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RESEARCH ARTICLE

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The prevalence of damaged tails in beef cows, pregnant dairy heifers and weaned dairy calves

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ABSTRACT

Aims: To determine the prevalence of tail deviations, trauma and shortening in weaned dairy calves, pregnant dairy heifers and beef cows on a selection of New Zealand farms, and to compare results to those recorded in lactating dairy cows.

Methods: This was a cross-sectional observational study. For beef cows, 25 farms were randomly selected from two veterinary practices. For dairy heifers and calves, data were collected from farms (70 and 76, respectively) previously involved in a study of tail damage in lactating cows. All cattle were tail scored using a modification of the New Zealand Veterinary Association Scoring System. Tails were palpated and lesions recorded as deviated (non-linear deformity), shortened, or traumatic (all other lesions). Cows could have more than one lesion, but for the prevalence calculations, only the presence/absence of a particular lesion was assessed. Descriptive herd-level prevalence data were reported for all farms/cattle types. For dairy heifers, the prevalence of tail deviation was compared to that in adult cows on the same farm.

Results: For beef cattle, median prevalence of any tail damage was 4.0% (min 0.0, max 37.5%), and for deviations + trauma, it was 2.0% (min 0.0, max 16.7%). For dairy heifers, equivalent figures were 1.7% (min 0.0, max 17.8%) and 1.3% (min 0.0, max 17.8%). In weaned calves, the median prevalence of any damage was 0% (min 0.0, max 11.6%): almost all damage (61/64 cases) was deviation. Farms with a heifer prevalence of deviations > 2% had a mean cow prevalence of deviations 3.65 (95% CI = 0.7–6.6)% higher than herds with heifer prevalence ≤ 2%, but this explained only 9% of the variation in log percentage cow prevalence.

Conclusions and clinical relevance: In all groups, median prevalence of tail damage was low (and lower than reported in dairy cows), but individual farms had high levels of damage. Beef cows were more likely to have shortened or traumatised tails than dairy heifers/calves, perhaps from an increased prevalence of faecal tail rings. Limited association between the prevalence of tail deviations in heifers and lactating cows on the same farm, and generally lower levels of tail damage in heifers, do not support the hypothesis that tail damage in cows principally results from damage earlier in life. This study adds support to our hypothesis that poor handling/infrastructure are responsible for most tail damage in dairy cows.

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Tail damage; prevalence; beef cows; dairy calves and heifers; New Zealand; comparison

Introduction

Tail damage in cattle can cause significant pain and reduce a cow's ability to communicate (Laven and Jermy 2020). In New Zealand, recent research has highlighted the relatively high prevalence of tail damage in lactating dairy cows, with Cuttance *et al*. (2024) reporting a median prevalence of tail damage (defined as any observed damage excluding shortened tails) of 11.5% in 200 dairy herds across New Zealand. It is commonly suggested that the principal causes of tail damage on dairy farms are poor handling by farm staff and/or the interaction between infrastructure and a cow's tail. This hypothesis was supported by a recent analysis of risk factors for tail damage (Cuttance *et al*. 2024 unpublished data) which identified that farmers who used coaxing (gentle persuasion) to get reluctant cows to move had lower odds of tail damage (OR = 0.83; 95% CI = 0.71–0.96) (compared to those who did not), while farmers who milked their cows twice daily throughout lactation (compared to those who milked cows less frequently) had higher odds (OR = 1.18; 95% CI = 1.02–1.37).

However, milking frequency and the use of coaxing explained only a small proportion of the variation between herds, so more information on the risk factors driving tail damage is needed. One way to potentially quantify the impact of poor handling and farm infrastructure on tail damage is to focus on cattle such as New Zealand dairy calves and pregnant heifers. In these cattle, handling and contact with infrastructure are rare, because they are almost exclusively kept at pasture from before weaning until first calving. Worldwide, there are very few reports of the prevalence of tail damage in calves and pregnant

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heifers, with most reporting outbreaks of tail damage (e.g. Millar and Kenward 2015), and none reporting the prevalence of tail damage across multiple herds. Collecting data on tail damage in calves will thus provide valuable baseline data on tail damage in pasture-based calves and pregnant heifers.

