

## Lamb behaviour during and shortly after tail-docking

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### Abstract

Routine husbandry procedures for lambs are increasingly scrutinised for their animal welfare implications. One such procedure is tail-docking, which is commonly performed to prevent breech blowfly strike. Although tail-docking is considered painful for lambs, the precise level of pain remains unquantified. While proponents argue that the long-term benefits outweigh the temporary pain caused; further investigations into the welfare implications of tail-docking are needed. This study assessed Merino lambs at an average docking age of  $14 \pm 3$  days across five cohorts, each comprising 25–35 ewes and their lambs ( $n = 228$ ). Two treatments were administered: the Control group lambs were left intact and undocked, while the Treatment group lambs were tail-docked. Lambs were randomly assigned to either group, with birth type and sex as stratifying factors. Observational data were collected during three periods: 1. during the tail-docking/sham procedure following the established protocol; 2. during a two-minute period immediately post-docking, upon returning to their dams; and 3. during a two-minute period 10 minutes post-docking. Signs of discomfort were evident during tail-docking and persisted at two and 10 minutes post-procedure. During the docking/sham procedure, undocked lambs were more likely to remain calm, whereas docked lambs exhibited signs of distress, including restlessness, kicking, bleating, and tense facial expressions. Observations at two minutes post-docking aligned with those recorded at 10 minutes post-docking, indicating sustained discomfort. These findings suggest that tail-docking results in both immediate and longer-term discomfort. Further research should assess whether the long-term benefits of tail-docking justify the associated pain.

**Keywords:** discomfort, ethical production, ovine, pain, welfare

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### Introduction

There is a growing movement in international commerce and trade to prioritise product quality over quantity. Consumers increasingly demand that animal-derived products be produced with respect for the animals and with consideration for their welfare throughout the production process (Henryon *et al.*, 2023). The World Organization for Animal Health (OIE, 2008) has developed animal welfare guidelines that can be used to govern international trade in animal products. Not only have consumer concerns about animal welfare led to improved standards, but they have also stimulated changes in

production, traceability, and labelling practices worldwide (Passantino *et al.*, 2008; Haggerty *et al.*, 2009). Some of the most challenging changes in farming practices required by certification programmes are the reductions in physical alterations to production animals, such as prohibiting the tail-docking and castration of lambs raised for market (Rogers *et al.*, 2011). Social standards have the power to drive the adoption of more acceptable welfare practices. Increased social scrutiny of tail-docking would not be surprising, despite its approval as a management tool for controlling breech blowfly strike in wool sheep breeds (Lagler *et al.*, 2022).

There are significant welfare implications for sheep when they contract flystrike (Phillips, 2009), and tail-docking is a routine procedure performed on sheep to prevent flystrike in the breech area (Wall, 2012). However, the advantages of tail-docking are not justifiable in all sheep production systems (Orihuela & Ungerfeld, 2019). According to Fisher *et al.* (2004), tail-docking is a proactive practice in regions where Merino sheep, which have been bred for exceptional wool qualities, are predisposed to cutaneous myiasis and dag formation. Alternative control methods, such as insecticides, may compromise the occupational health and safety of those in the wool production pipeline. Wool is also commonly bulk tested for residual harmful pesticides, and noncompliance may lead to a reduced market share, and/or exclusion from high-value markets. Tail-docking is thus a popular measure for preventing breech strike in wool breeds, especially since the mules operation became an ethically unacceptable method of control (Phillips, 2009). Broom (1988) defined animal welfare as an animal's ability to adapt to its surrounding environment, influenced by the duration and intensity of physiological and/or behavioural stressors. Animal welfare therefore benefits if the risk of flystrike is minimised (Bath, 2017); however, docking lambs' tails causes short-term discomfort. Nonetheless, compared to the stress and distress invariably associated with repeated breech flystrike events, it could be argued that tail-docking is ethically preferable.

