Nationwide survey of antibodies to bovine coronavirus in bulk milk from Swedish dairy herds

M. Trävén, L. Björnerot, B. Larsson

Bulk milk samples from 2236 dairy herds randomly selected throughout Sweden in proportion to region and herd size were analysed for antibodies to bovine coronavirus (BCV) in an ELISA. The results were expressed as optical density (OD) values and an OD > 0.04 was considered positive. Eighty-nine per cent of the samples were antibody-positive and 52 per cent had high levels of antibodies to BCV (an OD > 0.70). There were significantly higher OD values (P < 0.001) and fewer antibody-negative samples (P < 0.001) from larger herds than from smaller herds. There were also significantly higher OD values and fewer antibody-negative samples from herds in southern Sweden than from herds in northern Sweden (P < 0.001 and P < 0.001, respectively). These results indicate a higher frequency of BCV infections in larger herds and in herds in southern Sweden.

BOVINE coronavirus (BCV) has been shown to be involved in several disease syndromes: winter dysentery of adult cattle (Saif 1990, Alenius and others 1991), calf diarrhoea (Stair and others 1972, Mebus and others 1973) and calf respiratory disease (Thomas and others 1982, McNulty and others 1984, Möstl and Bürki 1987). In studies of winter dysentery diagnosed by farmers an incidence of 28-5 per cent was recorded in central Sweden in one year (Trävén and others 1993) and an incidence of 33 per cent was recorded during nine months in an area on the east coast of the USA (White and others 1989). The seroprevalence of BCV in Swedish heifers was 61 per cent (Alenius and others 1991). In more limited surveys of adult cattle a seroprevalence of 61 per cent was recorded in Germany (Storz and Rott 1980) and 93 per cent in Switzerland (Battaglia and others 1986). However, no nationwide surveys for BCV antibodies have been reported.

Winter dysentery is economically important because of the marked reduction in milk yield that often occurs in affected herds (Roberts 1957, Campbell and Cookingham 1978). The aim of this study was, therefore, to estimate the infection rate of Swedish dairy cattle with BCV by measuring the level of antibodies in bulk milk.

MATERIALS AND METHODS

Sampling procedures
All Swedish dairy herds delivering milk to dairies (about 24,000 in 1991) are listed in the database of the Swedish Association for Livestock Breeding and Production (SALBP). The herds were grouped into 17 geographical regions and divided into three herd size groups on the basis of annual milk delivery: small herds producing less than 50,000 kg, medium size herds producing 50,000 to 199,000 kg, and large herds producing 200,000 kg or more. Ten per cent of the herds in each size group were randomly selected from each of the regions. The data processing for the selection procedure was done by Farmdata at the SALBP in Hallsta. Bulk milk samples from the 2408 randomly selected herds were then requested from the local milk classification laboratories, and 2236 samples were obtained for BCV antibody analysis, a 92-9 per cent participation rate.

Antibody detection
IgG antibodies to BCV were detected in an indirect ELISA (Alenius and others 1991). The bulk milk samples were analysed undiluted in duplicate wells. Samples with a mean optical density (OD) at 450 nm of more than 0.04 were considered positive.

Statistical analyses
The distribution of OD values among the three herd size groups and four major geographical areas were compared by Friedman’s non-parametric two-way analysis of variance. An examination of the residuals showed that the data did not meet the requirement for a parametric analysis of variance with equal variance in each group whatever transformation was applied. The major areas were derived by grouping the 17 regions from south to north (Table 1, Fig 1). Logistic regression was used specifically to evaluate the distribution of antibody-negative herds (Table 2) and the participation rates of herds of different sizes in the four major areas. An examination of the residuals showed that these two data sets did satisfy the requirement for logistic regression with a normal distribution of the residuals. The approximate Wilk-Shapiro normality statistic was 0.97 for the analysis of the distribution of antibody-negative herds, and 0.90 for the participation rates of herds.

