Title: *(Use Normal style (times new roman 12). Only capitalise the first letter of the first word. No full stop at the end of the title)*

A comparison of sole lesion development for Norwegian Dairy Cattle and Holstein Friesian dairy cattle on three different systems in lactation 1 and 2

Summary: *(Your summary must use Body text (times new roman 10) style and must not be longer than this box)*

Application Norwegian dairy cattle (N) had lower total and white line lesion scores than Holstein Friesian Cattle (HF). Low levels of concentrate supplementation in housed cows led to lower lesion scores relative to dairy cattle grazing grass.

Introduction Sole lesions and lameness are significant problems for dairy cow production and welfare. Producers are increasingly incorporating non-Holstein genetics into the make-up of dairy herds for a number of reasons, particularly to promote improved fertility and health. However, much of the evidence that alternative breeds improve hoof health characteristics is anecdotal. The aim of the present study was to assess the effects of HF and N genotypes on lameness parameters in dairy cattle within different production systems.

Material and methods Following calving, HF (n = 39) and N (n = 45) heifers were allocated to one of three dietary treatments (high ("High") or low level of concentrate ("Low"), and grass-based ("Grass"), referred to as "Diet" in the model). Treatments were balanced for breed. In Lactation 1 and 2 animals on the "Low" treatment were offered a diet of grass silage and concentrate at a ratio of 70:30 and 65:35, respectively for the first 100d of lactation. After 100d of lactation the grass silage to concentrate ratio changed to 80:20 and 75:25, for Lactations 1 and 2 respectively. Animals offered the "High" treatment received a diet of grass silage and concentrate at a ratio of 40:60 and 35:65 for the first 100d of Lactation 1 and 2 respectively. Similar to the "Low" cows, the proportion of concentrates was reduced 100d post-calving to 50:50 and 45:55, in Lactations 1 and 2 respectively. "High" and "Low" animals were continuously housed indoors on a rotational system so that they spent similar amounts of time on slatted and solid concrete floors and were exposed to similar conditions produced by automatic scrapers. Animals on the "Grass" treatment grazed from spring to autumn in both years of the study, so that most animals on this treatment grazed from around peak to late lactation. Tracks used by "Grass" cows were mainly stone/dust lanes with short segments on grass and concrete. While housed, "Grass" cows were offered a diet based on grass silage with a low level of concentrate supplementation. In Lactation 1 "Grass" cows were offered a diet with a grass silage to concentrate ratio of 55:45 from calving to turnout. In Lactation 2 "Grass" cows were offered a total mixed ration with 9 kg of concentrates per day and fresh grass silage. Both hind hooves of each animal were scored for sole lesions 4 times during both the first and second lactations, at 4 observation periods during lactation as follows: (1) -8 to 70d post-calving, (2) 71 to 150d post-calving, (3) 151 to 225d post-calving, and (4) 226 to 364d post-calving. Sole lesions were scored for severity and extent of the hoof affected, using the methodology described by Livesey *et al.* (1998) and the hoof map described by Greenough and Vermunt (1991). Lesion scores over the 6 zones of the sole were added to obtain cumulative lesion scores for the whole claw (zones 1 to 6, "total lesion score") and for the sole (zones 4 to 6) and white line (zones 1 to 3) separately. Scores for both hind claws were added so that each animal had one score. Data were analysed using each observation as a repeated measure in a REML variance components analysis with Lactation, Period (during lactation), Diet, Breed and interaction terms as fixed effects.

Results Cumulative lesion scores were higher in Lactation 1 than 2 ($P < 0.001$ for total, sole, and white line lesion scores). Total cumulative lesion scores were highest in Period 2, which corresponds with peak lactation. Breed and Diet effects are shown in Table 1. HF cows had higher total lesion scores and higher white line lesion scores than N. Cows on the "Grass" treatment had higher total lesion and sole lesion scores compared to the "Low" treatment. There were no significant interactions between breed and diet.

Table 1 Breed and diet effects on hoof lesion scores

	Breed				Diet				
	HF	N	s.e.d	P	Grass	High	Low	s.e.d	P
Total Lesion Score	11.5	9.4	1.30	0.047	12.4^{b}	10.2^{a,b}	8.7^{a}	1.58	0.023
Sole Lesion Score	6.1	5.0	0.81	n.s.	7.0^{b}	5.2.^{a,b}	4.5^{a}	0.98	0.009
White Line Lesion Score	5.4	4.4	0.56	0.023	5.4	4.9	4.3	0.68	n.s.

Conclusion The reduced levels of total lesions and white line lesions of the N cattle indicate potential breed differences in relation to predisposition to development of lameness. The increased levels of sole lesions in cattle on the "Grass" relative to "Low" treatment merits further investigation, for example the condition of laneways required to access pasture.

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References

Greenough P R and Vermunt J J 1991. Veterinary Record. 128, 11-17.
Livesey C, Harrington T, Johnston A M, May S A and Metcalf J A 1998. Animal Science. 67, 9-16.

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