Clustering of determinants for respiratory disease in Danish calves

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INTRODUCTION & OBJECTIVE

Respiratory diseases expose a great health and welfare challenge for young calves reared in both dairy and veal herds. An increasing number of vaccines have been released to aid in the control and alleviation of this health issue.

However, an effective vaccination programme should be based on the presence of virus and clinical signs of respiratory disease.

The present study seeks to investigate herd-specific information and characterize differences and similarities between farms regarding respiratory disease and determinants for disease.

MATERIALS

Herds

- The "Robust Calves project" initially enrolled 36 Danish herds with 9 clusters with 1 fattening herds and 3 dairy herds supplying fattening calves

- In the present study, five dairy herds were excluded due to incomplete data leaving N= 31 study herds
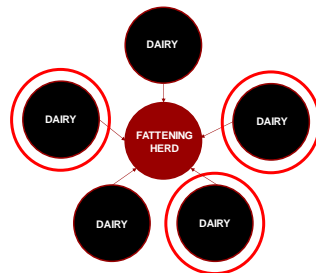
Study units

- Calves in dairy herds were examined at 1 week, 3 weeks and 12 weeks of age

- Calves in veal herds were examined at 2 weeks post arrival and 12 weeks at age

DAIRY N = 540

FATTENING N = 269
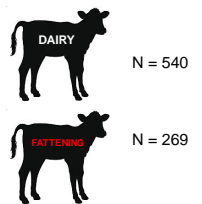
METHODS

Clinical protocol

Examination of each calf included:
- *Nasal discharge(ND)*
- *Ocular discharge (OD)*
- *Cough (C)*
- *Temperature (T)*

Nasal swab for qPCR:
- *Pasteurella multocida* (PM)
- *Histophilus somni* (HS)
- *Mycoplasma spp.* (M)
- *Mycoplasma bovis* (MB)
- *Mannheimia haemolytica* (MH)
- *Trueperella pyogenes* (TP)

Statistical Analysis
STEP 1 - Logistic regression for each herd:

OUTCOME Sick = Cumulative score ≥ 5
- Score 1: ND serous, OD serous, T 39-39.3 ° C
- Score 2: OD mucopurulent, T≥ 39.4° C
- Score 3: C ≥1 spontaneous
- Score 4: ND mucopurulent, +1 if mucopurulent oculonasal discharge

EXPLANATORY VARIABLES:
Continuous PCR Cq-values for each agent

$$Logit[P(Sick_i)] = \beta_{i0} + \beta_{i1}Cq\,PM + \beta_{i2}Cq\,HS + \beta_{i3}Cq\,M + \beta_{i4}Cq\,M + \beta_{i4}Cq\,MB + \beta_{i5}Cq\,MH + \beta_{i6}Cq\,TP$$

STEP 2 -
Principal component analysis (PCA):

Herd similarities/differences are investigated in the PCA using the Ward clustering criterion

Coefficients from the logistic regression model and herd specific proportions of animals with serous or mucopurulent nasal/ocular discharge and fever, proportions of breeds (Holstein, Crossbreeds or Red Danish) and heifers/bulls

Number of clusters were chosen by visual inspection of dendrograms

RESULTS

Highest prevalences of test-positive calves were found for:
- dairy herds: PM (0.12) and TP (0.12)
- fattening herds: M (0.43), MH (0.3) and PM (0.25)

The PCA biplot: four main clusters of variables (Fig.1)

Ward´s clustering criterion showed six clusters of herds (Fig. 2, Table 1)

Table 1. Overview of quantitative variables describing the six herd-specific clusters

Cluster	Increased levels	Decreased levels	Herd Type
1	High Cq´s for PM (test-negative) Proportion of bulls	Low Cq´s for TP (test-positive)	Herd 11 – atypical fattening herd
2	High proportions of mucopurulent nasal and ocular discharge	Low proportions of serous nasal discharge	7 larger fattening herds, 1 dairy herd
3	Proportion of bulls and serous nasal discharge	Proportion of heifers	9 dairy herds, 1 fattening herd
4	Proportion of heifers and Holstein calves	Proportion of bulls and crossbreds	7 smaller dairy herds
5	High proportion of Red Danish	Low proportions of fever, serous and mucopurulent ocular discharge and Holstein calves	3 dairy herds with primarily Red Danish calves and two smaller dairy herds
6	High Cq´s (test-negative) for M, HS and TP	Low Cq´s for MH and MB (test-positive)	Herd 10 – atypical fattening herd

CONCLUSION

Common causal agents for respiratory diseases in calves showed similar patterns between herd types (fattening or dairy) or herd sizes

However, the presence of clinical signs of respiratory disease differed between fattening and dairy herds and between breeds of calves

Hence, the production system appeared to be a more important determinant of respiratory disease in calves than the occurrence of pathogens
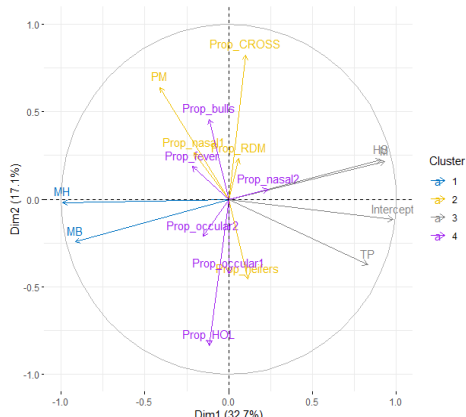
Figure 1. Principal component analysis biplot of variable clusters for presence of pathogens and respiratory disease in 31 Danish calf herds
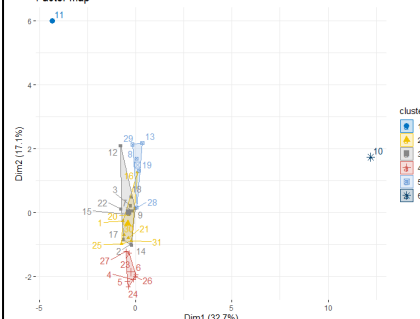

Figure 2. Herd clusters obtained by Principal component analysis with Ward´s clustering criterion for calves with respiratory disease in 31 Danish calf herds