Beef cows represent another cattle population where measuring the prevalence of tail damage may provide useful information on the importance of handling and infrastructure as causes of tail damage. Tail damage associated with fascial tearing is unlikely to improve with time, thus older cows (whether beef or dairy) are likely to have a higher prevalence of tail damage than younger ones (Olsen *et al*. 2023). In New Zealand, beef cows, like pregnant dairy heifers and calves, are kept almost exclusively at pasture, so they also experience limited handling and interaction with infrastructure (Kaurivi *et al*. 2020). However, unlike pregnant dairy heifers and dairy calves, adult beef cows have had the time to accumulate tail damage. This is important as differences in the prevalence of tail damage between dairy calves/heifers and dairy cows may simply be that the latter are older, whereas differences between beef cows and dairy cows cannot be explained by age.

Published data on tail damage in beef cattle is more common than that in dairy calves and heifers; however, it is principally focused on tail tip necrosis, a condition which is strongly associated with cattle housed on slatted floors (Schrader *et al*. 2001). Data from beef cattle kept at pasture is less common. In Australian beef cattle, 'tail rot', characterised by tail necrosis and potential shortening of the tail, has been identified as a common type of tail damage, especially in northern Australia (Fordyce *et al*. 2009). Large-scale studies of tail rot are lacking, but a recent survey of 531 cows on a single station identified a prevalence of approximately 4% (Wooderson *et al*. 2019). In New Zealand, the only published data on tail damage in beef cows is that by Kaurivi *et al*. (2020), who reported that across 25 herds in the Waikato, the median prevalence of short tails was 3.0% (IQR = 0.6–6%). They did not identify any deviated tails; however, they only observed cows in the race rather than using palpation combined with observation. We therefore need more data on tail damage in beef cattle using a systematic tail scoring system such as that used by Cuttance *et al*. (2024).

Thus, the aim of this study was to measure the prevalence of tail damage and shortened tails in dairy calves, pregnant dairy heifers, and beef cows on New Zealand farms and to compare these estimates of prevalence with our data on tail prevalence in lactating dairy cows.

Materials and methods

All animal manipulations were approved by Massey University Animal Ethics Committee application AEC 21/71.

Beef farm selection and scoring

This study was a cross-sectional observational study, with 25 farms enrolled from two regions of New Zealand. Study size was based on an expected true prevalence of 5%, with the aim of estimating prevalence with a precision of 10% at 95% confidence. The calculation identified that 19 farms were needed for this level of confidence and precision, which was inflated to 25 farms to allow for data loss. A convenience sample of two veterinary practices (one in Waikato and one in Southland) were selected for the study. All current beef clients within 2 hours of travel from the enrolled regional veterinary practice were eligible to be enrolled. Farms were enrolled using the random selection procedure described by Cuttance *et al*. (2024), with each clinic listing their eligible beef farms in alphabetical order and then selecting the correct number of farms. Identified farms were then contacted and asked if they wanted to participate. Fourteen farms were enrolled from Waikato and 11 from Southland.

As in Kaurivi *et al*. (2020), tails were examined during pregnancy testing, but tails were palpated and scored using the system described by Cuttance *et al*. (2024). Three categories of tail damage were recorded: deviation (i.e. non-linear deformity), shortened (tail appearing shorter than normal) and trauma (all other lesions). All lesion types on a tail were recorded so a cow could have more than one lesion type and multiple lesions of the same type. Scoring was carried out by one trained technician per region (see Cuttance *et al*. 2024 for details of training) between March and May 2022.

Youngstock farm selection and scoring

Eighty farms were selected from the 200 farms used in the adult cow prevalence study reported by Cuttance *et al*. (2024). Eligible farms were considered for enrolment if they had recorded ear tag numbers alongside tail scoring, with 10 farms being randomly selected from all regions that participated in the adult cow study, apart from Manawatū. (No farms were eligible in Manawatū as in this region it had never been the intention to carry this study on beyond the cow scoring phase). Scoring was carried out by trained technicians as per Cuttance *et al*. (2024), with all heifers on the farm being tail scored prior to their first calving (approximately May 2022) and calves being scored in November 2022. All dairy calves born in spring (July–October) 2022 (whether female or male) that were present on the farm at the time of scoring were tail scored, with no data being collected on calf sex.

