

AWI Breech Strike R&D Technical Update
Maritime Museum, Sydney
20th August 2014

Ian Colditz & Alison Small
CSIRO Agriculture

Welfare assessments of Skin Traction, Liquid
Nitrogen, Laser Technology,
Tail Docking and Castration



This talk

Welfare assessments of technologies not yet commercialized

- SkinTraction
 - Liquid Nitrogen
 - Laser wool removal
- } Ian

Meloxicam for pain relief (prior to lunch)

Tri-Solfen for pain relief (R&D updates 2010)

Castration and tail docking practices } Alison

Welfare assessments

- Assess acute impact of the technologies at time of application on welfare of animals – not efficacy for breech modification or long term welfare benefits
- Undertaken early in technology development
- Provide evidence to Animal Ethics Committee for re-approval for next stages: more detailed studies and technology development
- Methods
 - Clinical observation
 - Behaviour
 - Physiology
 - Tissue damage and repair



SkinTraction

Skintraction™ (Cobbett Technologies Pty Ltd)

- sodium lauryl sulphate (7%)
- benzyl alcohol (20mg/mL),
- phosphate buffer and
- water for injection
- 32.5ml per lamb
- needleless injector

Study conducted in an animal house - October 2008

Lambs 10 - 12 weeks old and still on their mothers

Behaviours monitored by video for 12h per day on the day of treatment (day 0) and on days 1, 2, 4, 5, 7 and 13



16:15:14
2007-08-17

Navigation buttons: Home, Back, Forward, Stop, Play, Pause, Mute, Volume, Power

GUARD

Function buttons: Home, Back, Forward, Stop, Play, Pause, Mute, Volume, Power

16:15:14

| | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 | 21:00 | 22:00 | 23:00 |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. PEN1 EAST | █ | | | | | | | | |
| 2. PEN1 WEST | █ | | | | | | | | |
| 3. PEN2 EAST | █ | | | | | | | | |
| 4. PEN2 WEST | █ | | | | | | | | |

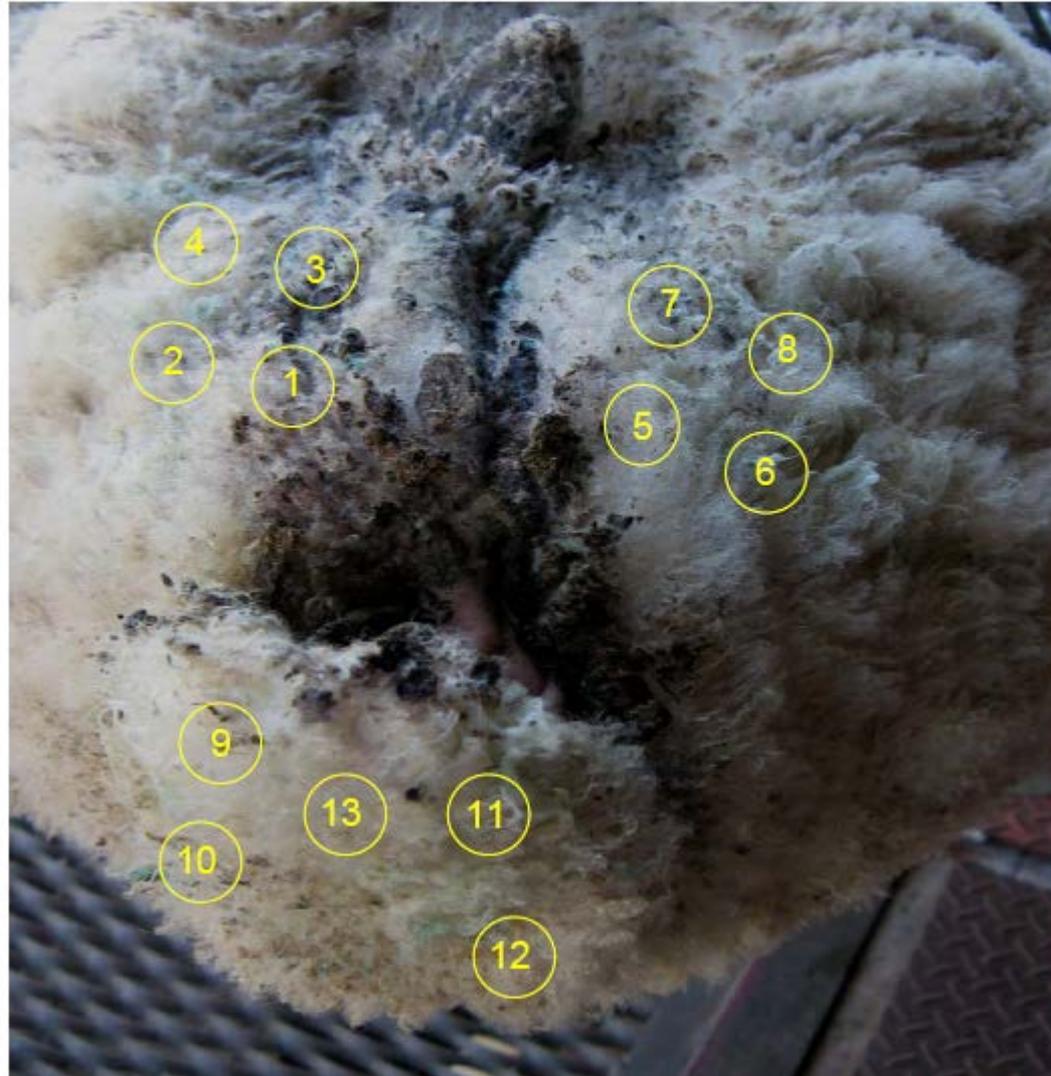
Prev [2007-8] Next

| S | M | T | W | T | F | S |
|----|----|----|----|----|----|----|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

