New technique to monitor Johne’s disease on infected farms

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Summary

- Transmission of \textit{Mycobacterium avium} subspecies \textit{paratuberculosis} (MAP) from infected adult cattle to susceptible calves occurs mainly through contamination of the calf environment with adult faeces.
- This study evaluated a novel technique for monitoring the calf environment.
- Boot swabs along with faecal grab samples were used to detect MAP in 28 infected dairy farms.
- In total, 46\% of farms had detectable MAP in the overall calf/calving environment, with 36\% of farms having detectable MAP in the calving area.
- It was concluded that environmental sampling is a potentially useful tool to objectively measure transmission risk in the calf/calving environment on farms.

Introduction

\textit{Mycobacterium avium} subspecies \textit{paratuberculosis} (MAP) is primarily transmitted orally through ingestion of faeces, colostrum or milk from an infectious animal. Environmental contamination of housing and pasture with faeces from infected animals constitutes a risk for transmission of infection to susceptible animals. Faeces is the most important source of transmission, both through faecal contamination of the calf environment and through faecal contamination of colostrum and milk fed to calves. Environmental sampling may be a potentially useful technique to detect MAP in the pre-weaned calf area and calving area of farms.

Control programmes for Johne’s disease (e.g. Irish Johne’s Disease Control Programme - IJCP) usually involve a combination of herd testing to detect infection (e.g. ELISA blood/milk testing) and biosecurity measures following a risk assessment and management plan (RAMP) to reduce the spread of disease within herds and between herds.

The objectives of this study were (1) to determine what proportion of MAP-infected farms enrolled in a control programme had detectable MAP in their calf/calving environment, and (2) to compare RAMP scores and apparent within-herd prevalence (aWHP) of PCR-positive and PCR-negative farms.

Materials and methods

Dairy herds with confirmed MAP infection within the last five years based on individual faecal PCR were identified in the IJCP database. Of these, 28 farmers agreed to participate in this study. Annual RAMP score data were available for these herds. The aWHP for each herd was calculated based on the most recent annual whole-herd ELISA test recorded on the IJCP database. These were all spring calving herds, located mostly in the south and east of Ireland. Herd size ranged from 41-393 cows with a mean herd size of 166 at the time of sampling. On each farm three boot swab samples were obtained, one pair from the calving area and two pairs from the pre-weaned calf area. Manure grab samples were also obtained off the floor of the calving pen. All samples were tested for MAP using PCR.
Results

Overall RAMP scores (biosecurity assessments) ranged from 47–155 (out of a total score of 227). The lower the score, the lower the perceived risk of transmission of MAP. The mean overall RAMP score in PCR-positive and PCR-negative farms was 96.8 and 95.9, respectively, with no significant difference between mean scores.

The aWHP (blood ELISA results) for the herds ranged from 0–21%, with a median of 3.5%. The median aWHP for PCR-positive and PCR-negative farms was 5% and 3% respectively, with no significant difference identified between groups.

Table 1 shows the distribution of positive, negative and inconclusive dung results when boot swab sub-samples and calving area floor samples were pooled to give one result per location on each farm.

Table 1. Distribution of pooled MAP PCR results for calf pens and calving pens

<table>
<thead>
<tr>
<th>Environment</th>
<th>Positive</th>
<th>Inconclusive</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf pens</td>
<td>6</td>
<td>6</td>
<td>16</td>
<td>28</td>
</tr>
<tr>
<td>Calving pens</td>
<td>10</td>
<td>5</td>
<td>13</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>11</td>
<td>29</td>
<td>56</td>
</tr>
</tbody>
</table>

In total, 10/28 (36%) and 6/28 (21%) of farms had positive PCR results in the calving area and pre-weaned calf area, respectively. A total of 13/28 (46%) farms had at least one positive sample from either location. There were 4/28 (14%) farms that had at least one inconclusive sample from either location, and no positive samples.

Discussion

This study presents a novel and objective strategy for monitoring the efficacy of RAMPs conducted in herds engaged in the IJCP for reducing the risk of transmission of MAP within herds. The median aWHP across all herds was relatively low at 3.5% however, the proportion of truly infected animals may be much higher than this, due to the low sensitivity of blood tests for MAP. The relationship between PCR test result and aWHP or RAMP scores at farm-level, location-level or sample-level was not significant. This may be due to insufficient number of herds/samples examined, and/or the limitations of using RAMP scores or aWHP to assess transmission risk. It may be concerning that 46% of the herds had detectable MAP in either their calving pen, calf pen, or both locations. On a typical Irish spring-calving farm the compact calving season may increase the chances of contamination of calf pens with faecal material from adult cows due to the frequent movements of animals and personnel between cow housing (including the calving pen) and the calf rearing areas.

Conclusions

This research has demonstrated a potential novel application for environmental sampling as an objective test to complement the annual RAMP, to help monitor the progress of infected farms in reducing the risk of transmission of MAP to calves. However, further research on a larger scale is needed to support these results.

Acknowledgments

We wish to acknowledge the collaboration and technical support of the microbiology laboratory of the Irish Equine Centre during the planning and completion of this study.