RESULTS

Of the 2236 bulk milk samples, 1994 were BCV-antibody positive, giving a prevalence of 89-2 per cent. A majority of the samples (51.7 per cent) had an OD over 0.70 (Fig 2). Of the total, 18.5 per cent were small herds, 63-0 per cent were medium size herds, and 18.5 per cent were large herds (Table 1). There was a significant difference between the OD values of the herds of different sizes (P < 0.001). Adjusted mean ranks in the Friedman’s analysis were 232, 288 and 307 for the small, medium and large herds, respectively. Thus, the lowest OD values were among the small herds and the highest were among the large herds. There was also a significant difference between the proportions of antibody-negative herds among the herds of different sizes (P<0.001, Table 2), with the small herds having a higher proportion of antibody-negative herds.

The prevalence of antibody in each region is shown in Fig 1. There was a significant geographical difference in the distribution of OD values between the four major areas (P<0.001), with higher OD values in the southern areas than in the northern areas. The adjusted mean ranks for areas A, B, C and D were 294, 407, 243 and 159, respectively. There was also a significant difference between the frequency of antibody-negative herds in the major areas (P<0.001). The proportions of antibody-negative herds were 6-0 per cent in area A, 5-5 per cent in area B, 15-5 per cent in area C, and 22-2 per cent in area D.
The prevalence of BCV antibodies in bulk milk from the 2236 herds in this study was 89.2% per cent, and corresponded with the high incidence of winter dysentery recorded by Trävén and others (1993). There was a higher prevalence of BCV antibodies (P<0.001) and higher OD levels (P<0.001) among the larger herds than among the smaller herds, indicating that the larger herds had a higher infection rate; winter dysentery is more common among large herds than smaller herds (White and others 1989), probably as a result of the greater number of contacts with potential virus carriers or vectors (human beings, vehicles or equipment). In the study by White and others (1989) large herds had more than 60 cows, whereas in this study 'large herds' had more than approximately 30 milking cows.

There was a higher prevalence of BCV antibodies and higher OD levels in the southern than in the northern parts of Sweden (P<0.001 and P<0.001, respectively), indicating that there was a higher infection rate in southern Sweden. One possible reason for the lower infection rate in the northern parts of Sweden is the much larger distances between herds, as indicated approximately by the numbers of herds sampled.

<table>
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<tr>
<th>Region (Fig 1)</th>
<th>Small (OD)</th>
<th>Medium (OD)</th>
<th>Large (OD)</th>
<th>Total number</th>
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The Veterinary Record, May 8, 1999
Hypocalcaemia in 23 ataxic/recumbent ewes: clinical signs and likelihood ratios

P. D. Cockcroft, P. Whiteley

Twenty-three ewes in a flock of 2000 were identified as having acute onset ataxia and/or having become recumbent in late pregnancy and early lactation. The presence or absence of 15 clinical signs were recorded. Thirteen of the ewes (57 per cent) were hypocalcaemic and 10 (43 per cent) were normocalcaemic. In the hypocalcaemic group, loss of anal reflex, constipation, tachycardia, hyposensitivity, ruminal stasis, ruminal tympany, salivation and tachypnoea were recorded in 50 per cent or more of the cases. In the normocalcaemic group, tachycardia, tachypnoea and ataxia were recorded in 50 per cent or more of the cases. Constipation, ruminal stasis, salivation and hyposensitivity had likelihood ratios of 3 and above for being associated with hypocalcaemia. Ruminal stasis and hyposensitivity had the likelihood ratios of 0-10 and 0-11 respectively for not being associated with hypocalcaemia.

HYPOCALCAEMIA is an economically important, common and sometimes fatal disease of adult ewes during late pregnancy and early lactation. The diagnosis of hypocalcaemia is confounded by a number of differential diagnoses which are also associated with acute onset, ataxia and/or recumbency, including pregnancy toxemia, hypomagnesaemia, toxic endometritis, acute mastitis, listeriosis and scrapie. Biochemical analysers which can be used in the field for measuring serum calcium levels are expensive and are not usually available. A presumptive diagnosis of hypocalcaemia

References


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in each region (Table 1) compared with the areas on the map (Fig 1). Long distances reduce the risk of spread of the virus between herds through local contacts with infected cattle or vectors. The statistical analysis revealed no geographical differences in the participation rate of herds in the different areas corrected for herdsize, but the prevalence of antibody might have been overestimated marginally owing to the significantly lower participation rate among the small herds (P<0.001).

The results show that bcv antibodies are present in a large proportion of the Swedish dairy cow population. The prevalence is higher among larger herds and higher among herds in the southern part of the country.
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