SkinTraction – study design

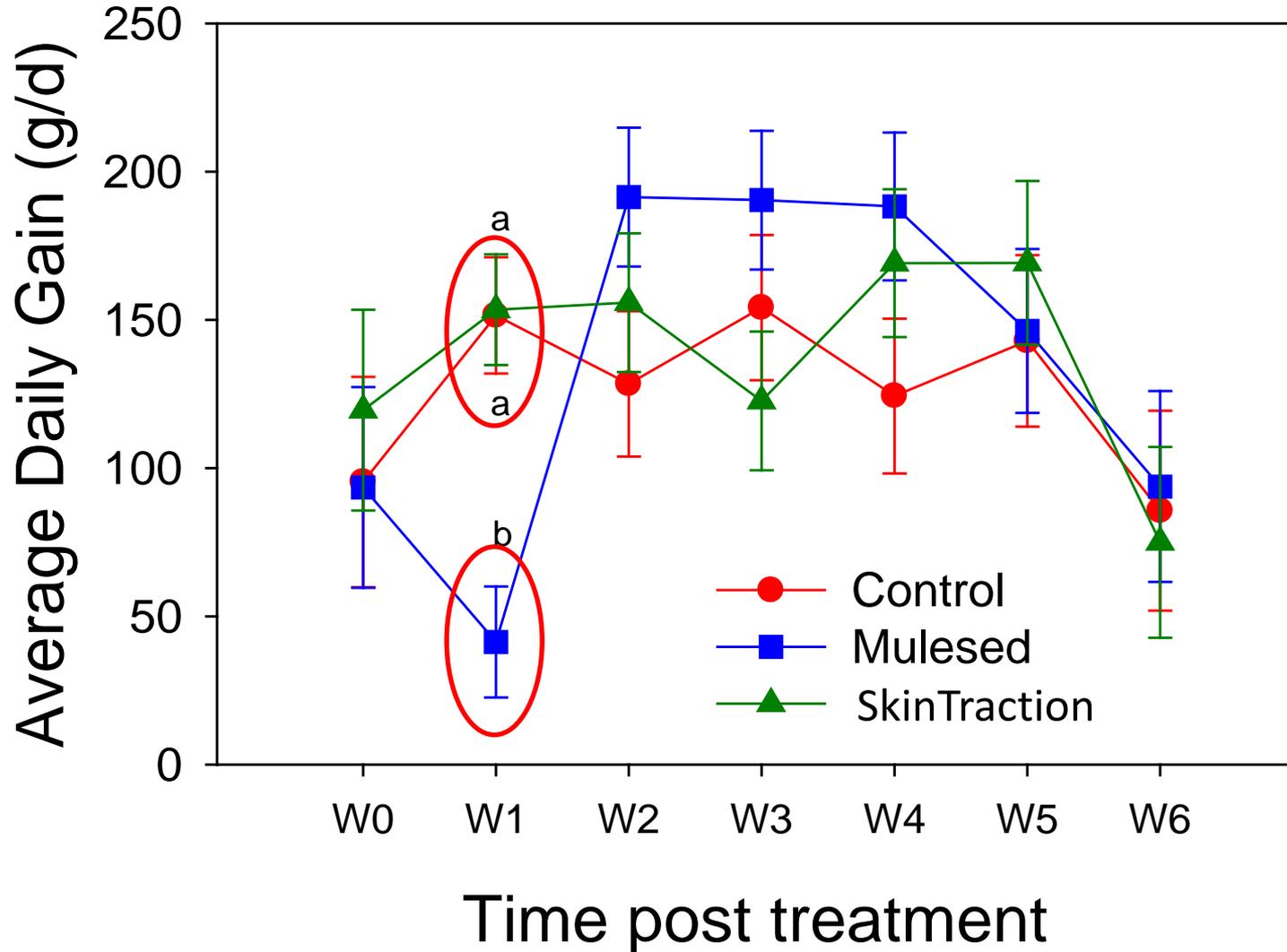
| Treatment | Week 1 | Week 2 | Total |
|------------------------------------|---------------|---------------|--------------|
| Control (unmulesed) | 5 | 5 | 10 |
| Mulesing + Tri-Solfen | 5 | 6 | 11 |
| Sodium lauryl sulphate intradermal | 6 | 5 | 11 |
| Totals | 16 | 16 | 32 |

