Pathology and form of dairy ewe udders

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Introduction

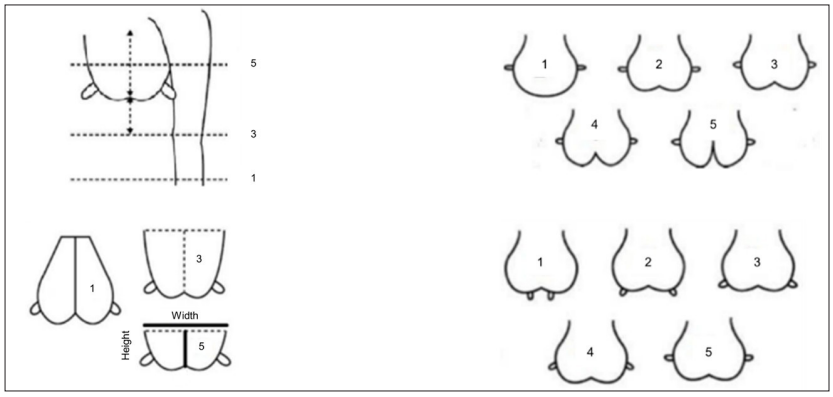
There were an estimated 30,000 ewes being milked on approximately 30 farms in 2022 (McCoard *et al.* 2023). The ideal dairy ewe allows milk to be harvested rapidly without manual assistance and has teats that are well-placed for easy application of milking machinery. Teat and udder conformation are therefore critically important to farmers as they improve their flocks, and they affect mastitis control. Some work has been conducted overseas to describe conformation and pathology and set up grading systems for selection purposes, but there are no large-scale studies of New Zealand dairy ewes. Understanding how teat and udder conformation is measured and putting the various teat and udder pathologies into perspective, will help veterinarians who work with dairy sheep farmers, especially in the context of milk quality and mastitis.

Methods

We conducted a repeated cross-sectional study on 20 commercial New Zealand sheep milking farms. The farms were selected to represent a range of locations and systems and have been previously described (Chambers *et al.* 2024). In brief, all farms were seasonal, and lambing occurred entirely in the spring except for one farm that also had an autumn-lambing flock. The median peak number of ewes milked per farm was 790 ewes, ranging from 171 to 1,530 ewes. All ewes lambed outdoors except on three farms, which lambed selected ewes indoors (e.g. ewes bearing triplets, one-year-old ewes, or other ewes during bad weather). Visits were planned on 3 occasions on each farm during the 2022/2023 lactation season: August–October 2022 (visit 1), November - December 2022 (visit 2), and March 2023 (visit 3), corresponding to the early, mid, and late lactation periods respectively.

Teat and udder morphology and pathology assessments were performed as described by Chambers *et al.* (2025) and are summarised in Figure 1. Briefly, morphological assessments included teat length and width (both measured in mm), and udder depth, udder suspension, udder separation, and teat placement (all measured on a 5-point scale). Udder symmetry was subjectively assessed as either symmetrical or asymmetrical. Pathology assessments comprised presence of lesions of the teats and udder, teat and udder palpation findings, presence of teat and udder inflammation, and teat end hyperkeratosis. Conformation and pathology were analysed descriptively.

Figure 1. Visual representation of the udder morphology scoring system developed by Griffiths et al. (2019) from the system of Casu et al. (2006), in a study of udder health of randomly selected ewes (n=893) on 20 commercial dairy sheep farms in New Zealand. Clockwise from top left: udder depth, udder separation, teat placement, and udder attachment.



Results

Across the three visits, 893 observations were made on 882 unique ewes. Mean (SD) teat length and width were 27.5 (4.9) and 15.8 (2.9) mm. Morphology results are summarised overall and by visit in Table 1. Udder depth, separation, suspension, and teat placement had modal scores of 4, 3, 3, and 3 respectively, and varied across visits and age groups. The prevalence of udder asymmetry increased with age, with prevalences of 27% for hoggets, 38% for two-tooths, and 43% for mixed age ewes. Supernumerary teats occurred in 15% of ewes. There was between-farm variation in all udder morphology variables.

