The effect of the final wash location on the microbiological and visual condition of smallstock carcases

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PREPARED BY:	Jessica Jolley, Andreas Kiermeier, John Sumner
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1.0 EXECUTIVE SUMMARY

Project Description

Current visual monitoring requirements for export sheep and lamb meat are laid out in the Meat Hygiene Assessment (MHA) manual (2nd Edition) and include the visual assessment of carcases after the final trim but prior to the final wash. Trimming of visual defects located on the carcase surface is a corrective action, as acknowledged by the MHA guidelines (Section 5.5) that can result in substantial trimming losses. It is proposed that locating a carcase wash prior to final carcase trim would allow the reduction of trimming losses, provided that it did not affect the eligibility of the product.

Project Content

A trial was undertaken in September and December 2019 at a sheep and lamb processing establishment. The current system was as per the current slaughter chain layout while under the alternative system, trimming and Food Safety Meat Assessor (FSMA) inspection were undertaken after the wash, immediately prior to loading carcases into the chillers. In addition, two chilling regimes were investigated; spray- and air-chilling and both lamb and mutton carcases were monitored.

Carcases were assessed visually for defects as per the MHA guidelines by Quality Assurance (QA) staff when they were used as trimmers. QA staff were stationed at the four standard trimming stations used by the abattoir, namely at the bung/channel, hind legs, back and belly/front legs. The number of defects were recorded at each of the four trimming stations under categories of:

- Washable: defects that could be washed off, including zero tolerance (ZT), rail dust/specks/dirt, smears/stains, wool strands/clusters (not attached to the carcase); and

- Not washable: defects that are attached to the carcase, including bruises/blood clots, seeds, foreign objects/extraneous tissue and pathology.

Trimmed tissue was collected, separately for washable and not washable defects, in containers for weighing. After each monitoring period, trim from all carcase areas was weighed for all carcases under the current system and for all carcases under the alternative system.

For each run, eighty swabs were collected and tested for Total Viable Counts (TVC) and generic *E. coli* from carcases chilled overnight. Carcases were randomly selected and 100cm^2 areas each were swabbed below the bung, at the flank and at the shoulder.

Project Outcome

A total of 1,610 lamb carcases and 601 mutton carcases were assessed over the trial.
Key points are:

- Visual assessment of defects
    - Most of the defects were on the channel and leg areas of the carcase.
    - On four of the six trial runs, the number of ZTs and total washable defects recorded under the alternative system was considerably less than those under the current system; in some instances, the number was halved.
- Trim weights
    - In five out of the seven trial runs, less trim was removed under the alternative system, compared with the current.

- There was variability between the trial runs in the mass of trim removed.
- On average, the trim weight was 20g less per lamb carcase and 25g less per sheep carcase under the alternative system.

- Microbiological testing
  - Microbiological results of the alternative and current systems are very similar.
  - Spray-chilled carcases had higher *E. coli* prevalence compared with air-chilled carcases.

Benefit for Industry

In summary, this trial has demonstrated that under the alternative system:

- ZTs are less prevalent;
- Carcases have good/improved visual condition – fewer visual defects;
- The microbiological condition is very similar to the current system, and
- On average, carcases required less trimming.

2.0 INTRODUCTION

Current visual monitoring requirements for export sheep and lamb meat are laid out in the Meat Hygiene Assessment (MHA) manual (2nd Edition) and include the visual assessment of carcases after the final trim but prior to the final wash (AQIS, 2002). Trimming of visual defects located on the carcase surface is a corrective action, as acknowledged by the MHA guidelines (Section 5.5), which can result in substantial trimming losses. It is proposed that locating a carcase wash prior to final carcase trim would allow the reduction of trimming losses, provided that it did not affect the eligibility of the product.

To assess the efficacy of washing carcases prior to final inspection on the visual and microbiological status of smallstock carcases, a trial was undertaken at a sheep and lamb processing establishment.