Injection pattern

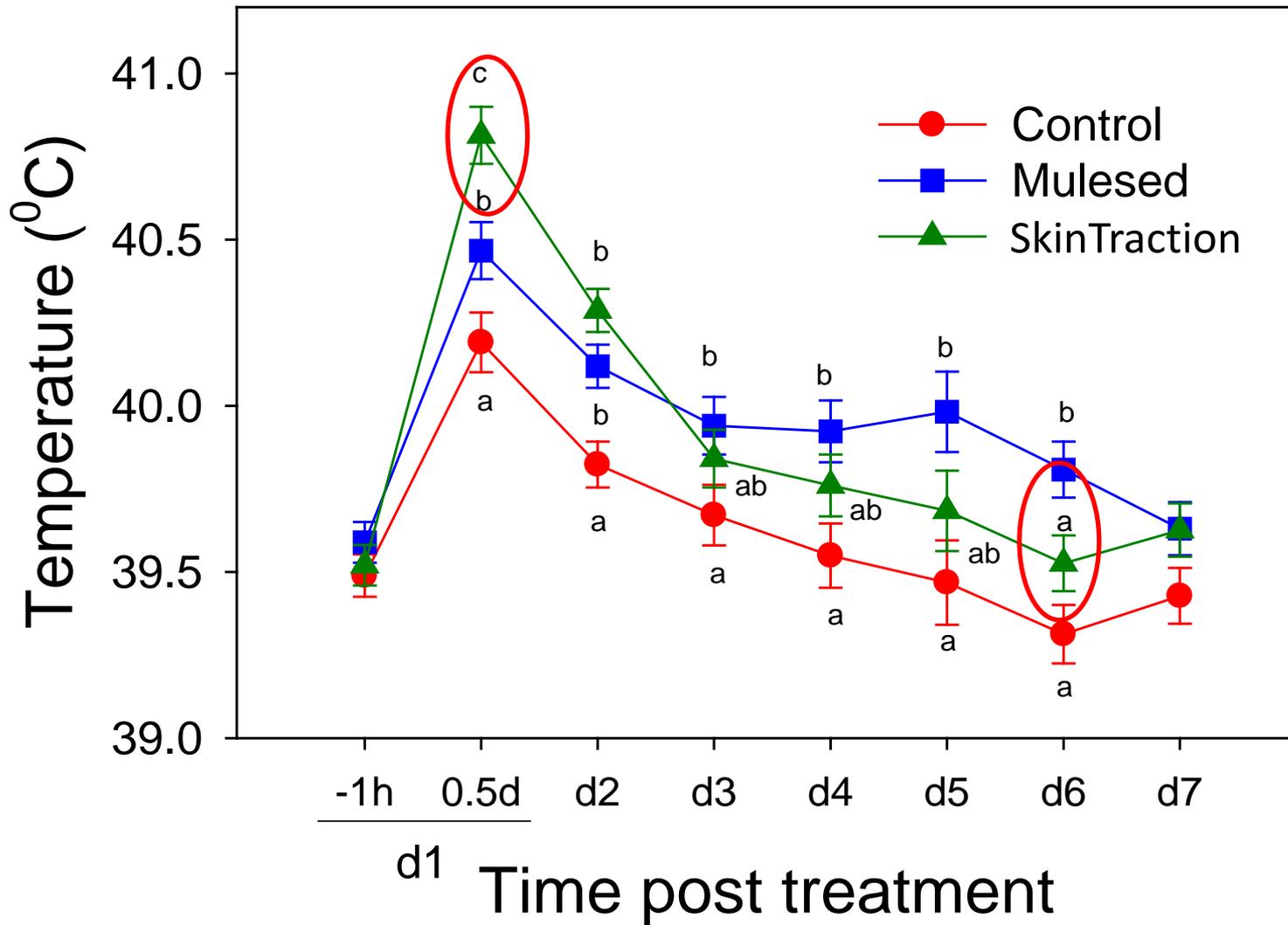




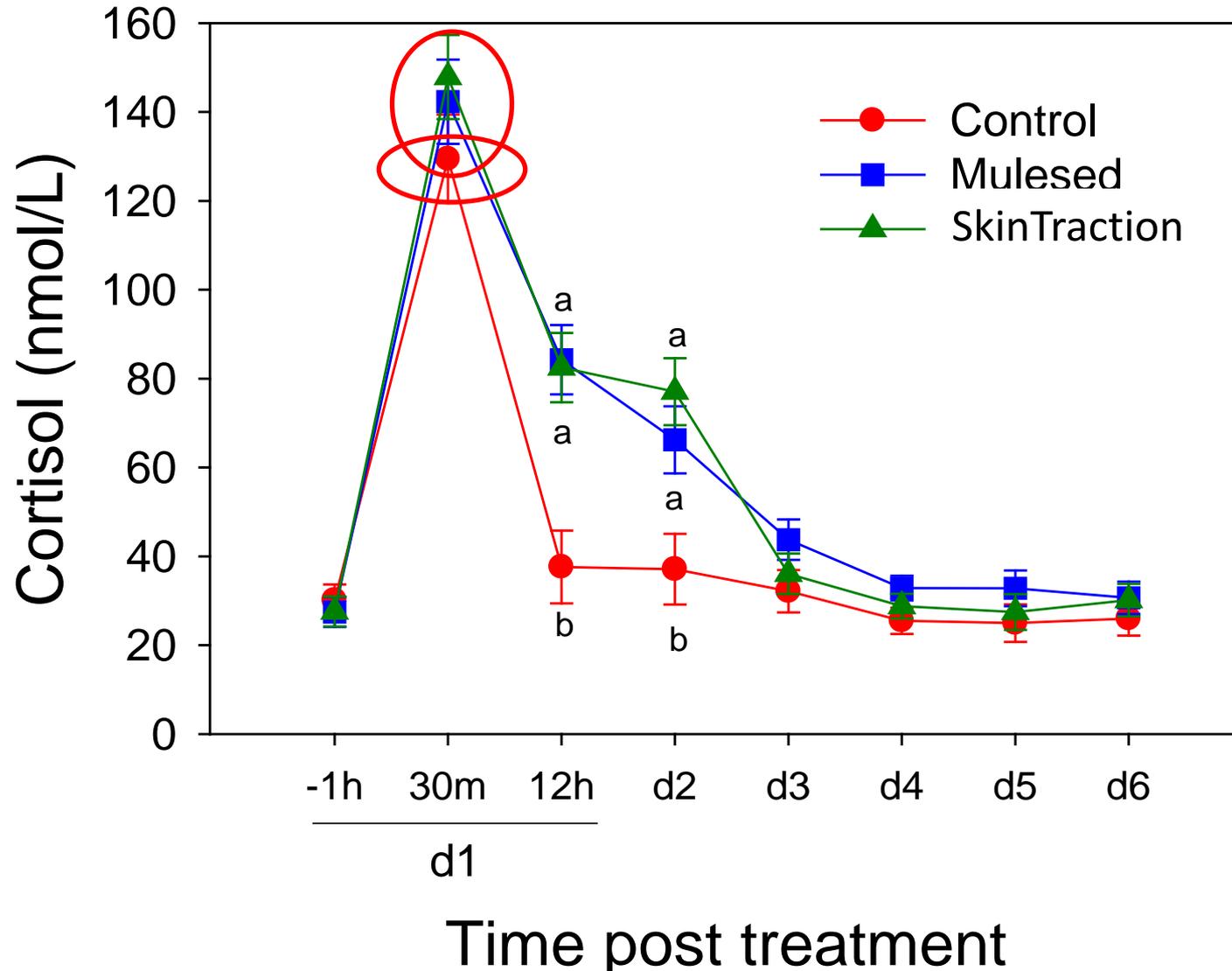
Results – Physiology: ADG



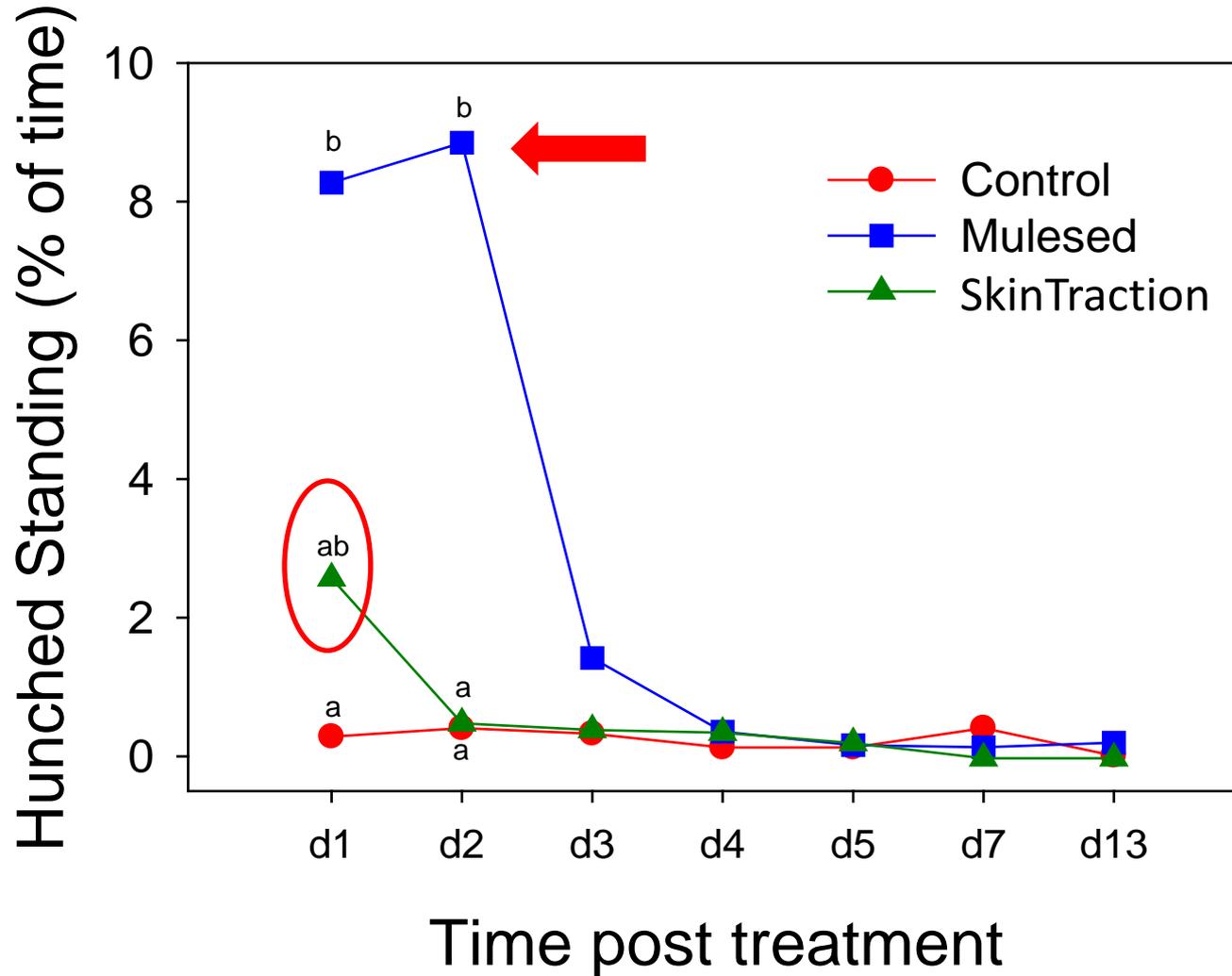
Temperature



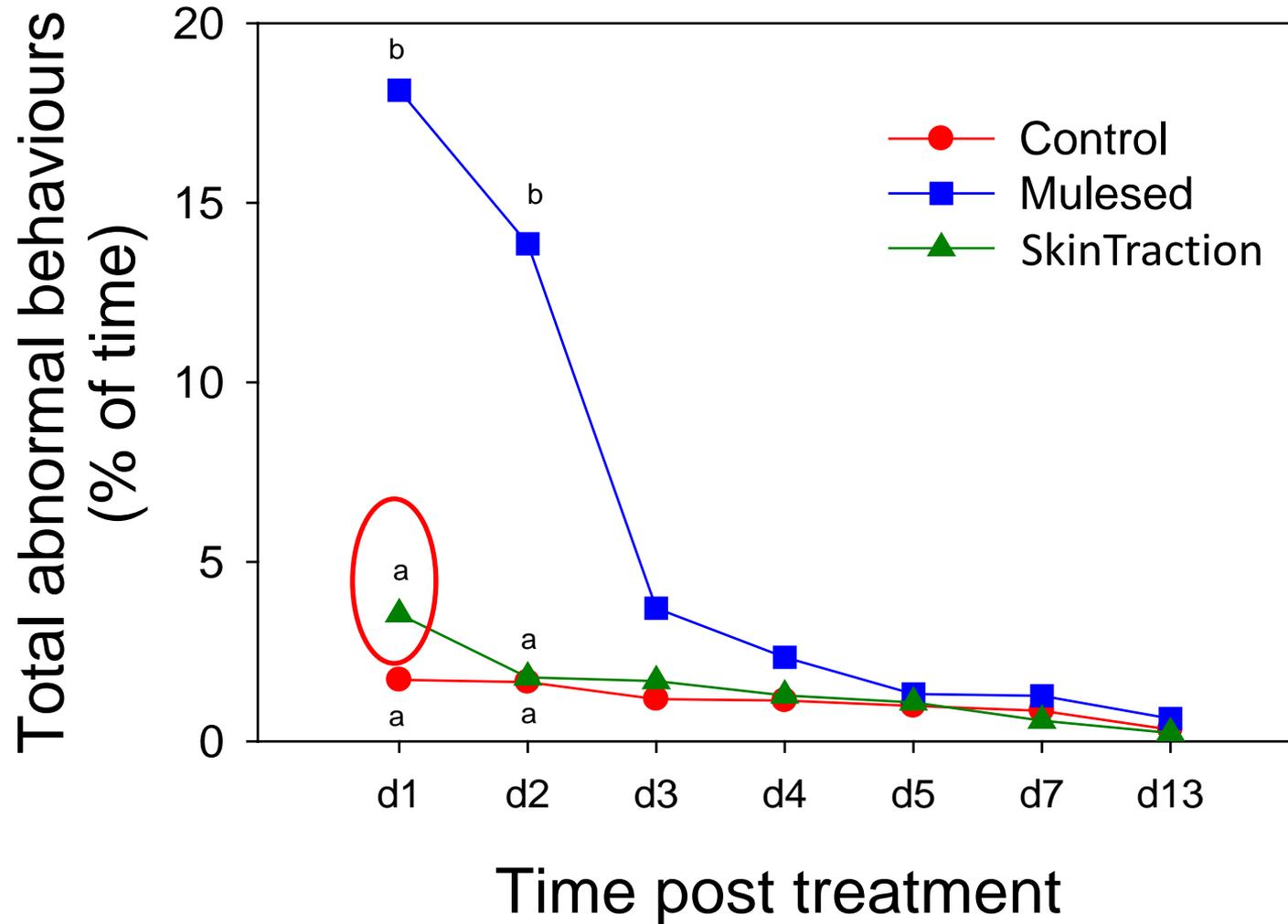
Cortisol profile



Behaviours: Hunched standing



Total Abnormal Behaviours



SkinTraction - Conclusions

Physiology

- Transient fever and cortisol response (2 days) comparable to Mulesing
- Signs of systemic response associated with the local tissue reaction to SLS
- Generally milder and shorter duration than mulesing
- Feed intake and ADG comparable to Controls – much less impact than Mulesing

Behaviour

- Only minor changes to normal behaviours
- Tendency ($P < 0.1$) for an increase in abnormal behaviours on day of treatment
- Behavioural impacts very much less marked and shorter duration than Mulesing

Treatment site

- Mild oedema, followed by hardening and scab formation
- Closed wound
- Scabs starting to lift at 42 days





Physiological and behavioural effects of intradermal injection of sodium lauryl sulfate as an alternative to mulesing in lambs

IG Colditz,^{a*} DR Paull,^a C Lee^a and AD Fisher^b

Aust Vet J 2010;88:483

Objective To assess the effects on physiology and behaviour of intradermal injection of sodium lauryl sulfate (SLS) as an alternative to mulesing.