Statistical analyses

All analyses were undertaken using R, version 4.3.3 (R Core Team, R Foundation for Statistical Computing, Vienna, Austria). Prior to analysis, data were assessed for completeness, formatting and logical consistency. For analysis, the recorded tail lesions were categorised as: presence of deviation, shortening, trauma, deviation and trauma, or presence of any tail damage at all.

All scored animals could have multiple lesion types recorded; however, they were only assessed as binary variables (i.e. presence or absence of lesion), not the count of damage. The prevalence of tail damage for each outcome for each farm was calculated by dividing the number of tail-damaged animals by the total number scored. Summary statistics calculated included the median, IQR and range for each region and overall.

To compare the prevalence of tail damage in dairy cattle with beef cows, dairy heifers and dairy calves, no formal statistical test was used. Instead, IQR were compared and if the lower limit of the IQR for dairy cattle was higher than the upper limit of the IQR for the stock class, then a claim of a difference in prevalence between dairy cows and that stock class was made (McGill *et al.* 1978). Where there was overlap of IQR, the 95% CI of the median prevalence of the stock class and dairy cows were calculated using the formula from McGill *et al.* (1978), i.e. 95% CI for the median is $\pm$ (1.96 * 1.25 * IQR width)/1.35 *$\sqrt{}$N), where N was the number of farms recorded for the stock class. If the lower limit of the CI for dairy cows was higher than the upper limit of the CI for the stock class, then a claim of a difference in prevalence between that stock class and dairy cows was made.

For heifer data only, the prevalence results for tail deviation were then compared to the prevalence of tail deviation in the adult cows on the same farm. Linear regression was used to analyse the association between natural log adult cow prevalence as the outcome variable and categorised heifer prevalence (i.e. $\leq$ 2% and > 2%) as the predictor variable.

Results

Prevalence of tail damage in beef farms

Across 25 farms, a total of 3,130 beef cows were scored. The descriptive statistics are presented in Table 1. Across all 3,310 beef cows, 154 (4.6%) had damaged tails. Of these 154 cows, 52 (32%) had tail deviation, 32 (20%) had trauma, and 77 (48%) had shortened tails. The median herd-level prevalence of any tail damage was 4.0 (IQR = 2.0–5.6; min 0, max 37.5)%. For shortened tails the equivalent figures were 1.7 (IQR = 0–3.0; min 0, max 23.6)%. Of the 25 farms, six (24%) had no recorded damage at all of any kind. One farm had 23.6% of cows with shortened tails, and 13.9% with tail trauma. On this and other farms with a relatively high percentage of shortened tails, the research technicians reported that cows were frequently observed with dried rings of faeces around the tail, although no formal count of this was made.

Prevalence of tail damage in pregnant dairy heifers

Data were collected from 7,739 dairy heifers across 70 farms in the eight regions (Table 2). The target of 80 farms was not met because of severe weather events in Canterbury, farmer reluctance to be involved again, and lack of veterinary compliance (in one region).

Tail damage was reported in 142 (1.8%) heifers, of which 122 (86%) were tail deviations. The median prevalence of tail deviation across all farms was 1.0 (IQR = 0–2.5; min 0, max 15.6)%, see Table 3. Across all 7,739 heifers, 45 (0.6%) heifers had shortened tails. Of the 70 farms, 29 (41%) had no heifers with tail deviations, 46 (66%) had no heifers with short tails, and 56 (80%) had no heifers with tail trauma. Across the regions, the median prevalence of any damage ranged from 0% on the West Coast to 3.5% in Southland, and the median prevalence of deviations ranged from 0% on the West Coast, to 3% in Northland (Figure 1).

Table 1. Descriptive statistics on the herd-level prevalence of beef cows with tail damage on 25 beef herds in the Waikato and Southland regions of New Zealand.

