Development of a skin cleanliness scoring system for the Australian lamb industry

E. Babiszewski1, S. Warner2, J.E. Hocking Edwards3, K.L. Pearce3 and A.J. Ball4

1 SARDI Livestock Systems, Struan Research Centre, Naracoorte, SA 5271, Australia.
2 DEPI, DPI Rutherford Centre, Rutherford Vic. 3685, Australia (currently AGristology, Beechworth, Vic 3747, Australia).
3 Murdoch University, School of Veterinary and Biomedical Science, South Street, Murdoch, WA 6150, Australia.
4 Meat and Livestock Australia, CJ Hawkins Building, University of New England, Armidale, NSW 2351, Australia.

Presenting author: Emma Babiszewski; emma.babiszewski@sa.gov.au

Summary

A skin scoring system to evaluate the cleanliness of a mob of sheep or lambs in Australian production systems was developed. Scores were recorded on a scale of one to three and take into account visible soiling, wool length and wetness. Implementation of this scoring system showed average cleanliness scores of lambs at saleyards was not different from those scored on-farm, indicating that source does not affect cleanliness. There was a significant correlation between cleanliness score prior to loading and after transport to the abattoir (r=0.93; P<0.001) and there was an increase of 0.14 of a score after transport compared to pre-transport score (P<0.05). This scoring system will enable further research into the correlation of carcase microbial contamination and visual cleanliness, which will facilitate the development of this scoring system into a tool that can be used along the supply chain to predict carcass contamination, assist pre-slaughter management and enhance animal welfare.

Introduction

Excessively wet and dirty fleece on sheep and lambs can cause microbiological contamination of carcases post-slaughter (Biss & Hathaway 1996b) which may pose serious health risks to humans (Duffy et al. 2010) and decrease the shelf life of meat products (Hadley et al. 1997). The likelihood of contamination can be predicted by visual appraisal of the level of soiling, with greater soiling resulting in a higher probability of contamination (Gill 2004; Byrne et al. 2007). Consequently, several countries, including Ireland (Byrne et al. 2007) the United Kingdom (UK) (McEvoy et al. 2000), Norway (Hauge et al. 2011) and Finland (Ridell & Korkeala 1993) have developed visual cleanliness scoring systems which can be used throughout the supply chain to inform processors of the likely risk of contamination. These scoring systems allow the option of excluding heavily soiled animals from slaughter. Currently, no such system exists in Australia. The aim of this study was to develop a scoring system that is applicable in Australian production systems and can be used to underpin further research into microbiological control and pre-slaughter management.

Methods

Factors that were considered important in the development of the cleanliness scoring system were dirt and/or faecal contamination, fleece length (Biss & Hathaway 1996b) wetness (Ridell and Korkeala 1993) and position of soiling in relation to cutting lines (Biss & Hathaway 1996a).

Table 1. Description of the skin cleanliness scores.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Location</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faeces/dirt</td>
<td>Belly</td>
<td>Nil</td>
<td>Medium</td>
<td>Heavy</td>
</tr>
<tr>
<td></td>
<td>Body</td>
<td>Nil</td>
<td>Medium</td>
<td>Heavy</td>
</tr>
<tr>
<td></td>
<td>Breech</td>
<td>Nil</td>
<td>Medium</td>
<td>Heavy</td>
</tr>
<tr>
<td>Wool</td>
<td>Belly</td>
<td>&lt;50mm</td>
<td>&gt;50mm</td>
<td>&gt;50mm</td>
</tr>
<tr>
<td></td>
<td>Body</td>
<td>&lt;50mm</td>
<td>&gt;50mm</td>
<td>&gt;50mm</td>
</tr>
<tr>
<td></td>
<td>Crutch</td>
<td>&lt;8mm</td>
<td>&gt;8mm</td>
<td>&gt;8mm</td>
</tr>
<tr>
<td>Wetness</td>
<td>Belly &amp;</td>
<td>Dry</td>
<td>Damp</td>
<td>Saturated</td>
</tr>
<tr>
<td></td>
<td>Body</td>
<td>Dry</td>
<td>Damp</td>
<td>Saturated</td>
</tr>
<tr>
<td>Dags</td>
<td>Breech</td>
<td>Nil</td>
<td>Short</td>
<td>Long</td>
</tr>
</tbody>
</table>

Robustness of scoring system within and between assessors

Eleven pens of lambs were scored by four assessors (A, B, C, D) using the skin cleanliness scoring system (Table 1) at Dublin saleyards (South Australia). Five pens were scored twice by each assessor leaving at least 10 minutes between repeats to reduce bias. In large mobs (>100), 50 animals were scored as a representation of the mob and in smaller mobs (50 – 100), 20 animals were scored.

Subsequently, one original assessor (C) trained four additional assessors (E, F, G, H) in the skin cleanliness scoring system at Muchea saleyards (Western Australia), and 39 to 46 pens were scored by each assessor to evaluate intra- and inter-assessor repeatability.

Skin cleanliness assessment through the supply chain

Skin cleanliness scores (Table 1) were recorded for 27 loads of lambs at saleyards and again at lairage (10 in Victoria, 10 in South Australia and seven in Western Australia), and 17 loads of lambs directly consigned to slaughter were assessed on-farm and again at lairage (seven in Victoria, six in South Australia and four in Western Australia). An additional 13 loads had a single assessment; four loads of lambs consigned directly to the processor were assessed in lairage; three loads of lambs sourced from saleyards were assessed in lairage; and six loads of lambs were assessed in the saleyards.

