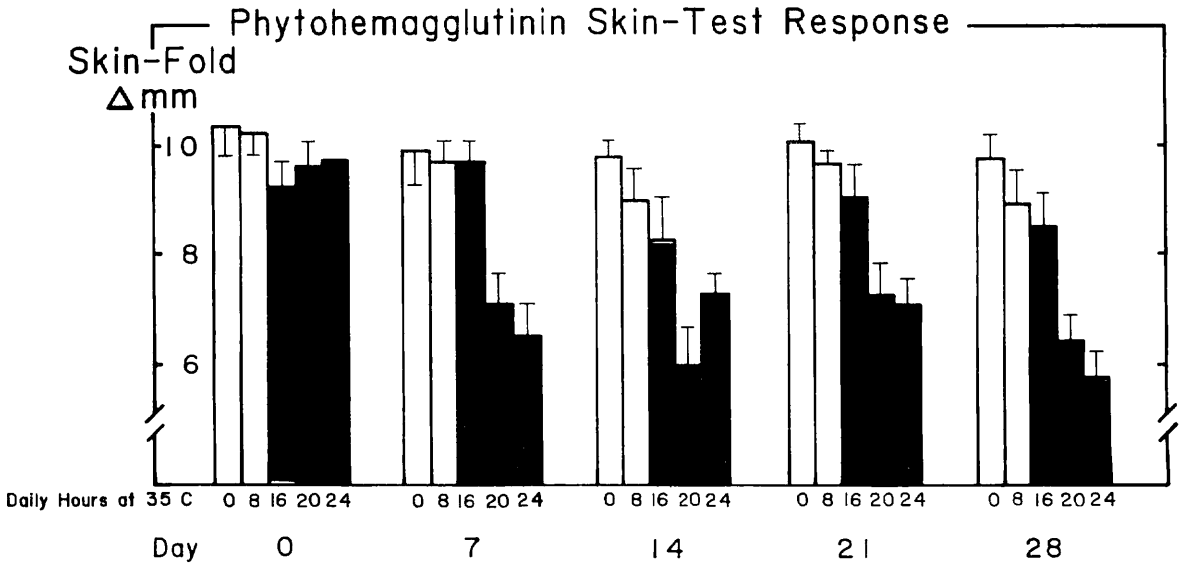


Fig. 3

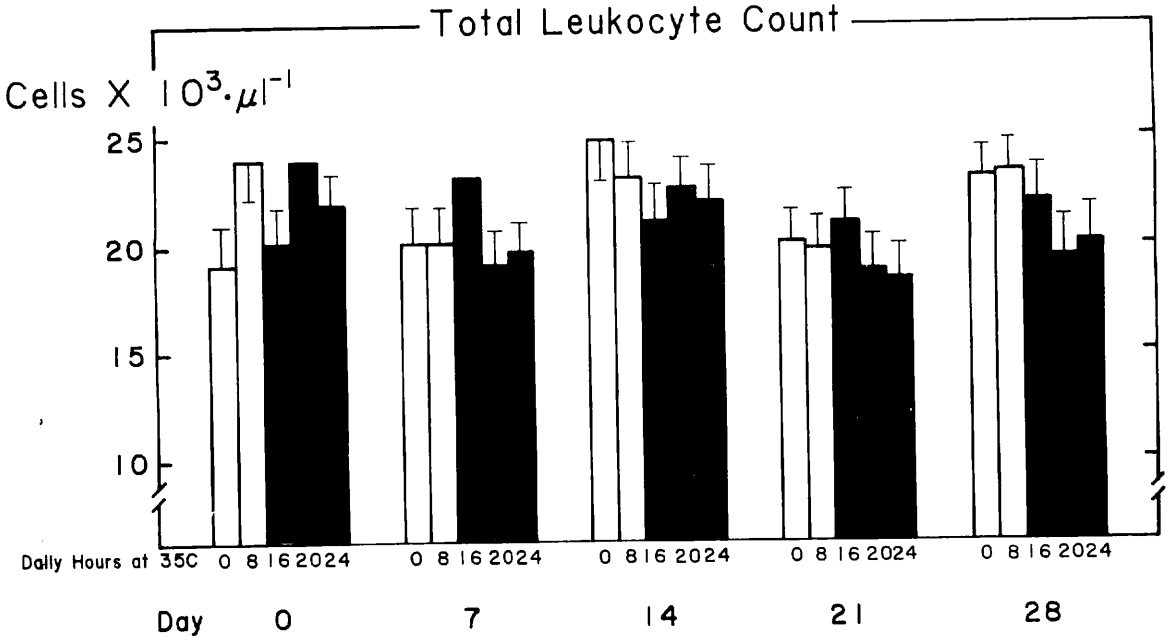

Total Leukocyte Count
Cells X $10^3 \cdot \mu l^{-1}$
25
20
15
10
Daily Hours at 35C 0 8 16 2024 0 8 16 2024 0 8 16 2024 0 8 16 2024 0 8 16 2024
Day 0 7 14 21 28