Damage type	Overall (n = 25)	Southland (n = 11)	Waikato (n = 14)
Deviated			
Median (IQR)	1.7 (0.2–2.9)	0.0 (0.0–2.3)	1.9 (1.3–4.2)
Min – Max	0.0–7.9	0.0–6.3	0.2–7.9
Trauma			
Median (IQR)	0.0 (0.0–0.9)	0.0 (0.0–0.0)	0.6 (0.0–1.2)
Min – Max	0.0–13.9	0.0–1.3	0.0–13.9
Shortened			
Median (IQR)	1.7 (0.0–3.0)	0.6 (0.0–2.3)	1.9 (0.0–4.0)
Min – Max	0.0–23.6	0.0–4.0	0.0–23.6
Any damage			
Median (IQR)	4.0 (2.0–5.6)	3.4 (0.0–4.3)	5.2 (3.5–7.9)
Min – Max	0.0–37.5	0.0–7.6	1.4–37.5
Deviated or trauma			
Median (IQR)	2.0 (1.1–3.5)	0.0 (0.0–2.3)	3.3 (2.0–5.6)
Min – Max	0.0–16.7	0.0–7.6	1.2–16.7

Table 2. Number of farms and heifers tail scored in a study assessing the prevalence of tail damage in dairy heifers across eight regions of New Zealand.

Region	Number of farms	Number of heifers (% of total animals)
Bay of Plenty	9	726 (9.4)
Canterbury	5	1,754 (23)
Northland	6	1,055 (14)
Otago	10	491 (6.3)
Southland	11	1,678 (22)
Taranaki	9	509 (6.6)
Waikato	10	712 (9.2)
West Coast	10	814 (11)
Total	70	7,739

Table 3. Descriptive statistics on the herd level prevalence of pregnant dairy heifers with tail damage on 70 dairy herds across New Zealand.

Damage type	Prevalence (%)
Deviated	
Median (IQR)	1.0 (0.0–2.5)
Min – Max	0.0–15.6
Trauma	
Median (IQR)	0.0 (0.0–0.0)
Min – Max	0.0–6.7
Shortened	
Median (IQR)	0.0 (0.0–0.7)
Min – Max	0.0–9.9
Any damage	
Median (IQR)	1.7 (0.0–3.5)
Min – Max	0.0–17.8
Deviated or trauma	
Median (IQR)	1.3 (0.0–2.9)
Min – Max	0.0–17.8

Prevalence of tail damage in weaned dairy calves

Data were available from 76 farms (four selected farmers were reluctant to be involved again; Table 4). Across all the 9,471 calves, 61 (0.64%) had damaged tails. Of these 61 calves, 58 (95%) had tail deviation, with three calves (from three farms in three different regions) having tail trauma. None of the calves had tail shortening. The median prevalence of any calf tail damage was 0 (IQR = 0–0.9; min 0, max 11.6)%, see Table 5. The farm with the highest prevalence (11.6%) was in Northland, as was the farm with the next highest prevalence (5.9%).

Table 4. Number of calves and farms tail scored in a study assessing the prevalence of tail damage in dairy calves across eight regions of New Zealand.

Region	Farm number	Calf number (% of total)
Bay of Plenty	10	989 (10)
Canterbury	9	1,633 (17)
Northland	10	858 (9.1)
Otago	10	1,846 (19)
Southland	9	1,610 (17)
Taranaki	8	513 (5.4)
Waikato	10	1,048 (11)
West Coast	10	974 (10)
Total	76	9,471

Across the regions, median herd prevalence of any tail damage ranged from 3.8% in Northland to 0% in all other regions, except for the Bay of Plenty (which had a median prevalence of 0.8%). Of the 61 calves identified with tail damage, 34 (55.7%) were observed in Northland, all of which had tail deviations. With Northland scores removed, there was a total of 27/8,613 (0.3%) calves with tail damage.