Table 1. Udder morphology of ewes, overall and at each of three visits between August 2022 and March 2023 in a study of udder health of randomly selected ewes (n = 893[a]) on 20 commercial dairy sheep farms in New Zealand.

Variable	Overall	Visit 1	Visit 2	Visit 3	P-value[b]
Udder depth[c]					<0.001
1	0/893 (0%)	0/286 (0%)	0/306 (0%)	0/301 (0%)	
2	8/893 (0.9%)	2/286 (0.7%)	4/306 (1.3%)	2/301 (0.7%)	
3	129/893 (14%)	61/286 (21%)	39/306 (13%)	29/301 (9.6%)	
4	613/893 (69%)	195/286 (68%)	219/306 (72%)	199/301 (66%)	
5	143/893 (16%)	28/286 (9.8%)	44/306 (14%)	71/301 (24%)	
Udder separation[d]					<0.001
1	26/890 (2.9%)	14/284 (4.9%)	8/305 (2.6%)	4/301 (1.3%)	
2	291/890 (33%)	115/284 (40%)	86/305 (28%)	90/301 (30%)	
3	383/890 (43%)	118/284 (42%)	133/305 (44%)	132/301 (44%)	
4	162/890 (18%)	34/284 (12%)	67/305 (22%)	61/301 (20%)	
5	28/890 (3.1%)	3/284 (1.1%)	11/305 (3.6%)	14/301 (4.7%)	
Udder suspension[e]					<0.001
1	39/893 (4.4%)	7/286 (2.4%)	8/306 (2.6%)	24/301 (8.0%)	
2	252/893 (28%)	82/286 (29%)	77/306 (25%)	93/301 (31%)	
3	346/893 (39%)	114/286 (40%)	130/306 (42%)	102/301 (34%)	
4	182/893 (20%)	68/286 (24%)	71/306 (23%)	43/301 (14%)	
5	74/893 (8.3%)	15/286 (5.2%)	20/306 (6.5%)	39/301 (13%)	
Teat placement[f]					0.003
1	0/893 (0%)	0/286 (0%)	0/306 (0%)	0/301 (0%)	
2	76/893 (8.5%)	25/286 (8.7%)	21/306 (6.9%)	30/301 (10.0%)	
3	450/893 (50%)	122/286 (43%)	174/306 (57%)	154/301 (51%)	
4	304/893 (34%)	124/286 (43%)	90/306 (29%)	90/301 (30%)	
5	63/893 (7.1%)	15/286 (5.2%)	21/306 (6.9%)	27/301 (9.0%)	
Udder asymmetry[g]	345/891 (39%)	104/285 (36%)	132/306 (43%)	109/300 (36%)	0.15
Supernumerary teat(s)[h]	135/884 (15%)	32/280 (11%)	53/304 (17%)	50/300 (17%)	0.093

[a] Denominators differ because of incomplete data collection and ewes with dry glands.
[b] Fisher's exact test or Pearson's $\chi 2$ test for differences in the distributions of each variable's scores (1–5) across visits.
[c] Scored on a scale of 1–5. Depth scores 1 or 2 implied a pendulous udder and were subjectively made in relation to score 3 which was applied when the cleft was level with the hocks, while a score of 5 applied when the cleft was against the belly.
[d] Defined as the extent to which the two glands were separated by the cleft and scored on a scale of 1–5 where 1 = no separation and 5 = cleft extending more than half of the udder height.
[e] Defined as the ratio between the udder width at the abdominal attachment and the udder height and scored on a scale of 1–5 where 1 = attachment width less than the udder height; 3 = equal udder attachment width and height; and 5 = attachment width greater than udder height.
[f] Determined from the vertical distance between the teat attachments and the most distal point of the udder and scored on a scale of 1–5 where 1 = teats that are placed at the most dependent part of the udder and orientated downward and 5 = teats placed high up the udder and orientated laterally.
[g] Subjectively appraised as symmetrical or asymmetrical.
[h] Present or absent

The prevalences of teat end hyperkeratosis (of any degree of severity), and gland/teat inflammation, lesions, palpable defects, and half udders were all <6% (Table 2).