3.0 PROJECT OBJECTIVES

The objective of this project was to assess the effect of moving final inspection/trimming of smallstock carcases to a new location, after the final carcase wash.

4.0 METHODOLOGY

The trial was undertaken in September and December 2019:

- Trial Period 1: 2nd – 5th September 2019
- Trial Period 2: 23rd – 27th September 2019
- Trial Period 3: 2nd – 6th December 2019

The current system of visual assessment of carcases by the Food Safety Meat Assessor (FSMA) after the final trim but prior to the final wash was compared with an alternative system of visual assessing carcases by the FSMA after the final trim and after the final wash. The current system was as per the current slaughter chain layout while under the alternative system, trimming and FSMA inspection were undertaken after the wash, immediately prior to loading carcases into the chillers.

In addition, two chilling regimes were investigated, spray- and air-chilling, and both lamb and mutton carcases were monitored (based on their availability).

Quality Assurance (QA) staff were used as trimmers for most trial runs to ensure consistency in recording defects between trial runs (i.e. remove variability between people as much as possible) and to remove the least area of contamination, thus providing a conservative change in trim weight. QA staff were stationed at the four standard trimming stations used by the abattoir, namely at the bung/channel, hind legs, back and belly/front legs. In the later stages of the trial, slaughter floor operators, who normally carry out the final trim, were used to give a more realistic assessment of trimmed mass.

Visual Assessment of Defects

Carcases were assessed visually for defects as per the MHA guidelines (AQIS, 2002) by QA staff when they were used as trimmers. The number of defects were recorded at each of the four trimming stations under categories of zero tolerance (ZT), rail dust/specks/dirt, smears/stains, wool strands/clusters, bruises/blood clots, seeds, foreign objects/extraneous tissue and pathology.

Trim Weights

The four trimmers were stationed along the chain for both the current and alternative systems. All trimmed tissue was collected in containers for weighing. After each monitoring period, trim from all carcase areas was weighed for all carcases under the current system and for all carcases under the alternative system. For logistical reasons, trim from different areas was not kept separate.

With QA staff as trimmers, trim removed as a result of "washable" defects were put into a different container to trim from "non-washable" defects, where washable defects were defined to include ZTs, rail dust, specks, dirt, smears, stains and loose wool strands and clusters (not attached clumps of wool). The reason for this separation was to assess whether there was a decrease in the trim weight of the washable defects under the alternative system, since the expectation was that the carcase wash would wash off or remove some of the washable defects and hence, result in less trimming.

Normal trimmers did not identify the defects and so all trim was collected in the one container.

Microbiological Testing

For each day's run, eighty swabs were collected and tested for Total Viable Counts (TVC) (aerobic) and *E. coli* from carcases chilled overnight. Forty swabs were taken from spray-chilled carcases (twenty from carcases under the current system and twenty from carcases under the alternative system) and forty swabs were taken from air-chilled carcases (twenty from carcases under the current system and twenty from carcases under the alternative system).

Carcase were randomly selected and 100 cm^2 areas were sponged below the bung, at the flank and at the shoulder, using both sides of a Whirlpak sponge moistened with Butterfields solution.

The sponge was replaced in its bag and squished by hand in 25 mL Butterfields solution before stripping excess fluid from the sponge and plating 1 mL aliquots of diluent on Aerobic Plate Count (APC) and *E. coli* Petrifilms, which were incubated at 35°C for 48 hours.

Typical colonies were counted as per the manufacturer's instructions and recorded on an Excel spreadsheet.

5.0 PROJECT OUTCOMES

Trial Sampling

A summary of the trial schedule is given below in Table 1.

Table 1: Trial – type of stock, staff trimming, number of carcases and recording of visual defects and trim weights.