Procedures Three groups of Merino lambs were studied: Control (n = 10), SLS (n = 11) and Mulesed (n = 11). The SLS group received SLS (7% w/v) and benzyl alcohol (20 mg/mL) in phosphate buffer, and the Mulesed group received 6 mL topical local anaesthetic as a wound dressing. Haematology, cortisol, beta-endorphin and haptoglobin concentrations, rectal temperatures, body weight and behaviours were monitored for up to 42 days post treatments.

Results SLS treatment induced mild swelling followed by thin scab formation. Fever (>40°C) was observed at 12 and 24 h, cortisol concentration was elevated on days 1 and 2, haptoglobin concentration was highly elevated on days 2–7, white blood cell count was elevated on days 2 and 4 post treatment, but average daily gain was not affected. Fever at 12 h was significantly higher in the SLS than in the Mulesed group, whereas maximum temperature, temperature area under the curve (AUC), occurrence of fever, cortisol profile, cortisol AUC, white blood cell counts and haptoglobin concentrations until day 7 were comparable. The behaviours of normal standing, total standing and total lying were modified for 2 days by SLS treatment, but changes were less marked and of shorter duration

wrinkling and increase the area of bare skin in the perineal region decrease the risk of breech strike. A surgical method called mulesing achieves this goal by removing the skin lateral to the perineum and from the sides of the tail. Non-surgical methods of improving breech conformation have been explored since the late 1930s and include topical or intradermal application of a wide range of caustic, sclerosing, escharotic or photoactive chemicals, digestive enzymes, freezing and irradiation.¹ In addition, breech remodelling following avascular necrosis induced by application of occlusive clips to the skin has been examined.²

The potential for quaternary ammonium compounds to act as escharotic agents when applied topically or injected intradermally was examined by Chapman.³ Tissue remodelling and skin contraction during healing led to an increase in the bare area of the breech, but a limitation of the most promising compound identified was the induction of cortisol responses and pain-related behaviours of a similar magnitude to that for mulesing.⁴ Modifications of the composition and delivery of escharotic formulations based on quaternary ammonium compounds were subsequently developed by Australian Wool Innovation with a view to reducing adverse effects.⁵ From that work, cetrimide was chosen for further research and development. Recent assessments of the response to intradermal injection of a modified formulation based on cetrimide into the breech and tail of lambs

SkinTraction - Conclusions

Results are in accord with the findings of Hemsworth et al *Applied Animal Behaviour Science* 117:20-27 (2009)

