

## PAPER

# Prevalence of antibodies to bovine viral diarrhoea virus in bulk tank milk and associated risk factors in Scottish dairy herds

R. W. Humphry, F. Brülisauer, I. J. McKendrick, P. F. Nettleton, G. J. Gunn

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**R. W. Humphry,**  
**F. Brülisauer,**  
**G. J. Gunn,**  
Scottish Agricultural  
College, Inverness, UK  
**I. J. McKendrick,**  
Biomathematics and  
Statistics Scotland,  
Edinburgh, UK,  
**P. F. Nettleton,**  
Claverhouse Drive,  
Edinburgh, UK

E-mail for  
correspondence:  
roger.humphry@sac.  
ac.uk

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## Context

Bovine viral diarrhoea (BVD) is considered a disease of economic importance in cattle. Some countries, including Scotland, have BVD eradication programmes. Progress in eradication may be monitored by surveys of animals or herds. Before the start of the current eradication programme in Scotland, samples from bulk milk tanks from 374 farms across Scotland were tested for bovine viral diarrhoea virus (BVDV) antibodies giving an indication of BVD infection in those herds. A summary of antibody levels in the bulk tank milk received from 220 non-vaccinated herds within the sample was provided. The Swedish eradication programme proposed an interpretive system for antibody levels in bulk milk by describing four categories of antibody level (0 to 3).

## Main conclusion

Using the interpretive framework from the Swedish BVD eradication programme, herd-level prevalences of BVD among 220 non-vaccinated Scottish dairy herds was estimated to be 20.5 per cent (based on category 3 of the Swedish programme, indicating the highest probability of active infection) or 65 per cent (category 2 and 3, suggesting that infection has been present in the herd in the relatively recent past. Bulk tank milk from 35 per cent of farms showed undetectable or low levels of antibody titres to BVDV (category 0 and 1) indicating no recent exposure of the herd to the virus. This result suggests a lower herd level prevalence in Scotland in 2008 than that reported for England and Wales for 1996, although this difference could be due to concomitant changes in the test protocol.

## Approach

Bulk milk tanks were sampled from 374 dairy farms across Scotland. Antibodies in the milk samples using a commercially available ELISA kit (Svanovir BVDV-Ab; Svanova Biotech AB) and percentage positivity (PP) values were calculated. For each sample, farm management data were collected through a questionnaire completed by farmers. The farm data included information on vaccination for BVD allowing identification of the 220 non-vaccinated herds. The results from the non-vaccinated herds were categorised according to the Swedish classification system. As an alternative to using previously published PP thresholds for estimating classifying herds with probable infection or past exposure, mixture models tested whether there was evidence of distinct subgroups among non-vaccinated herds.

Multiple bulk milk tanks on 32 farms allowed an assessment of the relationship between the number of bulk milk tanks tested and the likelihood of detecting exposure within the farm.

Questionnaire data collected from the farms enabled a risk factor analysis resulting in a model that includes the

main farm-level factors found to be associated with the mean PP scores. A mixed-model allowed additional variation to be accounted for at the hierarchical levels of farm and veterinary practice.

## Results

Mean herd-level prevalences of BVD antibodies in milk amongst 220 non-vaccinated Scottish dairy herds was estimated at 20.5 per cent (based on category 3 of the Swedish programme, indicating active BVDV infection) and 65 per cent (categories 2 and 3, suggesting past exposure and/or active infection). For categories 0, 1, 2, and 3 the proportions were, respectively, 12.7 per cent, 22.3 per cent, 44.5 per cent and 20.5 per cent.

The best fitting mixture model included two subgroups, each of which was described using the gamma distribution. Taking the subgroup with the higher mean PP as representing 'high antibody' herds, a high antibody herd-level prevalence of 74 per cent is estimated.

The high level of within-farm (between tank) variation indicated that to achieve reasonable herd-level sensitivity all bulk milk tanks on a farm need to be sampled.

Risk factor analysis showed that, total number of dairy cows, proportion of cows that are dry, the housing of pregnant cows with calves, vaccination, and suspicion of BVD were all significantly and positively associated with higher mean levels of BVDV antibody in the bulk milk. A farm with a health plan that included BVDV control generally had a lower mean bulk tank milk titre.

## Interpretation

The results described here are comparable with those previously published for England and Wales using samples collected in 1996. The data for Scotland in 2008 suggest a considerable lower prevalence of BVDV antibodies in bulk milk in Scotland in 2008 than in England and Wales in 1996.

The alternative approach to assessing prevalence using mixture models is of interest since it does not depend on predefined thresholds for categorising antibody scores. The result from this mixture model cannot yet be compared to other studies since the method does not appear to have been used for such BVDV data previously but has been used within veterinary epidemiology.

## Significance of findings

As the Scottish eradication programme progresses, these data will be of interest, as a baseline, should a similar survey be carried out to assess progress towards eradication. A comparison with a survey done in a similar manner for England and Wales in 1996 suggests that the levels of antibodies in bulk milks from herds not routinely vaccinated in Scotland in 2008 was substantially lower than the levels found for England and Wales in 1996.