Linear type traits show pronounced phenotypic relationships to foot and claw health

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Background (1)

- Problems relating to **feet and legs** rank **third** among most important **disposal reasons** in Austrian cows.

- **Direct** and **indirect costs**, (considerably) **reduced welfare** of affected animals.

- **Routine genetic evaluation for health traits** since 2010 (Fleckvieh) und 2013 (Brown Swiss); Traits: **Mastitis, Early reproductive disorders, Cysts, Milk fever**.

- **Claw health only indirectly** considered by type traits.
Which traits without routine genetic evaluation should be improved by breeding?

Claw health
Inter/cross-sucking
Metabolic stability
Feed and energy efficiency
Temperament/Behaviour
Sucking insufficiency
Umbilical hernia
Suitability for AMS systems

50% of answers
20% of answers
www.zar.at

Questionnaire: Breeders demand improvement!
Question

- Relationship between **foot** and **claw health** with conformation traits?
  - phenotypic
  - (genetic)
Data (1)

• Fleckvieh and Brown Swiss cows (Project "Efficient Cow") in 2014

• **Linear Scoring** for all cows
  Lameness scores (1 = not lame, 5 = severely lame) in the course of each performance testing
  Hoof trimmer protocols
  Claw diagnoses since 2012

• Genes of other breeds < 50%
## Data (2)

<table>
<thead>
<tr>
<th></th>
<th>Fleckvieh</th>
<th></th>
<th>Brown Swiss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>No. of records</td>
<td>8,716</td>
<td>3.8%</td>
<td>3,373</td>
</tr>
<tr>
<td>No. of cows</td>
<td>4,129</td>
<td></td>
<td>1,678</td>
</tr>
<tr>
<td>Proportion claw diagnoses</td>
<td>6,260</td>
<td>49.5%</td>
<td>2,474</td>
</tr>
<tr>
<td>Proportion pos. trimmers’</td>
<td>2,779</td>
<td>47.0%</td>
<td>1,103</td>
</tr>
<tr>
<td>results</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion lameness score ≥ 2</td>
<td>3,891</td>
<td>20.4%</td>
<td>1,582</td>
</tr>
<tr>
<td>Proportion lameness score ≥ 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Model

- Herd (random)
- Lactation
- Calving year
- Calving month
- Type of recording/Claw trimmer/Scorer
- Type trait (linear, quadratic; pre-corrected)
Phenotypic Relationships

Feet and Legs

Frame
Feet and Legs Score – Claw diagnoses

Fleckvieh

Brown Swiss

![Graphs showing claw diagnoses for Fleckvieh and Brown Swiss](image-url)
Feet and Legs Score – Lameness scores $\geq 3$

**Fleckvieh**

**Brown Swiss**
Phenotypic relationships
Feet and Legs/Frame

• Animals with higher feet and legs scores have
  - lower proportions of claw diagnoses
    (by both veterinarians and hoof trimmers)
  - lower proportions of lame animals

• Animals with higher frame scores show
  - higher proportions of lame cows (significant in Fleckvieh only)
  - in tendency higher proportions of claw diagnoses
Phenotypic Relationships

Rear leg - side angle

Pasterns
Rear leg – side angle - Fleckvieh

Rear leg - side angle - Claw diagnoses

1 = straight, 9 = extremely sickled
Pasterns

Fleckvieh
Lameness score $\geq 3$

Brown Swiss
Claw diagnoses

1 = weak, 9 = steep
Animals of both breeds having a **somewhat straighter hock angle** (rear leg - side angle) had significantly **less** feet and legs problems.

- Slightly **steeper pasterns** also resulted in **less problems**; significant for lameness (Fleckvieh) and claw diagnoses (Brown Swiss) only.

- No effect of **hock development** or **hoof height**

**Phenotypic relationships**

**Linear type traits**
Conclusion

• Strong relationship between conformation and claw health and lameness

• Further genetic analyses necessary

• Non-linear relationships to linear type traits may complicate the interpretation of genetic correlations

• Breeding for conformation only is not sufficient to improve hoof and claw health!
Conclusion

• Strong relationship between conformation and claw health and lameness

• Further genetic analyses necessary

• Non-linear relationships to linear type traits may complicate the interpretation of genetic correlations

• Breeding for conformation only is not sufficient to improve hoof and claw health!

Combination of veterinarian diagnoses, claw trimming protocols and conformation traits preferable!
Thank you for your attention

Funding and partners are gratefully acknowledged
## Data (3)

<table>
<thead>
<tr>
<th>Measure</th>
<th><strong>Fleckvieh</strong> <em>(N = 3,235)</em></th>
<th><strong>Brown Swiss</strong> <em>(N = 1,405)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Min-Max</td>
</tr>
<tr>
<td>Frame</td>
<td>82.4</td>
<td>68-93</td>
</tr>
<tr>
<td>Feet and legs</td>
<td>80.8</td>
<td>68-93</td>
</tr>
<tr>
<td>Rear leg – side view</td>
<td>5.6</td>
<td>1-9</td>
</tr>
<tr>
<td>Hock development</td>
<td>5.8</td>
<td>1-9</td>
</tr>
<tr>
<td>Pasterns</td>
<td>5.4</td>
<td>1-8</td>
</tr>
<tr>
<td>Hoof height</td>
<td>5.3</td>
<td>1-9</td>
</tr>
</tbody>
</table>
EBV correlations
Fleckvieh sires; $r^2 \geq 50\%$, more than 20 daughters

<table>
<thead>
<tr>
<th>Trait genetic evaluation</th>
<th>Claw (EBV)</th>
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</thead>
<tbody>
<tr>
<td>Frame</td>
<td>-0.17</td>
</tr>
<tr>
<td>Feet and legs</td>
<td>0.23</td>
</tr>
<tr>
<td>Rear leg – side view</td>
<td>-0.03</td>
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<tr>
<td>Hock development</td>
<td>0.16</td>
</tr>
<tr>
<td>Pasterns</td>
<td>0.08</td>
</tr>
<tr>
<td>Hoof height</td>
<td>0.09</td>
</tr>
</tbody>
</table>

For claws positive EBVs desirable
# Heritabilities

**Fleckvieh**

<table>
<thead>
<tr>
<th>Trait</th>
<th>$h^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vet diagnoses</td>
<td>0.03</td>
</tr>
<tr>
<td>Claw trimmer results</td>
<td>0.03</td>
</tr>
<tr>
<td>LSC$\geq$2</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Genet. corr

- feet and legs-vet diagnoses: -0.34
- feet and legs-LSC$\geq$2: -0.61