FACULTY OF HEALTH AND MEDICAL SCIENCES

UNIVERSITY OF COPENHAGEN

# Evaluation of lameness prevalence in grazing and non-grazing Danish dairy herds - apparent vs. true prevalence

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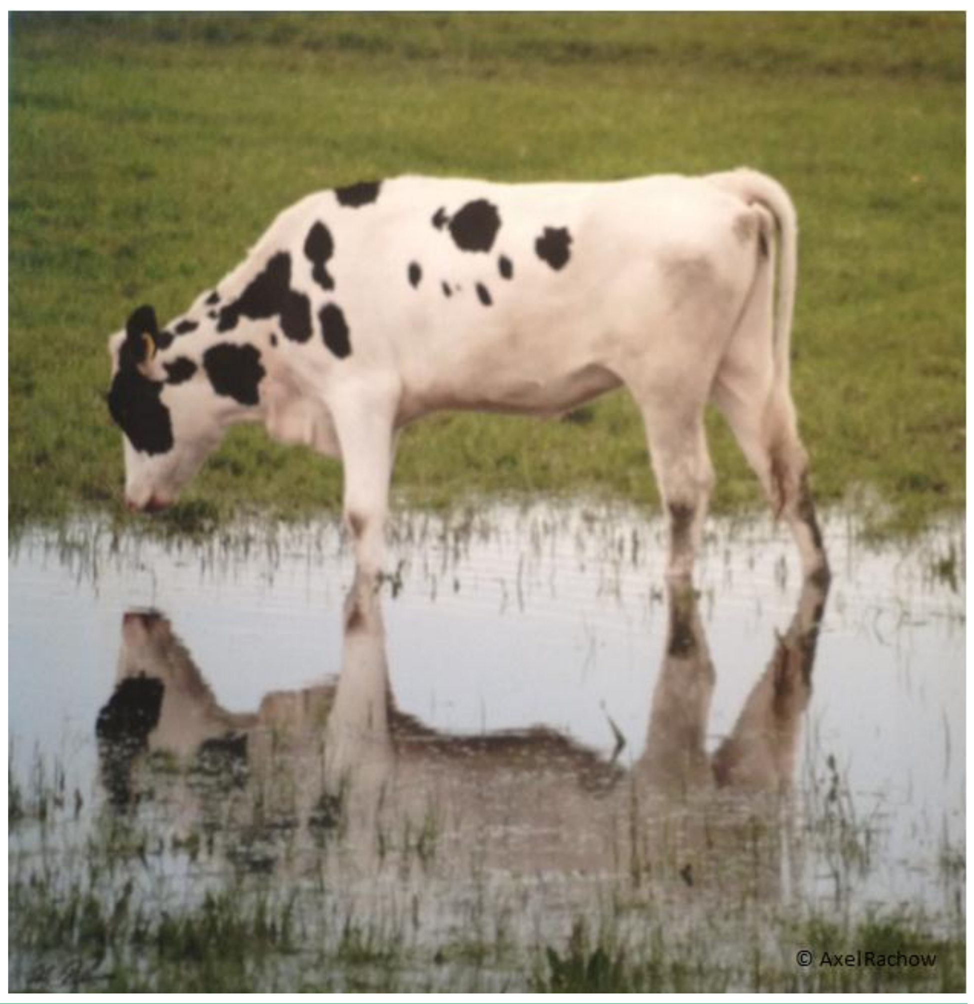

## Background

Lameness is seen as a major indicator for dairy cow welfare. Grazing compared to non-grazing may be a protective factor for lameness and therefore it is interesting to estimate the effect of non-grazing as a risk factor for lameness. However, the effect of observer needs to be taken into account since study designs often are skewed due to practicalities in multiobserver prevalence studies.

## Objective

To evaluate the effect of grazing on herd level prevalence of lameness in a multi observer observational study

## Materials and methods

- Observational study with four trained observers performing clinical scoring of min. 50 cows per herd
- Target population: Danish dairy herds, > 100 cows and loose-housing
- Sample: 80 Herds – stratified grazing (yes/no)
  - Grazing herds (N=46) and non-grazing herds (N=34)
  - Total number of cows: 5003
- Distribution of herds among observers:
  - Observer 1: 2 grazing/ 15 non-grazing herds
  - Observer 2: 28 grazing/ 2 non-grazing herds
  - Observer 3: 7 grazing/ 15 non-grazing herds
  - Observer 4: 9 grazing/ 2 non-grazing herds
- Lameness scoring (Welfare Quality©):
  - Normal = 0 normal gait
  - Moderate lameness = 1 impaired stride/rhythm, reduced weight bearing on affected limb
  - Severe lameness= 2 no weight bearing on affected limb or more than one limb affected
- Calibration of observer through scoring of video sequences of 39 cows used to evaluate observer sensitivity (Se) and specificity (Sp) through latent class analysis (LCA)
- PABAK= 0.49 showed moderate inter-observer agreement
- Statistical analysis for effect of grazing (dichotomous) and observer (nominal)

Lameness scores ≥ 1 → Mean herd level prevalence → Apparent prevalence AP →

Calibration test + observations → Se and Sp estimates (LCA) → True prevalence: TP= $\frac{AP + Sp - 1}{Sp + Se - 1}$ →

$\sin^{-1}\sqrt{AP}$ → t-test/ ANOVA

## Results

| Prevalence | Grazing herds (%) | vs. | Non – grazing herds (%) | Grazing effect | Observer effect |
|---|---|---|---|---|---|
| **AP** Apparent herd level lameness prevalence | Mean: 38.8<br>SD: 20<br>Min: 6.8<br>Max: 79.3 | | Mean: 21.3<br>SD: 12.3<br>Min: 3.8<br>Max: 65 | p = 0.03* | p< 0.001*** |
| **TP** True herd level lameness prevalence | Mean: 35.8<br>SD: 16<br>Min:: 9.4<br>Max: 76.8 | | Mean: 43.4<br>SD: 19<br>Min: 10.7<br>Max: 80.2 | p = 0.6 | - |

**Table 1. Descriptive statistics for lameness prevalence and associated effects**

Results showed a significant effect on the apparent lameness prevalence between the two treatments and observers.