Trial run	Species	Staff Trimming	# Carcases	Visual Defects	Trim Weight	Stock Condition
3rd Sep	Lamb	QA	200	Recorded	Recorded	Slightly dusty
23rd Sep	Lamb	QA	300	Recorded	Recorded	Unshorn suckers 2 inches wool length
24th Sep	Lamb	QA	244	Recorded	Recorded	
25th Sep	Lamb	QA	316	Recorded	Recorded	
2nd Dec	Lamb	QA	300	Recorded	Recorded	Short wool length
3rd Dec	Mutton	QA	300	Recorded	Recorded	Shorn wethers 1 inch wool length Lots of scouring
4th Dec	Lamb	Trimmers	250	Not Recorded	Recorded	Dirtier stock
4th Dec	Mutton	Trimmers	301	Not Recorded	Recorded	2 inches wool length

Visual Assessment of Defects

Summaries of the visual defects are given in Figure 1 – note, all trial runs were on lamb carcases, except for Tuesday (3/12) which was on mutton carcases.

Key points:

- Most of the defects were on the channel and leg areas of the carcase.
- The number of defects per 100 carcases can be greater than 100 when multiple defects are found on the same carcase area (belly, back, channel, legs) or on different carcase areas on the same carcase.
- On four out of six trial runs, the number of ZTs recorded under the alternative system was considerably less than the number of ZTs recorded under the current system.
- On five out of the six trial runs, the number of washable defects under the alternative system was considerably less than the number of defects under the current system; in some instances, the number of defects halved.

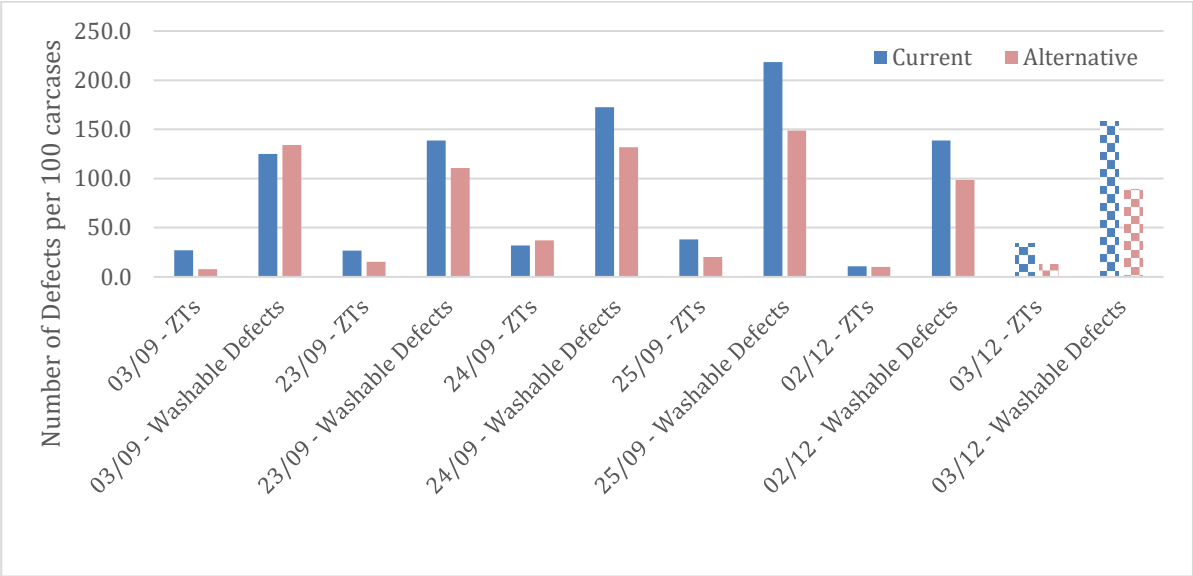

Figure 1: Number of visual defects per 100 carcases. The current system is represented by the blue bars and the alternative system is represented by the red bars. The solid bars were lamb carcases and the non-solid bars were mutton carcases.