Comparison of tail damage prevalence in dairy calves, pregnant heifers and beef cows with prevalence reported in dairy cows

For all three groups of cows scored in this study, the median prevalence of any tail damage was markedly lower (with no overlap of IQR) than that recorded in lactating dairy cattle in New Zealand (Cuttance *et al.* 2024) (Table 5). For dairy calves and heifers, the

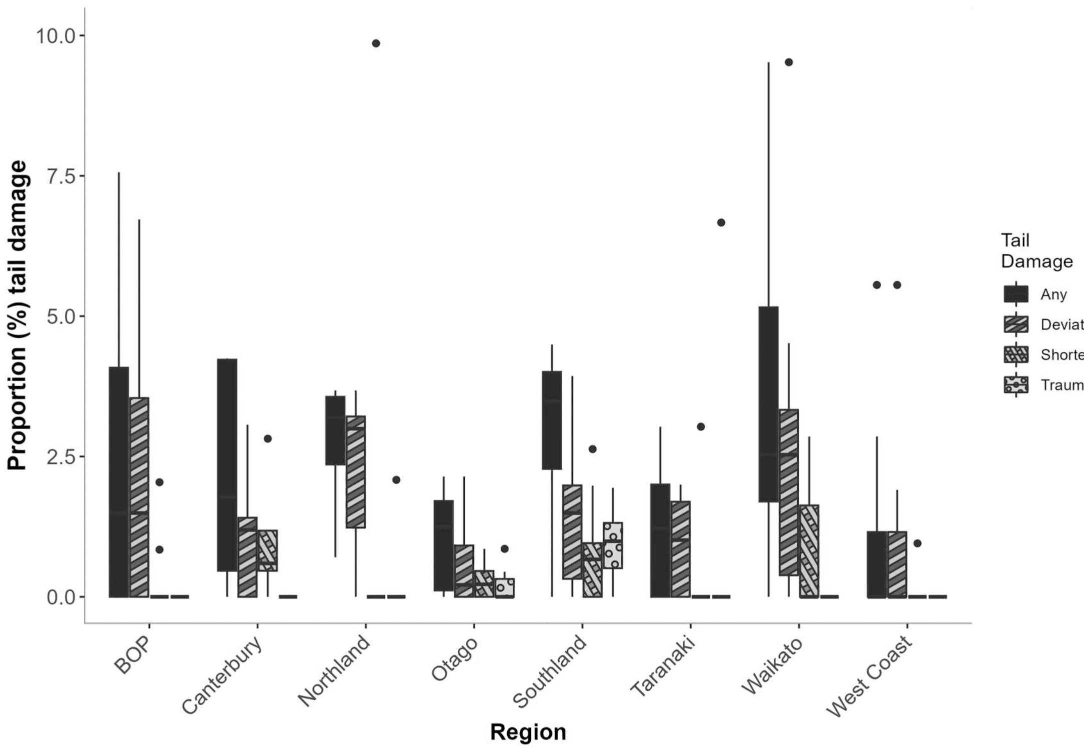

Figure 1. Boxplot of the herd prevalence of tail damage in pregnant dairy heifers on farms across eight dairying regions. Note, one Taranaki farm is outside the plot area with 17.8% for any tail damage, as is one Northland farm at 11.3% for any tail damage. Boxes represent the IQR, whiskers are 1.5 x the IQR and dots represent outlier values as defined as > 1.5 times the IQR. BOP = Bay of Plenty.

Table 5. Comparison of median herd-level prevalence of tail damage in beef cows, pregnant dairy heifers and dairy calves with prevalence in lactating dairy cows in New Zealand.

