EFFECT OF TEMPERATURE FLUCTUATION ON PETECHIAL HEMORRHAGES IN PIGS

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SUMMARY

A total of 7796 pigs were divided into 31 groups. Each group was split between two treatments: Control- 4-6 second stunning time, electric prods and ten minutes of rest after climbing a long ramp, Special Treatment- 3-4 second stunning time, no electric prods and overnight rest prior to stunning. Data was collected on different days from 16 groups in February and 15 groups in June. In February, Special Treatment had 12.34 percent, ±1.52 with petechial hemorrhages and Controls had 25.60 ±0.97, $P > 0.001$. Control pigs had significantly more petechial hemorrhages in February, $P > 0.01$. Time of year had a significant effect on the day to day variability of hemorrhages. Special Treatment provided the greatest reduction in petechial hemorrhages when low winter temperatures had greater day to day variability.

INTRODUCTION

Previous research by Grandin (1986) indicated that a Special Treatment procedure consisting of a shorter electric stun time, elimination of electric prods and extra rest significantly reduced both PSE and petechial hemorrhages in pigs. Elimination of electric prods and shorter stunning times reduce hemorrhages in the meat (Calkins et al. 1980; Braathen and Johansen 1984). There was a great day to day variation in the effectiveness of the Special Treatment. On some days there was a 100 percent reduction in petechial hemorrhages and on other days almost no reduction. Observations in many North American pork slaughter plants indicated that weather conditions affect the incidence of petechial hemorrhages. New Zealand researchers Petersen and Wright (1982) and Thornton et al. (1979) both reported that petechial hemorrhages in sheep decline as the killing season progresses. As the season progresses temperature declines. There is a need for more detailed study of climatic effects on petechial hemorrhages.

The purpose of this study is to quantify some of the effects of seasonal temperature differences on the overall incidence of petechial hemorrhages in pigs, and on the efficacy of improved stunning and handling under different temperature conditions.

EXPERIMENTAL METHODS

A total of 7796 Landrace cross pigs were divided into 31 groups. Each group from the same producer was split between two treatments. Surveyed pigs originated from over fifteen different producers and they were observed in a Canadian commercial slaughter plant. The treatments were: Control- 4-6 second electric stun time, electric prods were used and the pigs had only ten minutes of rest after climbing a long ramp to the stunner, Special Treatment - 3-4 second stun time, no electric prods and overnight rest prior to stunning. Pigs were stunned with a high voltage head to back stunner in a V conveyor restrainer. The stunner was set at 450 volts and 1.25 amps. Electric prods were wired through a transformer and grounded out through the pig's feet. Petechial hemorrhages were assessed visually after the carcasses were split. Carcasses were examined for petechial hemorrhages in the fat and the membrane surrounding the longissimus dorsi (loin) by separating the fat layer from the muscle. Data was collected on two to four different days each week from 16 groups in February and 15 groups in June. Temperatures ranged from -15 to 14°C in February and 10 to 30°C in June.

RESULTS

Special Treatment significantly reduced petechial hemorrhages during both months. On the average, Special Treatment reduced petechial hemorrhages 13.26 percentage points in February and 10.72 percentage points in June. There was no significant difference for average improvement between the two months. The variance for the percentage of improvement due to Special Treatment was much greater in February 103.83 and 26.42 for June. These variances were significantly different, $P > 0.05$. Control pigs had significantly more petechial hemorrhages in February, $P > 0.001$. In February, Special Treatment animals had 12.34% ±1.52 and Controls had 25.60% 2.17, $P > 0.01$. In June, Special Treatment pigs had 10.00% ±1.60 and Controls had 20.72% ±0.97, $P > 0.001$.

Time of year had a definite effect on the day to day variability of petechial hemorrhages. June control data had a significantly lower variance than February controls, 12.25 and 67.73 respectively, $P > 0.05$. Day to day temperatures fluctuated more in February than day to day temperatures in June, $P > 0.05$. The range of day to day temperature fluctuation during the entire month of February was 29°C and the range for June was only 20°C. Temperature fluctuation within each day was greater in June. The average within a day fluctuation was 4.45°C in February and 9.07 in June.