Trim Weights

Weights of trim removed under the current and alternative systems are given in Table 2 and Figure 2. The results from 3rd September are excluded from this table due to inadvertent inclusion of non-lactating udder fragments that had not been fully removed prior.

Table 2: Tissue removed at final trimming (kg per 100 carcases).

Trial run	Species	Current System	Alternative System
23rd Sep	Lamb	2.89	4.63
24th Sep*	Lamb	6.42	4.35
25th Sep*	Lamb	8.35	4.20
2nd Dec*	Lamb	3.10	2.07
3rd Dec*	Mutton	4.33	1.90
4th Dec	Lamb	5.79	3.50
4th Dec	Mutton	13.44	13.36
Average	Lamb	5.31	3.75
Average	Mutton	8.89	7.63

*Dates used in the calculation of trim weight gained per carcase (see third dot point below)

Key points:

- In 5 of 7 trial runs, less tissue was removed under the alternative system, compared with the current.
- There was considerable variability between the trial runs in the mass of trim removed.
- On average, the trim weight was 20 grams less per lamb carcase and 25 grams less per sheep carcase under the alternative system. This is based on the results from trial runs with QA trimmers (denoted with '*' in Table 2), with the exclusion of the 23rd of September, due to the inadvertent inclusion of udder fragments in the total trim weight. On the 4th of December, trimmers heavily trimmed mutton carcases and may require some additional training for calibration.

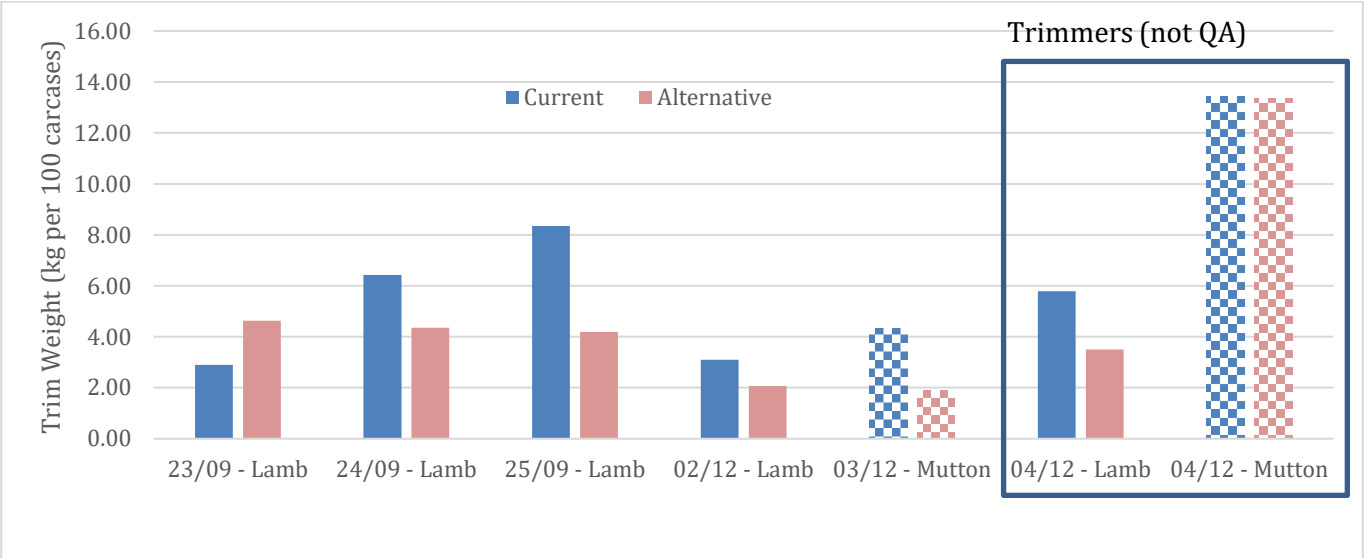

Figure 2: Weight of trim removed in kg per 100 carcases. The current system is represented by the blue bars and the alternative system is represented by the red bars. The solid bars were lamb carcases and the non-solid bars were mutton carcases. The trial runs on 04/12 were carried out by trimmers, not QA staff.