	Percentage (IQR; maximum)			
Category	Any damage	Deviations	Trauma	Shortened
Dairy cows[a]	17.0 (12.7–24.6; 73.7)	9.5 (6.3–13.5; 40.3)	0.9 (0.3– 2.8; 10.7)	4.5 (1.3–10.8; 70.4)
Beef cows	4.0 (2.0–5.6; 37.5)	1.7 (0.2–2.9; 7.9)	0.0 (0.0–0.9; 13.9)	1.7 (0.0–3.0; 23.6)
Dairy heifers	1.7 (0.0–3.5; 17.8)	1.0 (0.0–2.5; 15.6)	0.0 (0.0–0.0; 6.7)	0.0 (0.0–0.7; 9.9)
Dairy calves	0 (0–0.9; 11.6)	0.0 (0.0–0.9; 11.6)	0.0 (0.0–0.0; 0.9)	N/A[b]

[a]Data from Cuttance *et al*. (2024).
[b]No calves observed with shortened tails on any farm.

median prevalences for deviations, shortening and trauma were all markedly lower than in dairy cattle (with no overlap of IQR). For beef cattle, although the estimates from the study were lower for all damage types than Cuttance *et al*. (2024) reported in dairy cattle, there was no overlap of the IQR only for deviations (Table 5). Thus, for the prevalence of trauma and shortened tails, the CI of the median prevalence were calculated for both dairy and beef cattle. For trauma, the lower limit of the CI for dairy cows was 0.58%, while the upper limit for beef cattle was 0.33%, confirming that beef cattle had a lower prevalence of tail damage due to trauma than dairy cows. For shortened tails, the lower limit of the CI for dairy cows was 3.3%, while the upper limit for beef cattle was 2.8%, confirming that beef cattle had a lower prevalence of shortened tails than dairy cows.

However, despite the median prevalence of tail damage being lower for beef cows, pregnant dairy heifers and dairy calves than cows, this was not the case for all herds. The worst beef herds and heifer cohorts had prevalences of tail damage that were much higher than the median dairy herd (see Table 5).

Association between prevalence of tail deviation in heifers and prevalence of tail deviation in lactating cows in the same herd

Farms that had a prevalence of tail deviations in their heifers that was > 2% had a mean prevalence of tail deviations in their cows that was 3.65 (95% CI = 0.7–6.6%)% higher than herds where heifer prevalence of tail deviations was ≤ 2%. However, tail deviation in heifers only explained 9% of the variation in the percentage of tail deviations (at the log scale) in the adult cows on the same farm.

Discussion

There were two principal aims of this research: firstly, to establish, using a systematic approach, baseline data on the prevalence of tail damage in beef cows, pregnant dairy heifers and weaned dairy calves under New Zealand conditions; and secondly, to compare these results to those reported in dairy cows.

In all three stock classes included in this study, on average, tail damage was rare (median farm prevalence was 4%, 1.7% and 0% for beef cows, pregnant heifers and weaned calves, respectively), and markedly lower than that recorded in lactating dairy cattle (Cuttance *et al*. 2024) (Table 5). Thus, on most farms included in this study, tail damage was not a major welfare problem (although, of course, there is likely to have been a significant welfare impact in the individual animals with damaged tails). However, in all three stock classes, there were individual farms with concerningly high levels of tail damage (the highest farm prevalence was 37.5%, 17.8% and 11.6% for beef cows, pregnant heifers and weaned calves, respectively). On those farms, tail damage will have a sizable deleterious effect on overall animal welfare. This highlights the importance of recording tail damage and identifying risk factors for tail damage in all cattle in New Zealand, not just adult dairy cows.

The data strongly suggest that there are differences between beef cows and the other two groups in the causes of tail damage. In dairy heifers and calves, tail deviation was the most common type of tail damage identified (86% and 95% respectively). In contrast, on beef farms, tail deviation accounted for only 32% of all tail damage, with shortened tails being the most commonly observed form (48%). In particular, beef farms with high levels of tail damage were more likely to have above average levels of shortening and trauma than deviation. These differences in the type of damage suggest differences in cause. The pattern of tail damage seen in beef cows is similar to that reported in Australian herds with tail rot, where trauma precedes the loss (shortening) of the tail. However, the absence of typical signs of tail rot, i.e. dry gangrene or tail infection (Fordyce *et al.* 2009), suggests that what is being seen on New Zealand beef farms is not tail rot. Observations around this study suggest that faecal rings may be the principal cause of tail trauma and tail loss on many of the farms with a high prevalence of damage. This is consistent with the suggestions of Kaurivi (2024) who also identified faecal rings (faecoliths) as a problem on some Waikato beef farms. Unfortunately, identifying faecal rings as a cause of tail damage is of limited value because we do not understand the key risk factors for their occurrence and thus how to prevent them. Kaurivi (2024) suggested that there may be a breed predisposition (with Angus cattle having a higher percentage of faecal rings than other breeds), but more data is needed.