The objective assessment of pain associated with tail-docking is necessary to determine the ethically preferable path. Various methods for evaluating pain exist, and pain assessment continues to expand to include innovative approaches such as biomarkers (Niculescu *et al.*, 2019). Sheep experiencing chronic pain may undergo receptor changes in the spinal cord, including increases in alpha-2 adrenoceptors and mu-opioid receptors (Brandt & Livingston, 1990). Nociception involves sensory receptors that detect tissue damage and generate physiological and behavioural responses (Douglas *et al.*, 2018). However, such biomarkers are difficult to detect, as their presence may be transient and unpredictable. In the absence of reliable biomarkers for general application and direct communication between humans and animals, researchers often rely on indirect methods to assess animal discomfort. Observing the behaviour of animals undergoing potentially stressful procedures is an important indirect assessment tool (Ekman & Friesen, 1978; Sneddon *et al.*, 2014). Behavioural observations in animals can be categorised by complexity, with changes in behaviour being the most common indicators of pain (Sneddon *et al.*, 2014). Marchewka *et al.* (2016) noted that lambs employ different coping mechanisms to mitigate pain, depending on their social environment.

Different methods of tail-docking cause different levels of pain in lambs (Grant, 2004). Tail-docking with rubber rings elicited higher levels of active pain behaviour, agitation, postural pain indicators, and cortisol levels compared to tail-docking with a hot blade in lambs aged 3–6 weeks (Graham *et al.*, 1997; Grant, 2004). Tail-docking with a hot blade resulted in non-significant differences in cortisol levels and behavioural responses compared to undocked lambs (Graham *et al.*, 1997). Tail-docking with a hot blade also resulted in non-significant changes in posture (e.g., lying down, walking, or standing with legs apart) or active pain behaviours (e.g., kicking, bleating, restlessness, lip curling, and tail flicking) (Graham *et al.*, 1997, 2002; Grant, 2004). The use of a topical anaesthetic (Tri-Solfen®) significantly reduced pain behaviours associated with hot blade tail-docking (Lomax *et al.*, 2010). In addition, subcutaneous bupivacaine administration significantly reduced cortisol levels during tail-docking with rubber rings (Graham *et al.*, 1997). Bupivacaine was also found to be safe, with no adverse effects (Lomax *et al.*, 2010). Pain management was thus essential for the reduction of stress associated with tail-docking (Graham *et al.*, 1997). There is no evidence that docking tails at different lengths causes varying degrees of acute pain (Fisher *et al.*, 2004). However, docking through a vertebra was distinctly more painful than docking through an intervertebral space (Graham *et al.*, 2002).

Pain assessment is primarily based on observed changes in behaviour and visual cues. Behavioural parameters (vocalisation, restlessness, facial expression, and lameness) can be combined with physiological parameters (respiration rate) and clinical parameters (appetite) to assess the pain response. Such indicators have been identified as valuable reflections of animal discomfort in the

literature (Graham *et al.*, 1997; Grant, 2004). The Facial Action Coding System was designed to recognise pain behaviour in humans by analysing facial expressions (Ekman & Friesen, 1978). Similarly, Guesgen *et al.* (2016) coded and quantified the facial expressions of lambs, as associated with the pain they experienced during husbandry procedures. It was contended that humans could differentiate between the facial expressions of docked and undocked lambs using the Lamb Grimace Scale (LGS) system (Guesgen *et al.*, 2016). However, restraining the lambs obscured people's perceptions of pain and the quantifiable components of the LGS system (Guesgen *et al.*, 2016).

The aim of this study was to assess the behavioural and postural changes observed in lambs during the husbandry procedure of tail-docking with a hot iron, to indirectly evaluate the pain and/or discomfort experienced by the lambs in relation to untreated control lambs.

