

Distribution of *Mycobacterium avium paratuberculosis* in Minnesota Dairy Farms Using Bacterial Culture of Fecal Pools

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Introduction

Paratuberculosis, or Johne's disease, is a chronic and progressive intestinal disease in ruminants caused by *Mycobacterium avium* subspecies *paratuberculosis* (MAP). The usual route of infection is fecal-oral, with young cattle becoming infected by exposure to infected adults or their contaminated environment. The disease becomes manifest in adulthood and results in economic losses due to premature culling, reduced milk production and loss of body weight in cattle sold for slaughter. Johne's disease control programs have been developed in different countries and in several US states, with a goal to test and classify herds of cattle as infected or presumptively non-infected with maximum accuracy and least cost. Generally, these programs utilize recognized laboratory tests such as ELISA or direct microbiological individual fecal culture. However, these tests have several disadvantages, especially when applied in herds with subclinical disease or low prevalence. A pooled fecal culture method, which aggregates several cows' fecal samples to one culture unit, has been recently suggested as a good alternative strategy for lowering the procedure cost for herd screening programs for dairy cattle. The objectives of the current study were to: 1) describe the apparent fecal pool prevalence of MAP in known to be infected and noninfected Minnesota dairy herds based on pooled fecal culture, 2) estimate the animal-level prevalence based on fecal pool results, 3) characterize the association between cow age and pool status and shedding level results, and 4) characterize the association between pooled culture results and serum ELISA results at the herd level.

Materials and Methods

One hundred and eight Minnesota dairy herds were sampled during summer 2002, including 80 herds known to be infected from previous testing, which participated in the Johne's Disease Control Program (JDCP) of the Minnesota Board of Animal Health (MBAH), and

28 herds known to be uninfected based on previous testing, which participated in the Voluntary Johne's Disease Herd Status Program (HSP) of the MBAH. Fecal samples were obtained from up to 100 cows in each herd, and were cultured in pools of five cows based on age order. Fecal samples were tested using bacterial culture for MAP at the Minnesota Veterinary Diagnostic Laboratory.

Results

Twenty-six (93%) of VJDHSP herds had no positive pool; 7% (2) had one positive pool each. Sixty-four (80%) of JDCP herds had a least one pool positive and 20% (16) did not have any positive pool. In small positive herds (<100 cows), 30% had >30% positive pools, whereas in positive herds with >100 cows pool prevalence was >30%. In 74% of the herds with positive pools, the maximum level of shedding was >50 colonies per tube (heavy shedder). Within each herd, on average, 21% of positive pools were heavy shedders. Average individual fecal prevalence calculated from fecal pool results varied from 27 to 6% when test sensitivity was 50 and 99%, respectively. Overall average pool age among all positive pool herds was four years (min.=2, max.=11). There was no significant difference between all age groups (2-5 and 6 years) in terms of pools status ($p=0.19$) or level of shedding ($p=0.257$). There was a positive correlation between fecal pool prevalence and ELISA prevalence ($r=0.54$, $p<0.0001$), and also between herd maximum level of shedding and herd maximum ELISA result ($r=0.60$, $p<0.0001$).

Significance

This study results suggest that dairy herds can be categorized by fecal pool prevalence and maximum level of shedding, indicating bacterial culture of fecal pools is an alternative strategy for herd screening and approximation of herd prevalence.