For both dairy heifers and dairy calves, the prevalence of tail deviation was excessively high in some cohorts (up to 15.6 and 11.6%, respectively). In contrast, in these groups, prevalences of > 1% of shortened tails and tail trauma were only identified in heifer cohorts. It is unclear what is driving tail deviation in heifers and calves – it could be poor handling and/or interaction with infrastructure, as although such contact is limited, it is not absent, especially as there appears to be a significant farm effect, but there may be other explanations. We need further data to identify the causes of tail deviation in calves and heifers and shortened tails and tail trauma in dairy heifers.

Our data suggest that tail deviation is a particular problem in calves on Northland farms, with 60% of the calf tail deviations observed in this study identified on Northland farms. Our study design means that the scorer and region were confounded. However, the same scorer scored both heifers and calves, and no similar effect of scorer was observed in heifers in Northland. Nevertheless, it would still be useful to confirm these results with a second scorer, as, if correct, the large variation in prevalence of tail deviation would make it a useful starting point for an investigation of risk factors.

Our finding that dairy cows have a higher prevalence of tail damage than the stock classes observed for this study suggests that there are risk factors for tail damage in dairy cows which are not faced (or which are encountered less often) by beef cows, dairy heifers and dairy calves. This is consistent with our hypothesis that the prevalence of tail damage is principally related to handling by stockpersons and/or interactions with infrastructure, as all three of our study groups have less handling and contact with infrastructure than lactating dairy cows. Furthermore, our calf and heifer data strongly suggest that tail damage in adult cows does not primarily reflect tail damage at an earlier life stage. In particular, it eliminates congenital deformities as a major cause of abnormal tails in adult dairy cattle.

This suggestion that tail damage in calves and heifers is not strongly related to tail damage in cows is supported by our analysis of the relationship between heifer and cow tail deviation in the same herds. There was a clear association between the two: for the 30% of herds where the prevalence of tail deviations in heifers was > 2%, the prevalence of tail deviation in cows was almost 4% higher than herds where ≤ 2% of heifers had tail deviation. However, heifer prevalence explained very little of the variance between herds in cow-level prevalence of tail deviation. This limited association thus does not contradict the hypothesis that most tail damage in lactating dairy cows is caused by poor handling/infrastructure: if poor handling/infrastructure are causing tail damage in lactating cows we would expect to see a relationship between heifer and cow prevalence, as both groups are likely to be exposed to the same standard of handling and infrastructure, with heifers having a lower rate of tail damage as they are handled and encounter infrastructure less.

Nevertheless, it is important not to over-interpret this comparison, as the heifer data were collected after the prevalence data in adult cows on the same farm. Thus, our assumptions only hold if the prevalence of tail damage in both heifers and lactating cows is relatively consistent over time. Longitudinal studies are needed to more accurately establish the relationship, and studies looking at the risk factors in young stock would be beneficial to the industry.

Conclusions

This study has shown that, although the prevalence of tail damage is low on most beef farms and in most cohorts of dairy heifers and calves, there are still farms where tail damage is a significant herd-level welfare issue. The study has also shown that, in New Zealand, tail damage is a particular issue on dairy farms and added further support to our hypothesis that poor handling and infrastructure are responsible for much of the tail damage observed on dairy farms. This study cannot identify whether infrastructure or handling is the most important (indeed, it may vary considerably between farms). However, from a cow's perspective, it is irrelevant whether the damage is caused by infrastructure or handling. Thus, in both cases, farmers need to recognise the importance of tail damage and, once it is identified, actively work to prevent it from recurring. There is increasing recognition of the importance of tail damage in adult dairy cows on New Zealand dairy farms; this study shows that such recognition needs to extend to dairy calves and heifers as well as beef farms.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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