Improvements in SkinTraction technology since this assessment - likely now to have fewer adverse welfare impacts

Recommendation

- Undertake assessment of the improved SkinTraction technology



Liquid Nitrogen – Welfare assessment

Scoping study to assess the time course and clinical impact of cold-induced skin necrosis – April 2011

Provide data on impact of the treatment on clinical signs including

- rectal temperature
- heart rate
- lung sounds
- demeanour
- appetite
- freedom of movement
- wound appearance
- wound healing

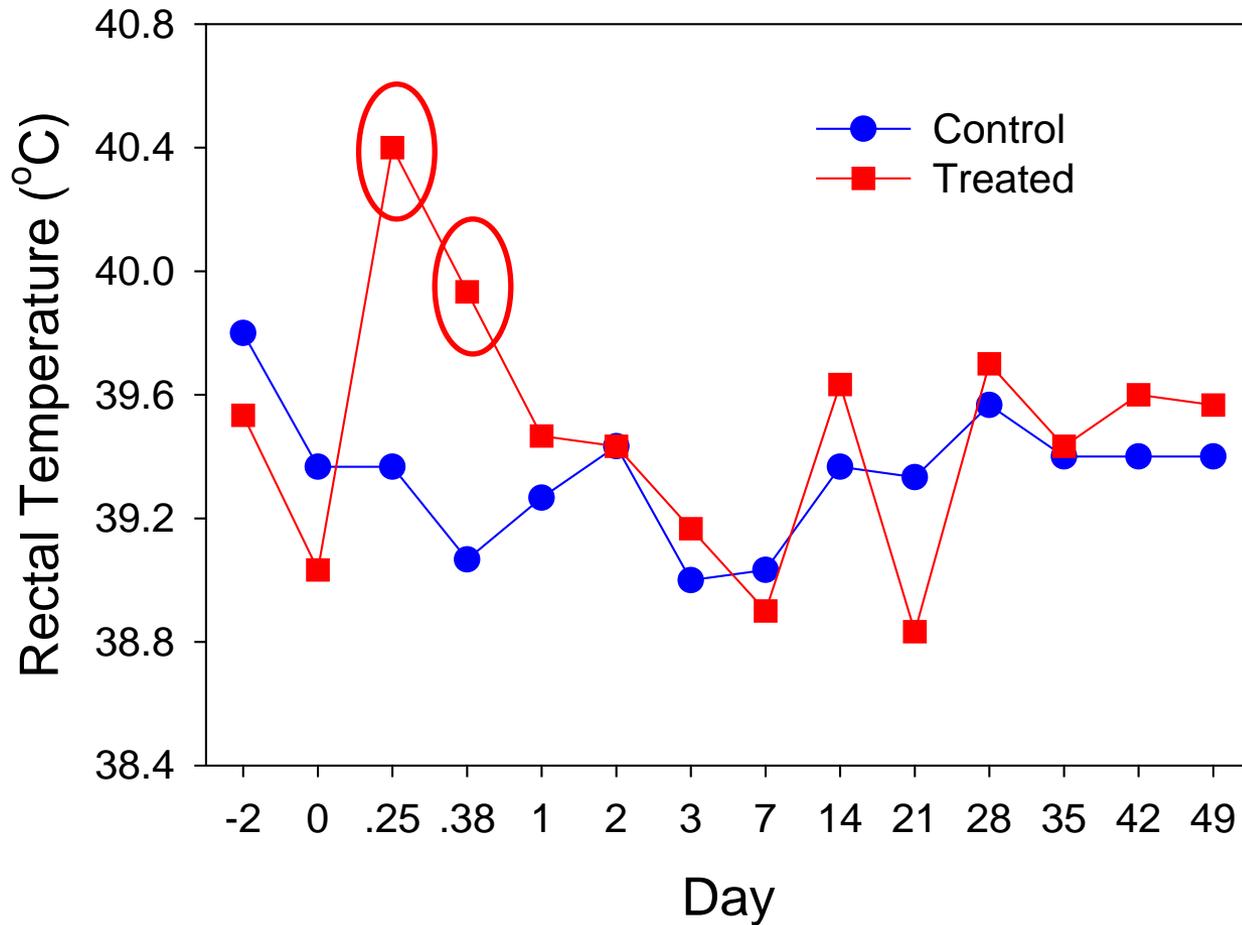
Sheep

- 6 x 6 month old wethers – 3 treated & 3 controls
- Descriptive study – no statistics