## Material and methods

Ethical approval was granted for the project within the Stellenbosch University Animal Care and Use system, with the ethical approval reference number of ACU-2023-25375. All available ewe and ram progeny ( $n = 228$ ) from the 2023 lambing season for the Merino flock at Elsenburg experimental farm were used (see Cloete *et al.*, 2004 and Nel *et al.*, 2021 for background on the flock). In the flock, lambs are routinely identified with their dams within 24 hours of birth, with birthweight also being recorded at this time (Cloete & Scholtz, 1998; Nel *et al.*, 2021). Ewes are identifiable from a distance by a uniquely numbered neck tag fitted to each ewe, and each dam's assigned identification number is spray painted on the side of that dam's lamb(s) to facilitate mothering-up during routine postnatal inspections.

At an average ( $\pm$  standard deviation) lamb docking age of 14 ( $\pm 3$ ) days, ewes in five management groups of 25–35 ewes each were taken to a pen at the Elsenburg stockyard with their lambs (see Cloete & Scholtz, 1998). The lambs were divided into two experimental groups: intact, undocked lambs served as the Control group and docked lambs served as the Treatment group. The docking procedure was guided by the recommendations of the National Wool Growers' Association, namely that: 'The tail stump must be left long enough to cover the ewe's external genitalia and the ram's anus'. To standardise the docking procedure according to these recommendations, tails were docked at the third palpable joint using a hot blade. Lambs were randomly allocated to both the Control and Treatment groups after stratification according to birth type and sex (Control group = 111 lambs, Treatment group = 117 lambs). The Treatment group lambs were observed during the tail-docking procedure, while the Control group lambs were handled and observed as if tail-docking were taking place. The measurement of tail length, as described by Teubes *et al.* (2023), allowed the Control lambs to also be subjected to what could be described as a sham treatment.

Lambs were removed from their dams during docking as they needed to be restrained for the procedure, but were placed back with their dams in the holding pens after docking. Lamb behaviour was monitored during the following time intervals: 1. during the tail-docking procedure as described above; 2. during a two-minute interval immediately following the procedure and after they were returned to their dams; and 3. during another two-minute interval 10 minutes after docking. Two-minute observation intervals were found to be adequate to discern between behaviour attributes typically expressed by lambs in the Treatment and Control groups. Each lamb was followed throughout the entire docking and post-docking observation periods by one of five trained observers assisting with the study.

The following expressions of discomfort/pain were recorded on a binomial scale (i.e. as either present or absent) in Treatment and Control lambs during either actual tail-docking or sham tail-docking: being calm, kicking, kicking violently, restless, bleating, and bleating intensely, as well as exhibiting a lip curl or a tense face.

In addition to the behavioural traits listed above, the following expressions of discomfort/pain were also recorded on a binomial scale in the Treatment and Control lambs during observations made after they were returned to their dams straight after docking or 10 minutes after docking: seeking teats, suckling, social interaction, acting relaxed, tail wagging, agitation, and tail flicking.

Normal suckling and comfort behaviours, as well as abnormal lamb behaviours, were recorded during the post-docking recording periods, as suggested by Graham *et al.* (1997) and Grant (2004). Behaviour changes were short and frequent, and behaviours were thus recorded as events. By the end of the trial, each lamb had been observed and recorded three times by the same individual. The score sheet provided to the observers was demonstrated beforehand and each of the observers had the same

degree of experience and knowledge about sheep. These observations were repeated for all five management groups.

Significant differences in behavioural observations between the docked (Treatment group) and undocked (Control group) lambs were analysed as 2 × 2 contingency tables by Chi-square procedures (Siegel, 1956), to test for differences in the proportions of lambs exhibiting a specific behaviour or not. Both Treatment and Control lambs were assessed for the behaviour attributes, as described above.