Microbiological Testing

The number of microbiological samples is presented in Table 3.

Table 3: Number of microbiological tests for the two systems, species and chilling regimes.

	Current System		Alternative System	
	Spray	**Air**	**Spray**	**Air**
Lamb	110	110	110	110
Mutton	30	30	30	30

The prevalence and concentration of *E. coli* for lamb and mutton as well as average TVC are presented in Table 4.

Table 4: Prevalence of E. coli (%), average concentration of E. coli (cfu/cm^2), when E. coli were detected and average TVC (log_{10} cfu/cm^2).

		Spray Chilled		Air chilled	
	Species	**Current**	**Alternative**	**Current**	**Alternative**
E. coli* Prevalence (%)	Lamb	83%	81%	47%	57%
E. coli* Prevalence (%)	Mutton	50%	47%	33%	20%
***E. coli* concentration (cfu/cm^2)**	Lamb	0.5	0.5	0.2	0.3
***E. coli* concentration (cfu/cm^2)**	Mutton	0.3	0.2	0.2	0.2
TVC (log_{10} cfu/cm^2)	Lamb	1.9	1.8	1.7	1.7
TVC (log_{10} cfu/cm^2)	Mutton	1.9	1.8	1.4	1.4

*Note: Prevalence is higher compared with ESAM because four times the area was swabbed compared with ESAM.

Key points:

- Microbiological results of the current and alternative systems are very similar and differences in average concentration are not practically important as they are less than 0.5 log_{10} cfu/cm^2.

- Spray-chilled carcases had higher *E. coli* prevalence compared with air-chilled carcases.

6.0 DISCUSSION

The trial has demonstrated that under the alternative system:

- ZTs are less prevalent.
- Carcases have good/improved visual condition – fewer visual defects.
- The microbiological condition is very similar to the current system.
- On average, less tissue is removed, resulting in reduced trim weight.

The present work was done in very dry conditions, with dust a major contaminant and it may be that different results will be obtained if the trial was repeated under conditions of high precipitation.

A number of scenarios to estimate the monetary value of the trim weight gained per carcase and hence overall, are presented in Table 5.

Table 5: Estimates of monetary value of the trim weight gained per carcase.

Species	Trim weight gained / carcase	Annual slaughter	$/kg for trim	Trim $ / year
Lamb	20g	500,000	$2	$20,000
Lamb	20g	800,000		$32,000
Mutton	25g	500,000		$25,000
Mutton	25g	1,000,000		$50,000
Lamb	20g	500,000	$7	$70,000
Lamb	20g	800,000		$112,000
Mutton	25g	500,000		$87,500
Mutton	25g	1,000,000		$175,000

The SARDI team met with Jason Ollington (Department of Agriculture) on the 18th of December, to discuss the results of this project and the feasibility of locating a carcase wash prior to the final carcase trim. From the Department's perspective, such an arrangement could be submitted in an establishment's Approved Arrangement with supporting data and information. The results from this project have validated the process for the establishment in question, but other establishments wishing to implement this change in their slaughter process would need to complete a similar trial.

The attached Snapshot was also circulated by AMPC to its relevant members for feedback and comment, in January 2020, with no feedback received by SARDI or AMPC.

7.0 CONCLUSIONS/RECOMMENDATIONS

This trial has demonstrated, for this particular establishment, that washing carcases prior to final inspection does reduce trim loss, whilst having no detrimental effect on the microbiological status of the carcases and improving the visual condition of the product.

8.0 BIBLIOGRAPHY

AQIS (2002). Meat Hygiene Assessment – Objective Methods for the Monitoring of Processes and Product, 2nd Edition, Canberra.