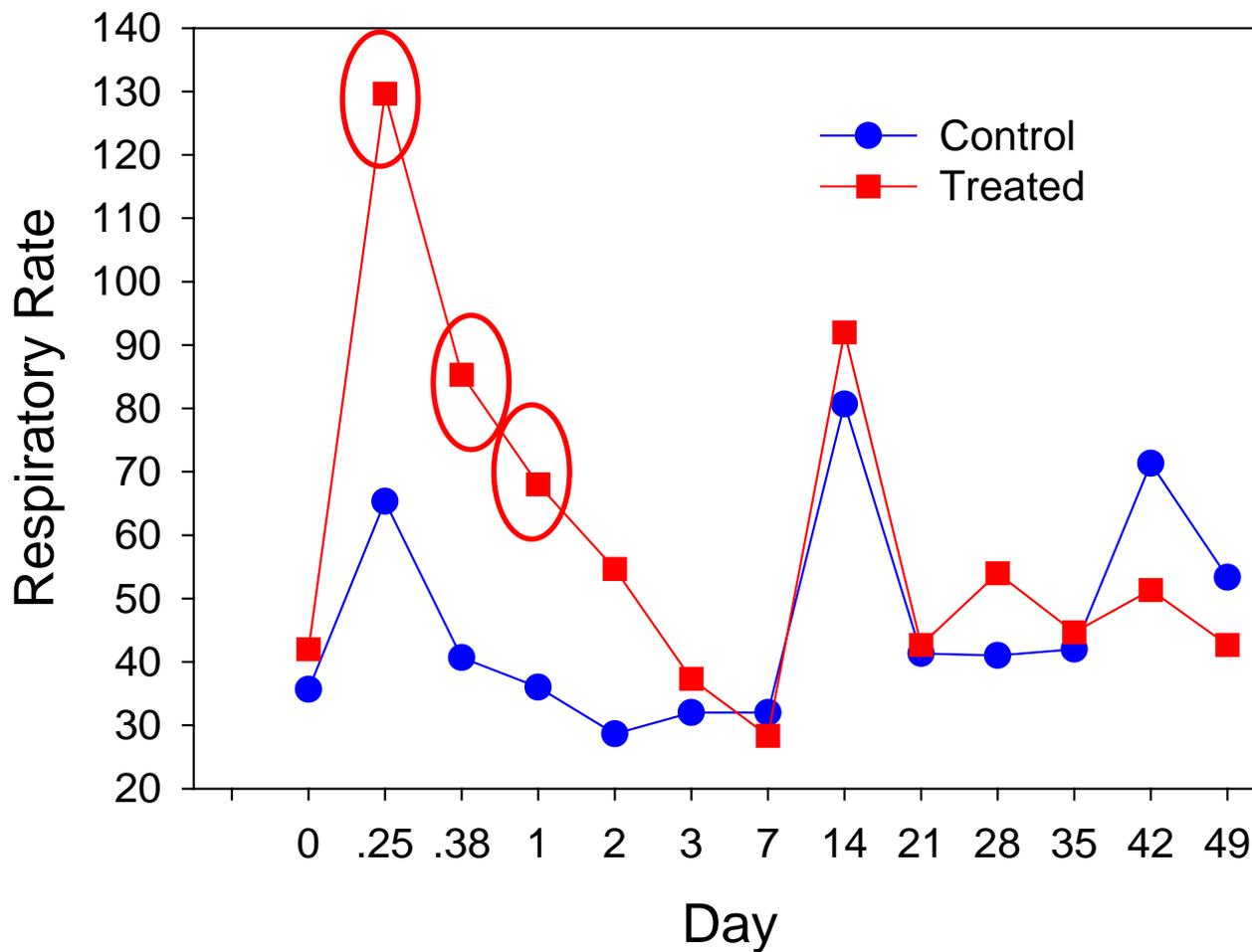




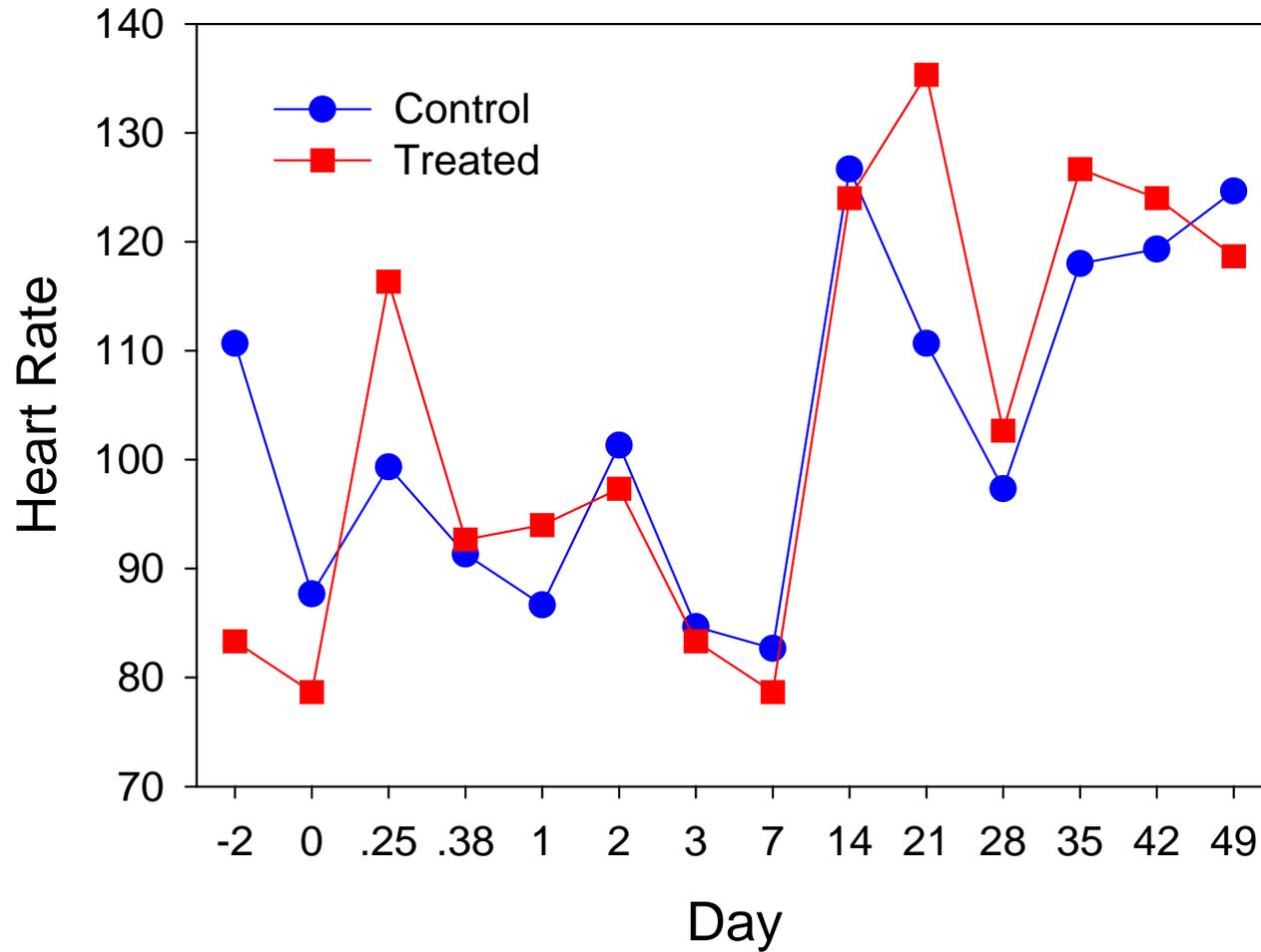
Liquid Nitrogen: Rectal temperature



Liquid Nitrogen: Respiratory rate



Liquid Nitrogen: Heart rate



Liquid Nitrogen: other effects

Demeanour

No change in demeanour observed

Appetite

No effect on appetite observed

Freedom of movement

Little effect on movement.