Fig. 4

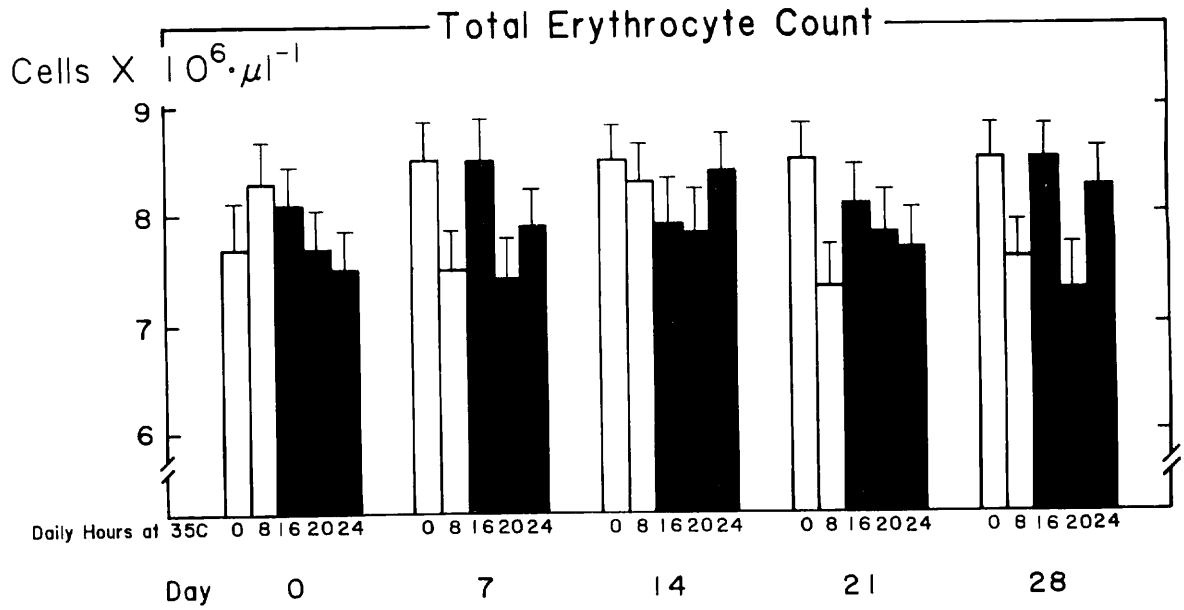
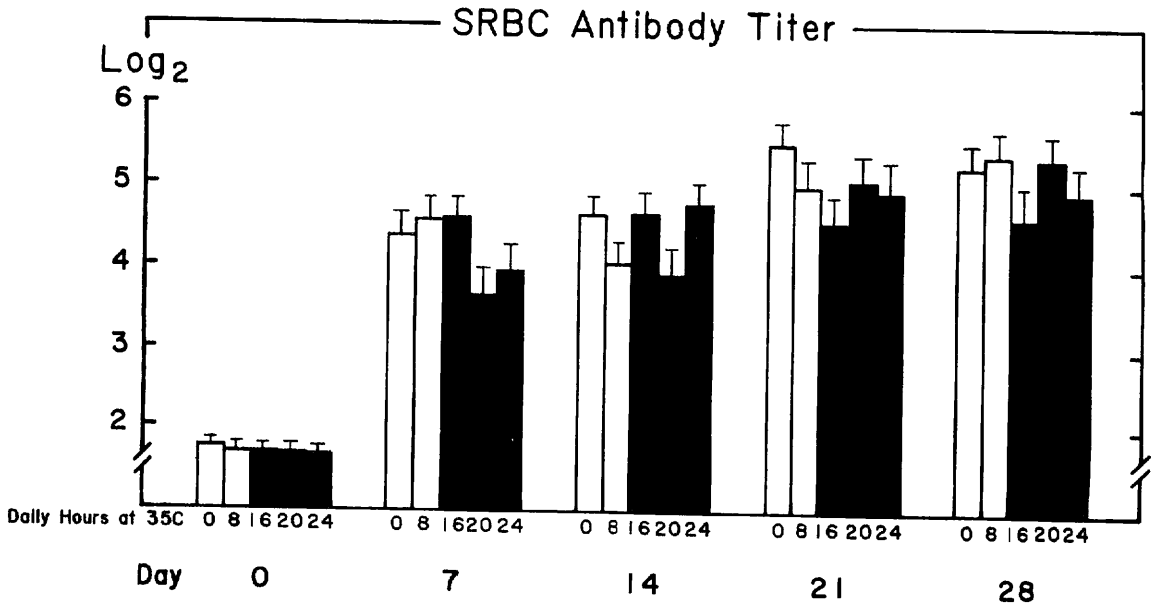

Total Erythrocyte Count
Cells X $10^6 \cdot \mu l^{-1}$
9
8
7
6
Daily Hours at 35C 0 8 16 2024 0 8 16 2024 0 8 16 2024 0 8 16 2024 0 8 16 2024
Day 0 7 14 21 28

Fig. 5


SRBC Antibody Titer
Log2
6
5
4
3
2
Daily Hours at 35C 0 8 16 20 24
0 8 16 20 24
0 8 16 20 24
0 8 16 20 24
0 8 16 20 24
Day 0 7 14 21 28