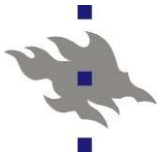




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Environmental and genetic effects on claw disorders in Finnish dairy cattle

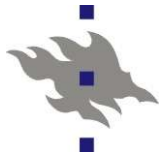
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Aims

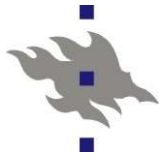
- Study various effects associated with claw disorders
 - Breed, parity
 - Lactation stage, 305-d milk production
 - Claw trimming season and frequency
 - Feeding, barn, bedding and manure removal system type
 - Herd size
 - Herd and claw trimmer effects

- Estimate genetic parameters of claw disorders



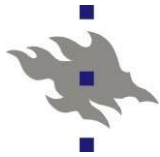
Data

- Collected in "Terveet Sorkat" (=healthy claws) programme
 - Joint nationwide programme to improve claw health in Finnish dairy farms, funded mainly by feed industry
 - This study included data collected in 2003-2004
- Participation in the programme is voluntary for farms
 - Data covered 10% of all dairy cows and 15% of all milk recorded dairy cows in Finland in the period
- 74 410 observations from 41 087 dairy cows and heifers
 - 1 462 different herds
 - Collected by 43 claw trimmers
 - Three breeds: Ayrshire (71%), Finncattle (1%), Holstein-Friesian (28%)



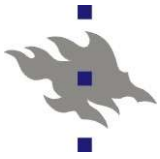
Studied traits

- Sole hemorrhage
- White line disease
- Screw claw ($> 90^\circ$)
- Heel erosion
- All claw disorders combined
 - Above plus (inter)digital dermatitis, chronic laminitis and sole ulcer + other unspecified claw disorders
- Disorder status classified by claw trimmer as yes/no
- Affected leg not specified, animal considered as affected if some disorder diagnosed in any leg
- Studied traits: prevalence in original data $> 5\%$



Prevalences

Disorder	% of observations (n = 74 410)	% of animals (n = 41 087)
Sole hemorrhage	28.2	30.0
White line disease	10.6	9.0
Screw claw	9.2	10.0
<i>Heel erosion</i>	<i>8.1</i>	<i>7.8</i>
Sole ulcer	3.5	3.7
Chronic laminitis	1.7	1.4
<i>Digital dermatitis</i>	<i>0.9</i>	<i>0.6</i>
<i>Interdigital dermatitis</i>	<i>0.2</i>	<i>0.1</i>
Other claw disorder	0.8	0.7
Any claw disorder	45.2	45.8



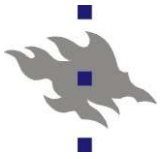
Methods

■ **Effects** on claw disorders:

- Fixed effects model, LS-analyses, F-test
- Breed + parity + lactation stage + 305-d milk production + herd size + feeding type + barn type + bedding type + manure removal system type + claw trimming season + claw trimming frequency + claw trimmer

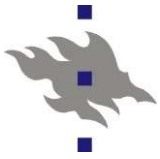
■ **Genetic parameters** of claw disorders:

- Mixed animal model with repeated observations, REML
- Fixed effects breed, parity, lactation stage, trimming season, trimming year and claw trimmer identity
- Random effects herd, (permanent environment), (trimmer), animal and residual



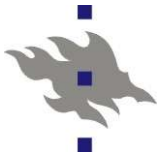
Effects (1)

- **Breed:** *** on all studied disorders except heel erosion
 - Highest prevalence in Holstein-Friesian, least in Finncattle
- **Parity:** *** on all studied disorders
 - Increased prevalence of claw disorders with increased parities except for screw claws (<- culling)
- **Lactation stage:** *** on sole hemorrhages, screw claws and combined claw disorders
 - Highest prevalence 60-180 days after calving: caused by subclinical laminitis in early lactation?
- **305-d milk production level:** *** on all studied disorders except white line disease
 - Higher milk production level -> higher prevalence of claw disorders (except screw claws)



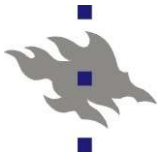
Effects (2)

- **Herd size:** *** on sole hemorrhages, heel erosions and screw claws
 - Larger herds (>40 cows) had more heel erosions (infectious) but less sole hemorrhages
- **Feeding type:** *** on all disorders except sole hemorrhages
 - Highest prevalences on cows fed with mixed ration feeding, i.e., usually the largest herds



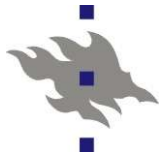
Effects (3)

- **Barn type:** *** on all disorders
 - Prevalences much higher in (warm) free-stall barns compared to tie-stall barns
- **Bedding type:** *** on all disorders
 - Higher prevalences on hard surfaces
- **Manure removal system type:** *** on heel erosions, screw claws and combined claw disorders
 - Higher prevalences on dry manure systems



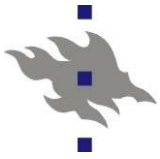
Effects (4)

- **Claw trimming season:** *** on all disorders
 - Heel erosion and sole hemorrhage prevalence highest in winter, white line disease in autumn
- **Claw trimming frequency:** *** on all disorders except sole hemorrhages
 - Lowest prevalence when trimmed twice per year
- **Claw trimmer:** *** on all disorders
 - 36 out of the 43 claw trimmers had been specially trained to evaluate disorders for the claw health programme
 - However, large differences remained in scoring between individual claw trimmers



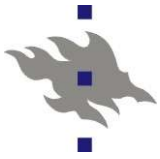
Random effects

	c^2_{herd}	c^2_{trimmer}	h^2_{bin}	h^2_t	r
Sole hemorrhages	0.04	0.10	0.05 ± 0.004	0.09	0.11
White line disease	0.06	0.05	0.04 ± 0.004	0.12	0.19
Screw claw	0.09	0.07	0.05 ± 0.004	0.15	0.30
Heel erosion	0.22	0.07	0.01 ± 0.002	0.03	0.05
Combined claw disorders	0.09	0.09	0.06 ± 0.005	0.09	0.17



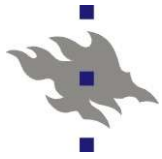
Discussion (1)

- Almost 50% of cows had some claw disorder – still less than in many other countries (esp. infectious disorders)
- Largest influence on claw disorder prevalence:
 - **Breed** (higher prevalences for larger breeds)
 - **Lactation stage** (highest prevalences right after peak lactation)
 - **Parity** (higher prevalences for older cows)
 - **Barn type** (higher prevalences in free-stall barns)
 - **Herd environment**
 - **Claw trimmer = evaluator**



Discussion (2)

- Difficult to improve claw health by breeding: low heritabilities
 - Esp. heel erosion = infectious disorder with 22% of phenotypic variance explained by herd effect
- Genetic correlations low to moderate between different claw disorders: largely different genetic backgrounds
- Genetic and phenotypic correlations between claw disorders and 305-d milk yield non-existent



Thank you!

■ Any questions?