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**The effects of on-farm mixing of bulls on beef quality
characteristics**

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requirements for the degree of**

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Abstract

Some degree of stress is an inevitable part of the slaughter process for production animals. The degree of stress will vary due to a number of conditions over which there is sometimes no control. Stress levels may depend on such variables as familiarity of the animal to human contact and handling, temperament and even adverse weather conditions. Pre-slaughter handling has been identified as an area that can have adverse effects on both animal welfare and ultimately on meat quality characteristics.

Published information on the association between stress and meat quality, and more specifically, pre-slaughter handling and meat quality is reviewed. The physiological response of an animal to stress is examined, and the effect of the stress response on the resultant final product is presented. A detailed summary of the role of muscle glycogen both pre- and post-slaughter is also provided.

The main objective of the present study was to investigate whether on-farm mixing of bulls potentially plays a role in undermining meat quality characteristics. Thirty-three Friesian bulls between 18 and 24 months of age and weighing between 550 and 600 kilograms (live weight) were commercially slaughtered in January of 2010. These bulls were originally from one of seven finishing groups. The bulls were randomly allocated into one of three treatment conditions 1) control (no mixing), 2) mixing four days prior to slaughter or 3) mixing one day prior to slaughter. Blood was collected at slaughter and analysed for non-esterified fatty acids (NEFA mmol/L), plasma lactate (mmol/L), creatine phosphokinase (CPK IU/L). A sample of the longissimus muscle was collected approximately 20 minutes after slaughter. A portion of the sample was immediately snap frozen for determination of muscle glycogen concentration. Meat pH, shear force and drip loss was measured at 24 hours, 7 days and 28 days post-slaughter. Purge loss was calculated for the 7 and 28 day samples. Colour measurements were taken on bloomed and unbloomed samples.

By varying mixing times it was also hoped that the effect of recovery from mixing on-farm could start to be elucidated. It was a further objective that demonstration of an effect on meat quality could be used to encourage industry to adopt certain handling practices that could be communicated to their suppliers. A best practice model of pre-

slaughter handling on-farm would be the ultimate goal. This project represents only a starting point from which further research would be needed prior to development of best practice guidelines.

In the present study, concentrations of creatine phosphokinase (logCPK) in blood at slaughter for the 1 day mixed group was significantly higher ($p < 0.001$) when comparing the three treatment groups, which indicates that these animals were more physically active in the twenty four hour period prior to slaughter than the 4 day mixed or control animals. Mean CPK values for the 4 day mixed group were not significantly different from the control animals suggesting that by four days, the bulls had re-established a social order and physical activity had returned to a “normal” level. In terms of meat quality, the difference in CPK values is relevant when considering that at 28 days post slaughter, muscle tissue from the 1 day mixed bulls had increased shear force measurements ($p < 0.05$) when compared to the four day mixed and controls. CPK values and shear force data were found to be positively correlated in the present study ($p < 0.001$). CPK values were positively correlated with ultimate pH ($p < 0.001$) and negatively correlated with muscle glycogen concentration ($p < 0.001$).

Although not statistically significant ($p = 0.09$), the pH after 28 days ageing for the meat from the 1 day mixed animals was also increased when compared to the other two treatment groups. Meat from five animals had a pH greater than 5.8 after 28 days ageing. Three of the five were from the one day mixed group while the other two were from the four day mixed group. The highest pH at 28 days was 6.14, and this one day mixed animal also had the highest CPK at 15,756 IU/l. Not surprisingly muscle glycogen concentration from the 1 day mixed animals was lower than for the other two groups, and the significance followed the same trend ($p < 0.073$).

Results of the current study indicate that the chances of high-pH beef and the accompanying decrease in beef quality may be increased if bulls are mixed within 24 hours of slaughter. Based on the results more research into the effects of on-farm mixing is certainly warranted.

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Table of Contents

Title page	i
Abstract	ii
Acknowledgements	iv
Table of contents	v
List of tables	vi
List of Figures	vii
Chapter 1: Introduction	1
Chapter 2: Review of Literature	4
Chapter 3: Materials and Methods	27
Chapter 4: Results & Discussion	35
Chapter 5: Conclusion & Recommendations	44
Appendix A	48
Appendix B	49
References	50

List of Tables

Table 1: Responses of target tissues to catecholamines.....	7
Table 2: Effects of epinephrine on muscle glycogenolysis.....	11
Table 3: Summary of muscle glycogen content.....	16
Table 4: Slaughter blood profile of bulls after mixing.....	35
Table 5: pH C of sampled striploin after mixing.....	36
Table 6: Shear force of sampled striploin after mixing.....	36
Table 7: Muscle glycogen of sampled striploin after mixing.....	36
Table 8: Colour measurements of sampled striploin after mixing.....	37
Table 9: Purge loss and drip loss of sampled striploin after mixing.....	37
Table 10: Correlation data.....	38
Table 11: Reported muscle glycogen concentrations from published literature.....	43

List of Figures

Figure 1: The HPA axis.....	5
Figure 2: Organization of skeletal muscle.....	8
Figure 3: Effects of epinephrine on muscle glycogenolysis.....	12
Figure 4A: The relationship between rank order and age.....	22
Figure 4B: The relationship between rank order and weight.....	22
Figure 5: The social interactions of young bulls and steers after re-grouping.....	23
Figure 6: The social interactions of young bulls and steers after re-grouping.....	24
Figure 7: Mixing protocol.....	29
Figure 8: Relationship between shear force and CPK.....	39
Figure 9: Relationship between muscle glycogen and CPK.....	40
Figure 10: Relationship between pH and CPK.....	40