PRE-SLAUGHTER HIDE WASHING AFFECTS MEAT QUALITY IN PASTURE FINISHED CATTLE

Farrah L. Preston[*1], Michael J. Wilkes[1], Peter McGilchrist[2] and Wayne S. Pitchford[1]

[1]The University of Adelaide, School of Animal and Veterinary Sciences, Roseworthy SA 5371 Australia

[2]The University of New England, School of Environmental and Rural Sciences, Armidale NSW 2351 Australia

*Corresponding author email: farrah.preston@adelaide.edu.au

I. INTRODUCTION

Dark cutting (DC) is detrimental to beef eating quality, and is a significant problem within pasture-finished supply chains [1]. DC is defined as high ultimate carcass pH (>5.70), which is caused by low glycogen levels in the muscle leading to insufficient lactic acid accumulation post slaughter. The causes of low muscle glycogen pre-slaughter are multifactorial, however there has been little research into abattoir-based factors and their effect on carcass pH. A previous study found lairage washing increased DC incidence in both grain and pasture finished cattle [2]. This study further examines the effect of pre-slaughter hide washing practices in lairage on the incidence of DC beef in pasture finished cattle.

II. MATERIALS AND METHODS

Data for this observational cohort study were collected from a large Southern Australian abattoir processing up to 800 head of cattle per day during 2015, 2016 and 2017. Pasture-finished mobs of cattle were selected from those scheduled to be processed. Animals were observed from the time of arrival until slaughter, and the number and duration of each wash type they received was recorded, as well as lairage pen number in which each group was kept. Cattle were washed in their lairage pen by an in-floor sprinkler system (lairage wash), followed by a hand held high-pressure hose in a holding pen (high-pressure hose wash), and finally in a belly wash pen with high-pressure in-floor sprinklers (belly wash). These final belly wash groups formed the unit of replication for this study (wash group); larger mobs may be separated into smaller groups at this point, forming more than one wash group per mob. Meat Standards Australia carcass grading data was used to identify DC carcasses (pH>5.70), and the percent of DC within each wash group was determined. Analysis was conducted using GenStat, 18th Edition. A restricted maximum likelihood (REML) linear mixed modal was developed and the response variate was the percent of DC within a wash group. The model included the effects of collection period (2015, 2016-17), lairage wash number, and lairage wash duration. Day of kill and pen number (1 - 24) were included as random terms to account for the effect of sampling period and other factors outside of the control of lairage management. This project was approved by The University of Adelaide Animal Ethics Committee (Approval number: S-2016-096).

III. RESULTS AND DISCUSSION

A total of 2,390 head of pasture-finished cattle from 75 commercial mobs were observed in this study. Mob size ranged from 7 to 92 head, and included steers, heifers, and mixed-sex groups. These formed 129 wash groups which ranged in size from 4 to 42 head. The overall DC incidence within this study was 26.8%, more than double the Australian average of 10.8% for grass-finished cattle [1]. Total lairage wash number varied from 0 to 7 times, for an average 18 ± 5 minutes, culminating in a total lairage wash duration of 64 ± 29 minutes (mean$\pm$SD). Table 1 presents a summary of lairage washing treatments and their effect on the percent of DC within a wash group. Each wash a group received was associated with an increased DC incidence of $6.6\pm3.0\%$ (P=0.029). Surprisingly, once the number of washes were accounted for, lairage wash duration had a positive effect, decreasing DC incidence (slope $-0.3\pm0.1\%$, P=0.035). Lairage wash number and duration were highly correlated (r=0.85) and both had a significant effect on DC incidence (P<0.05), which explains the large effect of wash number on DC. Together, these results suggest water being turned on initially is the source of stress, as the number of washes received had a large effect for a given amount of time. A longer duration may allow animals to acclimatise, although the effect of duration is small. A study by Preston et al. [2] reported similar results where each lairage wash increased DC incidence in both pasture- and grain-

finished cattle, although washing duration was not significant. These results also concur with those of Petersen [3] who studied lambs and found a positive linear relationship between the number of washes and ultimate pH. DC is a result of insufficient lactic acid accumulation post slaughter, which results from the initiation of glycogen break down prior to death. The results of this study suggest lairage washing is a source of pre-slaughter stress initiating these events, and thus impacting animal welfare and consequently meat quality.

Table 1 Effect of lairage wash number and duration (minutes) on dark cutting (DC) incidence in pasture finished cattle. The number of observations (wash groups) for each treatment combination are included (brackets) and blank cells are those with no observations.

Number of washes	0 mins	20 mins	40 mins	60 mins	80 mins	100 mins	120 mins
0	25.4% (3)						
1		25.8% (1)					
2		32.4% (13)	26.3% (14)		14.0% (1)		
3			32.8% (13)	26.7% (6)	20.5% (12)		
4			39.4% (9)	33.2% (6)	27.1% (17)	21.0% (3)	
5				39.8% (2)	33.7% (5)	27.5% (11)	21.4% (4)
6						34.1% (17)	28.0% (3)
7						40.7% (1)	34.5% (1)

IV.   CONCLUSION

Pre-slaughter hide washing remains an important area for continued research to address the issue of DC beef, while simultaneously improving animal welfare. Pre-slaughter hide washing is implemented as a means to improve cleanliness of slaughter stock, and thus reduce the likelihood of carcass contamination with human enteropathogens. From the available literature, the effectiveness of this procedure in preventing the spread of pathogens is unclear, with some studies reporting washing has little to no effect on contamination [4, 5], whilst some found washing increased contamination [6]. This research is currently being continued to better understand the relationship between pre-slaughter hide washing, meat quality, meat hygiene, and animal behavior and welfare. It is imperative to ensure washing methods are fit for purpose, and not detrimental to animal welfare, or the quality and consistency of beef produced.

ACKNOWLEDGEMENTS

REFERENCES

1. Meat Standards Australia (2017). Australian Beef Eating Quality Insights 2017. North Sydney: Meat & Livestock Australia
2. Preston, F.L., Burnard, C.L., Wilkes, M.J., Lee, S.J., Hazel, S.J. and Pitchford, W.S. (2016). Pre-slaughter washing increases dark cutting incidence in beef. Animal Production in Australia, Paper 1201.
3. Petersen, G.V. (1983). The effect of swimming lambs and subsequent resting periods on the ultimate pH of meat. Meat Science 9: 237-246.
4. Bell, R.G. (1997). Distribution and sources of microbial contamination on beef carcasses. Journal of Applied Microbiology 82: 292-300.
5. Bryne, C.M., Bolton, D.J., Sheridan, J.J, McDowell, D.A. and Blair, I.S. (2000).The effects of pre-slaughter washing on the reduction of *Escherichia coli* O157:H7 transfer from cattle hides to carcasses during slaughter. Letters in Applied Microbiology 30: 142-145.
6. Mies, P. Covington, B., Harris, K., Lucia, L., Acuff, G. and Save, J. (2004). Decontamination of cattle hides prior to slaughter using washes with and without antimicrobial agents. Journal of Food Protection 67: 579-582.