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## UCD VET VIEWS

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**JOHNE'S DISEASE: Part I**

Johne's disease (pronounced *yo-NEES*) is a condition of cattle and other ruminants that causes chronic diarrhea, weight loss, infertility, and eventual death in animals that are infected years earlier. The causative agent of Johne's disease is *Mycobacterium paratuberculosis*, a slow growing bacterium that can live in the environment for a year or more. Johne's disease in cattle has economic, regulatory, legal, and human health significance that we will review.

The first key to understanding Johne's disease is to review how the organism causes infection and how it is transmitted from animal to animal. The organism, *M. paratuberculosis*, usually gains access to the host via oral ingestion, although other routes of infection are possible. The *M. paratuberculosis* bacterium initially infects the last segment of the small intestine, the ileum. The growth of the organism and spread of infection in the ileum is slow and usually takes several years before any disease is detectable in the individual animal. As the amount of small bowel inhabited by the bacterium increases, the numbers of organisms shed in the feces increases. These *M. paratuberculosis* organisms in the feces of cattle are the primary way Johne's is spread from animal to animal. With time, the infection in the intestinal tract becomes more widespread and the lymph nodes near the bowel (the mesenteric lymph nodes) become infected with *M. paratuberculosis*. Later, the organism can become disseminated outside the intestinal tract and infect the uterus, mammary lymph nodes, udder, and sexual organs of bulls. Therefore, the agent can be shed in the milk and semen in addition to the feces. By the time the agent has spread outside the intestinal tract, the feces contain large numbers of *M. paratuberculosis* which can serve as a source of infection for many animals in the herd.

Transmission can occur in several ways. The first to consider is **prenatal** or **in utero** transmission of the agent. In this instance, the agent passes from the infected cow to the calf **before birth** and the calf is born infected. Infected cows that are showing clinical signs of Johne's disease (weight loss, diarrhea) transmit the agent to the unborn calf 20 to 40% of the time. For infected cows that are not showing signs of Johne's disease (asymptomatic), *in utero* transmission occurs about 8% of the time. Clearly, heavily infected, pregnant cows that are showing signs of weight loss or diarrhea should not be kept in the herd to "get just one more calf." These cows will have too high a chance of infecting their calf prenatally and will also shed high numbers of the organism in the environment. If these cows do not transmit the agent to their calf *in utero*, it is probable they will infect their calf (and perhaps many others) soon after birth.

The most common time of infection of calves occurs soon after birth. The young calves are most susceptible to the disease. The organism can be in the feces of the cow and can also be in the colostrum or milk. Also, there is usually some manure on the udder of cows, even in the best of circumstances. Therefore, the act of suckling can expose the calf to *M. paratuberculosis* in feces on the udder, in the milk (or colostrum), or to fecal contamination in the environment. Two factors determine susceptibility to infection by the Johne's agent; (1) age, and (2) dose of the organism. The younger the animal, the more susceptible. As an animal reaches one year of age, the resistance rises to that of adult levels. Also, the higher the dose, i.e., the more Johne's organisms encountered, the more likely an infection will result. So very young cattle ingesting a high dose of organisms are most likely to become infected and conversely, adult animals ingesting a low dose of organism are least likely to become infected. On beef operations, occasionally, twin calves or orphan calves do not have access to colostrum from their dams and colostrum from dairy cattle is given to these beef calves. Because the incidence of Johne's disease is much higher in dairies, there is some risk that the *M. paratuberculosis* organism could be introduced into a clean beef herd in this manner. This could be a potential for herd to herd transmission.

Other means of transmission exist. This agent can also infect sheep, goats, and wildlife ruminants such as deer. Johne's disease can affect all these species in a similar way to which it affects cattle. Therefore, transmission can theoretically occur between these ruminant species. Because deer, sheep, and goats have pelleted feces the chance of widespread fecal contamination is less than with cattle. Fecal contamination of clothes, boots, and equipment could also move the agent from one premise to another or from animal to animal. Therefore, human activity can be a significant means of transmission of Johne's disease. One of the more important means of transmission on beef operations is via infected bulls. The *M. paratuberculosis* organism can be found in the semen and accessory sex organs of infected bulls. Inoculation of the uterus with the Johne's organism can result in infection of the cow. Additionally, bulls are with the cow herd when the calves are young and if the bull is infected and shedding the organism in his feces (even when he has no signs of disease) he is exposing all the calves at a time when they are most susceptible. The practice of sharing or leasing breeding bulls (particularly older bulls who could be shedding the organism in their feces at high levels) can result in significant spread of Johne's disease in beef herds.

How important is this disease? In the dairy industry it is a significant source of economic loss-in Wisconsin alone, the losses

are estimated to be \$54 million per year. In a national survey of cull cows the prevalence in dairy cattle was found to be 2.9% and the prevalence in beef cattle was 0.8%. The disease affects beef cattle through decreased productivity, infertility, increased culling, and increased susceptibility to other diseases. It is a disease that can be devastating to a herd over time and can be particularly important in purebred herds.

Next month we will discuss diagnosis, treatment, and control of Johne's disease. Also, we will discuss the regulatory and legal issues surrounding this disease. Lastly, we will review the relationship between the Johne's disease agent and Crohn disease in humans.

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