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REDUCING LAIRAGE TIME RESULTED IN HEAVIER CARCASSES, WITHOUT COMPROMISING CARCASS CHARACTERISTICS OR MICROBIAL COUNTS ON CARCASSES

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I. INTRODUCTION

In Australia, lairage duration is often between 12-24 hours allowing cattle to rest after transport, time for washing, ante-mortem inspection and logistical coordination of slaughter [1]. Minimising time off feed and time in lairage benefits the red meat industry as it reduces stress and limits the time that muscle glycogen can be metabolized [2], leading to heavier carcass weights. However, microbial contamination on carcasses due to reduced time for washing of live cattle is seen as a barrier to adoption of reduced lairage in Australian commercial systems, especially during winter months [3]. Therefore, the objective of this study was to investigate the effect of reducing lairage (< 5 hours), on carcass weights, carcass grading traits and microbiological status of carcasses. It was hypothesized that microbiological status of carcasses would not be different between lairage times, and that cattle in the short lairage duration group would have heavier carcass weights compared to cattle in the normal lairage duration group.

II. MATERIALS AND METHODS

This research was approved by the University of New England Animal Ethic Committee (ARA23-048). A stratified, randomized block design based on liveweight (LW) was used to compare two lairage treatment times; short lairage (average 5 h: SHORT) and normal lairage (average 22 h: NORMAL). A total of 1968 cattle from a domestic feedlot were allocated to the study across 15 temporal replicates. Cattle were on feed for approximately 75 days. They were weighed and allocated to treatment group six days prior to slaughter and remained in their treatment group in adjacent pens until the point of exit from the feedlot. Cattle in the NORMAL group had their last feeding in the morning and were transported to the abattoir at approximately 3:00 pm the day prior to slaughter (Day -1), spending approximately 22.1 hours off feed and 21.9 hours in lairage. Cattle in the SHORT group had their last feeding on the afternoon prior to slaughter (to ensure fed was always available until exit) and were transported to the abattoir at approximately 7:30 am on the day of slaughter (Day 0), spending approximately 6.2 hours off feed and 4.8 hours in lairage. Cattle received a belly wash and further hosing if required. Post-slaughter, carcasses were weighed for hot standard carcass weight (HSCW), cold carcass weight (CCW) and ultimate pH was recorded 24 h postmortem. Carcasses with an ultimate pH of > 5.7 were classified as dark cutters and the proportions and counts are presented in Table 2. Microbiological testing was conducted on 10% of the carcasses using Whirl-Pak® Speci-Sponges (Sigma-Aldrich Solutions, Germany) wiped within a sterile template over the butt, brisket and flank for a total area of 3000cm^2. Samples were analysed by Symbio Laboratories (Sydney and Brisbane, Australia) for standard plate counts (TVC), coliform and *Escherichia coli* counts and *Salmonella* spp. identification. Data were analysed using R: a Language and Environment for Statistical Computing (R-Core Team, 2023, Vienna, Austria). Linear mixed effects models were fitted with treatment and replicate date. Pre-transport liveweight was used as a covariate. Least squares means were calculated for each variable with significance set at $p < 0.05$. Microbial count data were log transformed prior to analysis to report significance but least squares means are presented in the results on raw data.

RESULTS AND DISCUSSION

Cattle in the SHORT group had significantly higher ($P < 0.001$, $P < 0.001$ and $P < 0.001$, respectively) HSCW, CCW and dressing percentage compared with cattle in the NORMAL group (Table 1). These results align with Clariget et al. [4] where reducing time off feed to 3 hours as opposed to 24 hours resulted in heavier HSCW and CCW. The pHu was not significantly different between treatment groups (Table 1), however, the proportion of dark cutters was significantly different between treatment groups with 1.2 % detected in the NORMAL treatment group compared with 0.3 % detected in the SHORT group ($P = 0.038$, Table 2). By limiting time in lairage and time off feed, cattle remain hydrated resulting in optimised muscle glycogen status and carcass weights [2]. These benefits were also observed through the reduced incidences of dark cutters in the short lairage group compared to the normal lairage group. Total viable count was significantly higher in the SHORT group compared with the NORMAL group ($P < 0.001$; Table 3), although biologically these counts are below the reporting threshold in Australia [5] and safe for human consumption. There were no significant differences in coliform or *E. coli* counts between the

treatment groups and *Salmonella* was not detected on any carcasses. These results confirm that short duration lairage (< 5 hours) is acceptable for food safety and improved carcass weights.

Table 1 – Least squares means and standard errors for carcass weights of cattle in response to lairage duration.

Traits	Lairage treatment		
	NORMAL	SHORT	p-value
Hot carcass weight, kg	256.99 ± 1.35	259.39 ± 1.35	< 0.001
Cold carcass weight, kg	252.62 ± 1.31	254.87 ± 1.31	< 0.001
Dressing percentage, %	52.76 ± 0.28	53.25 ± 0.28	< 0.001
pH	5.55 ± 0.01	5.54 ± 0.01	0.156

Table 2 – Proportion and frequency of dark cutting carcasses in response to lairage duration.

Dark cutters	No	Yes	Count	p-value
Normal	98.8 % (971)	1.2 % (12)	983	0.038
Short	99.7 % (982)	0.3 % (3)	985	
Sum	99.2 % (1953)	0.8 % (15)	1968	

Table 3 – Least squares means and standard errors for microbiological counts on carcasses of cattle in response to lairage duration.

Traits	Lairage treatment		
	NORMAL	SHORT	p-value
Total Viable Count	39.10 ± 11.29	70.02 ± 11.16	< 0.001
E. coli	0.09 ± 0.01	0.09 ± 0.01	0.743
Coliform	0.09 ± 0.00	0.09 ± 0.00	0.110

*Note: Salmonella spp. was not detected on any carcasses

III. CONCLUSION

The results from this study indicate that short duration lairage offered a significant benefit in production efficiency and profitability across the supply chain by enabling heavier carcass weights and improved welfare as indicated by the reduction of dark cutting carcasss. Reducing time off feed and time in lairage also decreases the incidences of dark cutting which is a huge economic cost to the industry. In addition, concerns around food safety associated with short duration lairage have been alleviated in this study.

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