The efficacy of Special Treatment for reducing petechial hemorrhages fluctuated greatly in February (Figure 1). The range of Special Treatment improvement varied from 29 percentage points to only 3 percentage points. Improvements due to Special Treatment were much

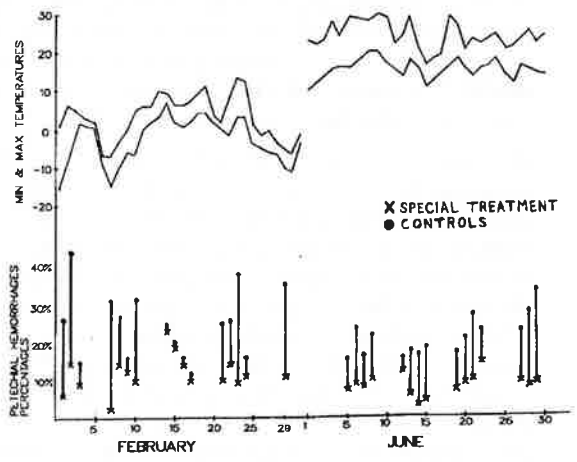

Figure 1. Relationship between temperature fluctuations and petechial hemorrhages in pigs.

more uniform in June. Special Treatment provided the greatest improvement when winter temperatures were more variable. It provided the least amount of improvement when winter temperatures were more stable.

There was a tendency for the greatest winter time improvement to occur when temperatures were rising or at their peak. On nine days in February Special Handling provided petechial hemorrhage reductions of more than 12 percentage points. On six of these days both the minimum and the maximum temperature were either rising or at a peak. On two other days with large Special Handling improvements the minimum and maximum temperatures were moving in opposite directions. Both minimum and maximum temperatures dropped on only one February day with a large Special Handling improvement.

Large day to day fluctuations in temperature increase the overall incidence of petechial hemorrhages. There was a definite trend for Special Treatment to provide the greatest improvement when fluctuating winter temperatures were rising. Overall Special Treatment provided the greatest improvement when low winter temperatures had greater day to day variability. Petechial hemorrhage levels in both groups steadily dropped during the middle of February when temperatures were more uniform.

DISCUSSION

Large day to day fluctuations in temperature make pigs more prone to petechial hemorrhages. This finding is in agreement with anecdotal observations made in several different pig slaughter plants. Large increases in petechial hemorrhages have also been observed during the summer when temperatures fluctuated widely. When pigs are subjected to widely fluctuating temperatures the effectiveness of improved stunning and handling procedure is much more variable. Proper evaluation of different procedures must be conducted over a series of days to determine the true effect of the procedure.

It is interesting that the larger within day temperature fluctuation in June had little effect on petechial hemorrhages. The magnitude of the within day fluctuation for the entire month of June is less than half the magnitude of the day to day fluctuation during the first week in February. It is likely that large temperature fluctuations over a short period of time are more detrimental than smaller fluctuations over a longer period of time.

Vasodilation is one possible mechanism to explain the temperature effect. Vasodilation increases petechial hemorrhages. Sheep given a vasoconstricting drug had reduced petechial hemorrhages (Devine et al. 1983). Vasodilation is normally associated with warm weather to keep the animal cool. Possibly, fluctuating winter temperatures make it difficult for the animal's physiological mechanisms to adapt. All pigs in this survey were raised in enclosed buildings, but temperatures inside the building still fluctuate.

REFERENCES

Braathen, O.S. and Johansen, J. (1984). 30th European Meeting of Meat Research Workers, Bristol, England pp. 22.

Calkins, C.R., Davis, G.W., and Hutsell, D.A. (1980). *Journal Animal Science* **50**:15, Supl. 1 (Abstract).

Devine, C.E. et al. (1983). *Meat Science* **9**:247.

Grandin, T. (1986). 32nd European Meeting of Meat Research Workers. pp. 105.

Petersen, G.V. and Wright, D.R. (1979). *New Zealand Veterinary Journal* **27**:166.

Thornton, R.N., Blackmore, D.K., Jolly, R.D., Harris, R.E. and Marsden, N.A. (1979). *New Zealand Veterinary Journal* **27**:181.