## Results and discussion

Control lambs were more likely to be calm during the sham docking procedure than their docked contemporaries ( $P < 0.001$ ; Table 1). In contrast, docked lambs were more likely to be restless, kicking, kicking violently, bleating, and bleating intensely than their intact Control contemporaries ( $P < 0.01$ ). The Treatment lambs also exhibited more tense facial expressions than their untreated contemporaries ( $P < 0.05$ ), while no treatment difference was found for lip curling ( $P > 0.05$ ). The higher proportion of docked lambs with tense facial expressions is consistent with the results of Guesgen *et al.* (2016), indicating an increased LGS score in docked lambs, but not in their undocked contemporaries. Frequencies of lambs in the fast-breathing category were too low for meaningful analysis.

**Table 1** Proportions of lambs in the Control (sham tail-docked) and Treatment (tail-docked) groups exhibiting the measured behavioural attributes during the sham or tail-docking procedure

	Control	Treatment	Chi-square <sup>1</sup>
<b>Number of observations (n)</b>	111	117	
<b>Proportion of lambs exhibiting behaviour</b>			
<b>Calm</b>	0.613	0.316	18.963***
<b>Kick</b>	0.306	0.538	18.921***
<b>Kick violently</b>	0.009	0.128	12.403**
<b>Restless</b>	0.077	0.128	7.388**
<b>Bleat</b>	0.234	0.444	11.183***
<b>Bleat intensely</b>	0.036	0.239	20.610***
<b>Lip curl</b>	0.081	0.128	1.343
<b>Tense face</b>	0.117	0.239	5.767*

<sup>1</sup> Chi-square value significance indicators: \*significant at  $P < 0.05$ , \*\*significant at  $P < 0.01$ , \*\*\*significant at  $P < 0.001$

Behavioural attributes that reflected a lamb's desire for comforting and social activities, such as seeking teats, suckling, and tail wagging, were all independent of the experimental group immediately after docking ( $P > 0.20$ ; Table 2). However, the docked Treatment lambs were less likely to be relaxed and more likely to be agitated ( $P < 0.01$ ). Behavioural attributes indicating discomfort and restlessness, such as tail flicking, standing with legs apart, tail licking, and lying down repeatedly, were all higher in the docked lambs than in their intact contemporaries ( $P < 0.05$ ). No clear-cut differences between the groups were found for bleating, head movements, and a tense facial expression ( $P > 0.17$ ).

The frequencies for lip curling and lameness in some cells of the 2 × 2 contingency tables were too low for meaningful statistical analyses and these results are not tabulated. According to the literature, mouth features and orbital tightening significantly increased after tail-docking when assessed using the LGS system (Guesgen *et al.*, 2016). The proportion of docked lambs with tense faces decreased from 23.9% during the procedure to 5.1% immediately after docking (Chi-square = 24.617, degrees of freedom = 1,  $P < 0.001$ ) (Tables 1 and 2). This result concurs with the findings of Guesgen *et al.* (2016), who reported that only two of the five facial actions were significantly affected after docking when assessed using the LGS system.

**Table 2** Proportions of lambs in the Control (sham tail-docked) and Treatment (tail-docked) groups exhibiting the measured behavioural attributes during a two-minute observation period directly after the sham or tail-docking procedure

	Control	Treatment	Chi-square <sup>1</sup>
<b>Number of observations (n)</b>	111	117	
<b>Proportion of lambs exhibiting behaviour</b>			
Seeking teats	0.649	0.709	0.966
Suckling	0.595	0.632	0.345
Social	0.324	0.248	1.634
Relaxed	0.658	0.326	26.591***
Tail wag	0.523	0.479	0.439
Agitate	0.018	0.410	51.186***
Tail flick	0.018	0.444	57.441***
Legs apart	0.027	0.188	15.125***
Tail lick	0.018	0.094	6.666*
Bleat	0.045	0.077	1.004
Head moves	0.054	0.094	1.318
Tense face	0.018	0.051	1.861
Lying down	0.027	0.145	9.990**

<sup>1</sup> Chi-square value significance indicators: \*significant at  $P < 0.05$ , \*\*significant at  $P < 0.01$ , \*\*\*significant at  $P < 0.001$

As found for the observations made directly after docking, comfort-seeking behaviours 10 minutes after docking were independent of the experimental group ( $P > 0.24$ ; Table 3).