When adjusting for observer with the estimated observer Se and Sp no significant effect of grazing on the true lameness prevalence was found.

The calibration test showed an overall high Sp at the expenses of Se

**Table 2. Results of calibration test**

| Observer | Se [95 % CI) | Sp [95 % CI] |
|---|---|---|
| 1 | 0.46 [0.33; 0.68] | 0.95 [0.9; 1] |
| 2 | 0.36 [0.29; 0.49] | 0.91 [0.86; 0.96] |
| 3 | 0.24 [0.23; 0.35] | 0.95 [0.91; 0.99] |
| 4 | 0.79 [0.52; 0.99] | 0.85 [0.75; 0.98] |

Differences in inter-observer Se and Sp showed greatest discrepancies between observers 1&4 and 3&4.
Best agreement is found between observers 1&3 and observers 2&4.

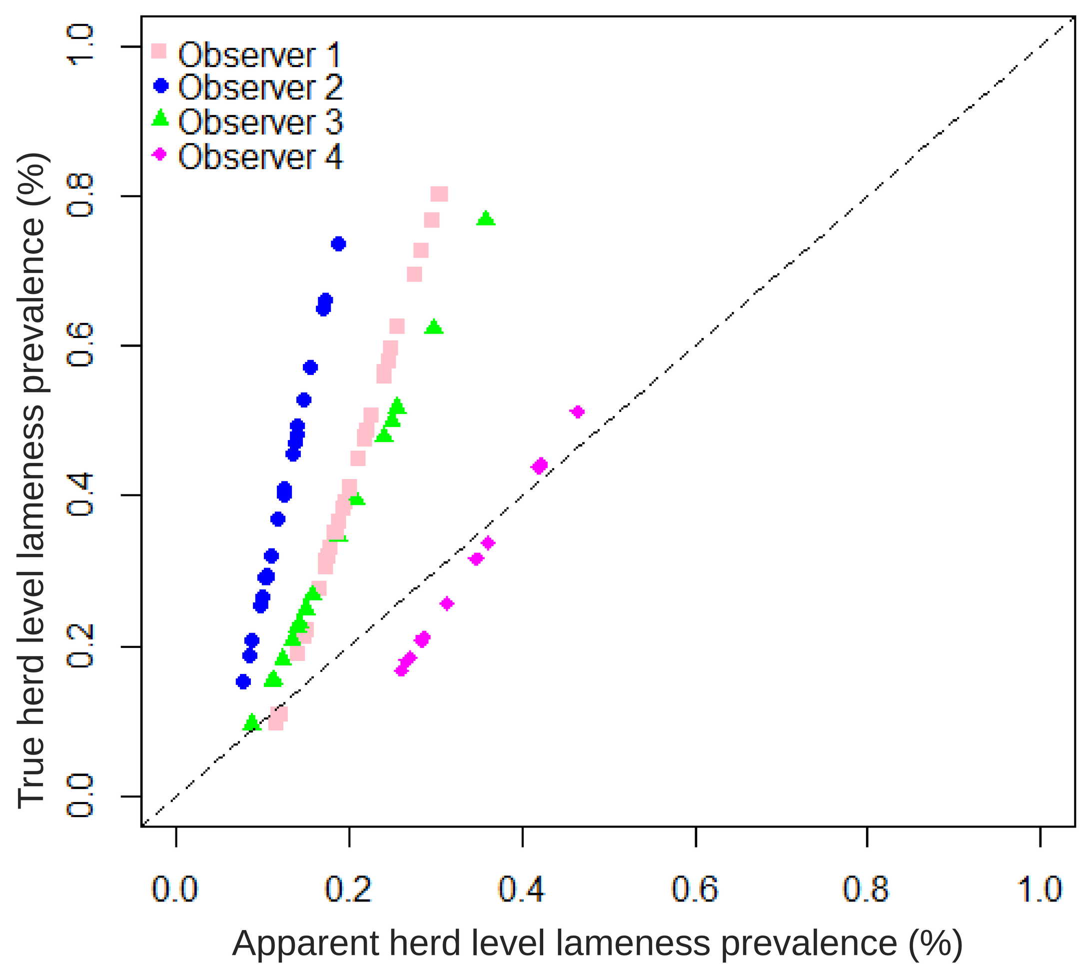


**Figure 1.**
**Plotting the herd level AP against the herd level TP based upon the estimates per observer from the LCA**

## Discussion and Conclusion

Multiobserver prevalence studies are not only highly dependent on observer agreement, but also on the between-observer differences in sensitivity and specificity as results from this study indicate.

When information from both the calibration test and the observations within the 80 herds were acknowledged the estimated sensitivity of the observers was fairly low, while specificity was at a high level. This caused the systematic underestimation of the lameness prevalence (figure 1). These results also highlight the implications of confounding bias when observers are not randomly distributed within treatment groups, since observers 2 and 4 visited 80 % of the grazing herds.

In conclusion prevalence estimates should be interpreted with caution even though inter-observer agreement seems to be acceptable.

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