Tails tucked slightly under, and to walk a little stiffly on their hind legs at 9 hour, day 1 and day 2 observations. Normal by day 3.

Treatment site

6 hours: “puffy” and “purplish” or “reddish”

9 hours: “purple discolouration, puffy, oedema under the tail, skin temperature slightly increased”.

Day 1: warm hyperaemia of the area, purple discolouration and visible oedema of the tail and breech area. Reluctant to have their tails handled. Some exudation of tissue fluid

Days 2 – 5: lesions hardened and the oedema and bruising resolved.

Day 7: Treated tissue had formed into hard ridges. No eschar formation

Week 4 - 10: Wool over treated site dry and with appearance of lumpy wool until hardened tissue sloughed.



24 hours



28 days

Liquid Nitrogen: Conclusions

- Initial discomfort
- Some short term systemic effects of treatment (respiratory rate, rectal temperature)
- Very few behavioural impacts
- Impacts much milder than mulesing

Recommendation

- From acute welfare perspective: suitable for further development
- Undertake detailed welfare assessment when procedure refined

Laser – welfare assessment

- 14 superfine Merino sheep, ewes and wethers 18 -30 months.
- September 2012 – April 2013
- Each sheep was observed closely during treatment
 - restlessness,
 - flinching,
 - struggling,
 - fasciculation of subcutaneous muscles,
 - turning the head towards the treatment site, vocalisation and respiration rate.
- Skin temperature recorded with an infra-red thermometer
- Sheep observed for up to 4 months after treatment





Day 3



Day 12



Day 47



Day 111

Laser: Conclusions

- No signs of behavioural reaction during laser treatment
- Skin temperature 30°C to 42°C immediately after treatment, dropping rapidly back to 26-28°C within one minute of treatment
- At higher doses, hard dry scabs formed at treatment sites
- Lesions slow to heal (weeks)

Recommendation

- Few acute welfare impacts : treatment well tolerated
- Detailed welfare assessment of refined procedure if efficacy goals achieved

Castration and tail docking - Comparison Trial

- Compare impact of castration or tail docking practices on behavioural, physiological and wound responses - Spring 2013
- 392 lambs (192 Merinos and 200 Cross bred) aged 28 to 74 days, 7.5 to 23.9 kg
- Only one procedure per lamb
- Scrotal and tail characteristics measured before marking
- Behaviour – at 5 min then every 15 min for 2 hours (9 observations / lamb)
- Body weight, wound score, wound temperature, haematology and haptoglobin – weekly for 3 weeks



Castration and tail docking

- **Castration**
 - Knife castration removing 1/3 of scrotum (n = 29) [K 1/3]
 - Knife castration removing tip of scrotum (n = 29) [K tip]
 - Ring castration (n = 29) [Ring]
 - Ring castration followed by removal of testes (n = 28) [R&R]
 - Sham (n = 30) [Sham]
- **Tail docking**
 - Cold knife (n = 40) [CK]
 - Conventional gas hot knife (n = 41) [HK]
 - Te Pari gas hot knife (n = 41) [Te Pari]
 - Ring (n = 40) [Ring]
 - Ring followed by removal of the tail below the ring (n = 41) [R&R]
 - Sham (n = 40) [Sham]

Comparison of castration versus tail docking

- castration had a greater impact on activities and abnormal behaviours of lambs than tail docking.
- tissue damage greater in tail docked lambs than castrated lambs.
- both procedures had a substantial impact on lambs, but not to the extent of affecting short term weight gain.

Comparison of castration treatments

- conventional knife castration (Knife 1/3) resulted in fewer behavioural and physiological impacts than conventional ring castration (Ring).
- both these procedures were still actively healing at 21 days as indicated by haptoglobin concentrations and wound scores.
- Ring and Remove had less impact on normal activities than Ring but a comparable impact on abnormal behaviours. It also resulted in faster resolution of tissue damage than Ring.
- Knife Tip did not differ from Knife 1/3 in behavioural and physiological impacts except that greater blood loss (as assessed by change in haematocrit) may have occurred in this group It provided no operator advantage over Knife 1/3.
- **No procedure was demonstrably better or worse when all assessment criteria were considered.**

Comparison of tail docking treatments

- ring treatments had a greater behavioural impact than knife treatments.
- Te Pari tended to have less behavioural impact than Cold Knife, with the Hot Knife lying between these two.
- Hot Knife and Te Pari caused more initial tissue damage with Cold Knife having an intermediate initial impact and ring treatments least initial impact, however healing progressed more quickly in hot and cold knife treated groups than in the two ring treated groups.
- Blood loss was greatest with the Cold Knife treatment.
- There was a suggestion that wound responses to knife treatments might be more adverse in lambs with more tail tissue but the magnitude of the effect was not strong.
- **No procedure was demonstrably better or worse when all assessment criteria were considered.**

Castration and tail docking

Next steps

- Compare impact of combined procedures v single procedures
- Longer observation period
- Greater range of lamb sizes



awi

Australian
Wool Innovation
Limited

2008