**Table 3** Proportions of lambs in the Control (sham tail-docked) and Treatment (tail-docked) groups exhibiting the measured behavioural attributes during a two-minute observation period 10 minutes after the sham or tail-docking procedure

	Control	Treatment	Chi-square <sup>1</sup>
<b>Number of observations (n)</b>	111	117	
<b>Proportion of lambs exhibiting behaviour</b>			
Seeking teats	0.324	0.376	0.67
Suckling	0.270	0.205	1.337
Social	0.342	0.325	0.079
Relaxed	0.624	0.108	22.073***
Tail wag	0.198	0.162	0.495
Agitate	0.018	0.316	35.727***
Tail flick	0.009	0.264	30.984***
Legs apart	0.018	0.188	17.482***
Tail lick	0.009	0.086	7.389*
Bleat	0.036	0.069	2.262
Head moves	0.018	0.068	3.445
Tense face	0.018	0.060	2.626
Lip curl	0.009	0.026	0.914
Lame	0.018	0.017	0.003
Lying down	0.171	0.308	9.698**

<sup>1</sup> Chi-square value significance indicators: \*significant at  $P < 0.05$ , \*\*significant at  $P < 0.01$ , \*\*\*significant at  $P < 0.001$

However, the docked Treatment lambs were still less likely to be relaxed and more likely to be agitated than the Control lambs ( $P < 0.01$ ), as found immediately after the procedure. All the attributes associated with restlessness and discomfort were more prevalent in the Treatment group, indicating the same trend as reported in Table 2 for directly after tail-docking ( $P < 0.05$ ). However, bleating, head movements, lip curl, facial tension, and lameness were all independent of the experimental group ( $P > 0.06$ ), as reported in Table 2.

When comparing the 10-minute post-docking behaviour to the two-minute post-docking behaviour, no significant differences within the Treatment and Control groups were evident. Therefore, there was no evidence of aggravated pain in lambs 10 minutes after tail-docking. It is thus suggested that the pain and discomfort associated with tail-docking are transient and are experienced for a relatively short period. In contrast, Lomax *et al.* (2010) found that tail-docking using a hot blade resulted in mild and transient secondary hyperalgesia for up to four hours post-docking. Furthermore, Marchewka *et al.* (2016) reported a significant difference in standing and walking behaviour between lambs tail-docked using a hot blade and lambs tail-docked with anaesthesia for up to three days post-docking. Anaesthesia was an option not considered in this study. Shutt *et al.* (1988) also concluded that tail-docking by means of surgery resulted in less behavioural stress than tail-docking using rubber rings in three-week-old lambs.

## Conclusion

The occurrence of some behavioural attributes indicative of restlessness and unease suggested that tail-docking was associated with some level of immediate discomfort and/or pain. This state seemed to persist during the period immediately after docking, as well as during the period 10 minutes after docking. The quantification of pain reflected by increased levels of restlessness or unease in docked lambs can serve as a benchmark for evaluating the trade-offs between the potential long-term benefits of docked tails and the transient episodes of discomfort directly associated with docking. Additional research is needed to allow the comparative analysis of the trade-offs between incidents of breech strike and objectively measured pain during tail-docking. Changes in livestock husbandry practices are likely to be driven by consumer demand for welfare-friendly products.

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## Authors' contributions

Project idea, design, and study execution were contributed by M.T., A.J.S., and S.W.P.C. M.T. was responsible for the analysis of the data after instruction by S.W.P.C. and K.D. M.T. was responsible for writing the manuscript under the guidance of the other authors. All authors have read, edited, and approved the final manuscript.

## Conflict of interest

The authors declare that no conflict of interest applies for this manuscript.

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