Table 2. Prevalence of udder and teat pathology, by visit and overall, in a study of udder health of randomly selected ewes (n=893a) on 20 commercial dairy sheep farms in New Zealand.

Variable[b]	Overall	Visit 1	Visit 2	Visit 3	P-value[c]
Teat-end hyperkeratosis[d]					0.4
Group 1	874/883 (99%)	281/282 (100%)	298/301 (99%)	295/300 (98%)	
Group 2	6/883 (0.7%)	1/282 (0.4%)	1/301 (0.3%)	4/300 (1.3%)	
Group 3	3/883 (0.3%)	0/282 (0%)	2/301 (0.7%)	1/300 (0.3%)	
Inflammation[e]					
Glands	15/888 (1.7%)	12/283 (4.2%)	1/305 (0.3%)	2/300 (0.7%)	<0.001
Teats	4/889 (0.4%)	0/284 (0%)	4/305 (1.3%)	0/300 (0%)	0.036
Lesions[e]					
Glands	35/883 (4.0%)	13/284 (4.6%)	3/305 (1.0%)	19/294 (6.5%)	<0.001
Teats	19/890 (2.1%)	3/284 (1.1%)	7/305 (2.3%)	9/301 (3.0%)	0.3
Gland palpation[f]					0.020
Normal	871/893 (98%)	273/286 (95%)	303/306 (99%)	295/301 (98%)	
Lump	22/893 (2.5%)	13/286 (4.5%)	3/306 (1.0%)	6/301 (2.0%)	
Hard	0/893 (0%)	0/286 (0%)	0/306 (0%)	0/301 (0%)	
Teat palpation[f]					0.011
Normal	54/893 (6.0%)	11/286 (3.8%)	29/306 (9.5%)	14/301 (4.7%)	
Abnormal	11/893 (1.2%)	5/286 (1.7%)	1/306 (0.3%)	5/301 (1.7%)	
Half udder[g]	11/893 (1.2%)	5/286 (1.7%)	1/306 (0.3%)	5/301 (1.7%)	0.2

[a] Denominators differ because of incomplete data collection and ewes with dry glands.
[b] Variables measured at the gland level (all variables except half udder) are presented at the ewe level.
[c] Fisher's exact test.
[d] Scored at the gland level on a scale of 1–4 (Vouraki ***et al.*** 2018) then classified at the ewe level into group 1 = no or mild hyperkeratosis (both <3); group 2 = medium hyperkeratosis (one ≥3); and group = severe hyperkeratosis (both ≥3).
[e] Positive if inflammation (heat, redness) or lesions (nodules, scabs, scars, other) were recorded in either gland/teat.
[f] Udders were scored on a scale of 1–7, then collapsed into normal (1, 2), lump (3–6) and hard (7); teats scored on a scale of 1–5, then collapsed into normal (1) and abnormal (2–5) (Griffiths ***et al.*** 2019). Ewes were assigned the worst of the teat and gland palpation scores.
[g] Subjectively defined as producing a small volume of milk compared to the contralateral gland, or non-lactating.

Summary

This study provides a set of teat and udder morphology and pathology data for veterinarians to compare against. Morphology resembled observations in overseas dairy sheep but varied across the season and between farms. Teat and udder pathology was rare and consistent across farms, with less pathology than has been observed in New Zealand non-dairy ewes. There is potential to improve milkability across the industry by selection on udder morphology traits, though attention must also be paid to mastitis susceptibility.

References

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