On-farm skin cleanliness scores were recorded immediately prior to loading onto the truck, with on-farm curfew period prior to loading ranging from four to 24 hours. Skin cleanliness scores at saleyards were recorded two to six hours after being unloaded from trucks into saleyards. Curfew period for the saleyard lambs was not recorded. Skin cleanliness scores in lairage were recorded immediately after off-loading from the trucks. Travel time between site of origin and lairage ranged from two to six hours.

Statistical analysis

Pearson correlation coefficients were calculated to describe the correlations between assessors scoring the same pens of lambs. Chi-squared tests were used to analyse the pattern of scoring between assessors and the distribution of scores between assessors. Within and between assessor repeatability
were determined using generalised linear mixed models with maximum-likelihood methods (PROC GLIMMIX; SAS Institute Inc. Cary, NC, USA 2008). Pen was included in the model as a random effect.

The effect of source (direct consignment or saleyard) and timing (pre-transport, lairage) on skin cleanliness was determined using generalised linear mixed models with maximum-likelihood methods (PROC GLIMMIX; SAS Institute Inc. Cary, NC, USA 2008). A multinomial model for ordinal data was used. Pen * assessor was included in the model as a random effect. Pearson correlation coefficients were calculated to describe the correlations between assessment at the source of the lambs (saleyard or on-farm) and in lairage.

Results and Discussion

Robustness of skin cleanliness scoring system

Across assessments, there was no significant difference within individual assessors (P=0.3674), indicating good repeatability. There were significant differences in skin cleanliness scores between pens of lambs, demonstrating that individual assessors were able to consistently score across a range of skin cleanliness scores.

Correlations of pen scores between assessors were significant at Dublin and Muchea. At Dublin, correlations ranged from r=0.913 between Assessors B and D to r=0.702 between Assessors C and D. Correlations from the assessment conducted at Muchea ranged from r=0.775 between Assessors H and F, and r=0.486 between Assessors F and C.

There was a significant difference in average cleanliness score, and pattern of scoring between assessors at Dublin (P<0.0001), with Assessors B and D scoring lambs at a lower score, while Assessors A and C scored fewer lambs as score 1 and more lambs as score 2. Likewise, there was a significant difference between assessors in the average skin cleanliness scores of each pen of lambs at the Muchea saleyards (P<0.0001). Assessor C scored more lambs as a score 2, whereas Assessors E, F, G and H scored more lambs as score 1.

Importantly, assessors at both sites were able to consistently identify lambs that were a score 3 (P<0.05). This demonstrates that assessors agreed on those lambs that are likely to present the greatest risk of contamination further along the chain. These remain the most important to identify.

Skin cleanliness scores along the lamb supply chain

There was a strong positive correlation (P<0.001) between skin cleanliness scores at the source (either saleyard or on-farm) and skin cleanliness scores of the same consignment of lambs in lairage. This trend was consistent across assessors and source (either saleyard or farm). Lambs assessed in lairage had 0.14±0.052 (P<0.05) of a score higher than lambs assessed prior to transport. This is likely to be due to increased faecal and dirt contamination on their bellies and/or brisket during transport.

Source of lambs did not affect skin cleanliness score, with the score of lambs sourced from saleyards not significantly different from directly consigned lambs (0.3±0.30 difference). There was no interaction between source of lambs and time of assessment. This lack of difference indicates that the additional time spent in transit of lambs that pass through the saleyard system had no significant effect on skin cleanliness. The time spent actually travelling may affect skin cleanliness score, but the time spent on board transport was not recorded, so we were unable to assess the effect of travel time on skin cleanliness. Nevertheless, the lack of interaction between source and final assessment in lairage indicates that both groups of lambs were changing in a similar pattern between initial assessment and assessment in lairage. The scoring system developed here is therefore sufficiently robust to be used at any point on the delivery chain to predict how a mob of lambs will score at another point.

Other factors that have an impact on the visual cleanliness of livestock include breed, age, parasite load, feed type, climate and truck cleanliness (Gill 2004; Fegan et al. 2009; Small & Buncic 2009). The season in which the current study was undertaken was considered to be fairly mild, and none of the consignments experienced extreme weather events. Most consignments came off relatively dry paddock feed, with anecdotal evidence suggesting lambs coming off actively growing pasture are significantly dirtier. Further research is required to investigate the effects these factors have on skin cleanliness at the source and their impact on changes throughout transport.

The skin cleanliness scoring system developed in the current study was repeatable within assessor, and was sufficiently robust to be used at one or more points along the supply chain to determine the visual cleanliness of a mob of sheep. With training of assessors, and further research to determine the correlation between visual cleanliness and actual microbial carcass contamination, this scoring system can become a tool that can be used along the supply chain to predict carcass contamination, assist in pre-slaughter management and enhance animal welfare.

Acknowledgement

This research was primarily funded by Meat and Livestock Australia.

References


Small A. & Buncic S. (2009) Potential for the cross-contamination of the hides of cattle while they are held in lairage. Veterinary Record 164, 260-5.

ASAP Animal Production 2016, Adelaide