

Juvenile Vaccination against *Mycobacterium avium* ssp *paratuberculosis* Impacts Incidence and Cull Rates

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Introduction

Johne's disease (JD) caused by *Mycobacterium avium* ssp *paratuberculosis* (MAP) is significant and costly to dairy producers. These costs manifest from increases in culls and opportunity costs derived from losses in the genetic potential of the herds. Vaccination with the USDA-approved vaccine (Mycopar) between five and 35 days of age reduces the incidence of clinical MAP infection. Limitations of vaccination with Mycopar for MAP are economic losses incurred during the period between vaccination and integration into the lactating dairy herd, and the possibility of vaccinated animals exhibiting continued shedding of bacteria. This pragmatic trial examines the efficacy of Mycopar vaccination in dairy heifers up to 15 months of age on the incidence of clinical Johne's disease.

Materials and Methods

A total of 256 heifers aged five days to 15 months from one dairy herd with a MAP prevalence of over 10% were enrolled in this trial. Special permission was received from the Iowa Department of Agriculture and Land Stewardship (IDALS) for juvenile vaccination. The heifers were skin tested with MAP – Purified Protein Derivative (MAP-PPD), and vaccinated with 0.5 mL Mycopar by label instructions or no vaccine. The producer was not blinded to the status of the animals. The diagnosis of MAP infection was based on the culture of pooled fecal samples collected at 42 months after vaccination. Individual animals in positive pools were cultured to determine shedding status. All production data was retrieved from the herd's management software.

Whole-herd cull data was analyzed descriptively to evaluate the overall effect of MAP vaccination. Data between vaccinated and non-vaccinated groups was evaluated through a Mantel-Haenszel chi-square test. A Fisher's exact test was used to evaluate the experimental groups stratified by age due to the reduction in sample sizes. MAP-PPD skin testing and vaccination-site responses were evaluated with a one-way ANOVA.

Results

During the first two years of the study, with few vaccinated animals in the lactating herd, the total number of culls in the lactating herd due to clinical JD was 25 and 22 animals, respectively. During the fourth year of the study, this number had fallen to eight animals. The number of JD culls as a percentage of total culls in the lactating herd also decreased from 11% and 9% in the first two years of the study, to 5% in the fourth year.

While not statistically significant ($P=0.175$), the incidence of MAP quantified by fecal culture was reduced after 42 months, with six positive non-vaccinates and three positive vaccinates. The lack of significance was most likely a result of the limited statistical power of the study, and the low incidence of JD. Of the three vaccinated heifers which were positive for MAP, two were from dams which were seropositive and culled with clinical JD. In addition, seven study animals culled for clinical MAP infection were not utilized in the statistic analysis, five of which were non-vaccinated and two of which were vaccinated. No significant difference was shown in MAP infection between age groups. Vaccinated animals had significantly greater MAP-PPD DTH responses when compared to non-vaccinated animals prior to vaccination.

Significance

The ability to generate protective immunity against MAP infection in heifers up to 15 months of age could reduce the number of MAP-shedding animals in the lactating herd in a shorter period of time and improve current Johne's disease management programs. This study suggests that juvenile vaccination is efficacious in reducing the number of shedding animals in the lactating herd. Exposure to positive dams also plays a role in the development of clinical disease, even in vaccinated cattle, indicating that the continued culling of seropositive, non-vaccinated cows is beneficial. The results of this pragmatic study are supportive of juvenile vaccination, and should be further studied between conventionally vaccinated and juvenile-vaccinated cohorts.