

Salmonella Heidelberg: An emerging problem in the dairy industry

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Introduction

Salmonella is endemic in modern dairy operations. Colonization of newborn calves typically occurs at birth although in-utero transmission has been reported. Most of the time when newborn calves are colonized with *Salmonella* spp., there are no issues with calf health with the caveat that the calves receive an adequate quantity of good quality colostrum within 2 hours of birth, they receive at least 1.5 gallons of milk or its equivalent in milk replacer each day, there is adequate space and heat or cold stress is minimized. However, not all *Salmonella* behave the same way in newborn calves. This report describes a very dangerous, multi-drug resistant (MDR) strain of *Salmonella* Heidelberg that can cause high mortality (> 25%) in well managed dairy operations. In addition, this same strain of *Salmonella* has a high potential to cause illness and hospitalization of calf care workers as well.

Materials and Methods

Beginning in late 2015 and early 2016, the WVDL started receiving diagnostic samples from dairy calves (less than 3 weeks of age) that died less than 6-8 hours after they were first noticed to be ill or they were found dead. Some of the calves had diarrhea and a fever (> 40 C) but many calves did not. Upon postmortem examination, the only consistent finding was enlarged mesenteric lymph nodes in 25-50 % of affected calves. A mild interstitial pneumonia and a fibrinous peritonitis was also observed in less than 10% of affected calves. Histological examination found an acute, necrotizing and suppurative gastroenteritis with lymphoid depletion in 25-50% of affected calves with 25-50% of the calves examined having no significant gross or microscopic lesions. Consistently, *Salmonella* Heidelberg was found in large numbers in multiple organs (lung, kidney, spleen, liver, small and large intestine and mesenteric lymph nodes) indicating that the calves died of bacteremia/septicemia. *Salmonella* Heidelberg isolates were sent to the Wisconsin State Lab of Hygiene for molecular finger printing either by pulse field gel electrophoresis (PFGE) or whole genomic

sequencing (WGS). Antimicrobial susceptibility testing (Sensititre, Thermo Fisher Scientific, Madison, WI) was done on all the *Salmonella* Heidelberg isolates.

Results

As of 05-01-17, the WVDL has isolated *Salmonella* Heidelberg from 30 different premises located in 4 different states (SD, MN, MO and WI). The majority of the livestock operations (80%) were located in Wisconsin. At least two-thirds of the isolates were obtained from dairy beef operations that had a high death loss (25-65%) in calves that were received 5-7 days before the outbreak started.

All the *Salmonella* Heidelberg isolates were MDR (only susceptible to gentamicin) and are very closely related when examined by PFGE or WGS. The dominant strain (dendogram: #PF6X01.0523) of *Salmonella* Heidelberg differs by only 8-12 base pairs (bp) when WGS is done. Molecular finger printing has shown that this is a very rare strain of *Salmonella* Heidelberg that was first identified in 2014 and it probably originated in one or more livestock operations in the upper Midwest. It is important to understand that this strain of *Salmonella* Heidelberg is quite different from previous isolates that have been found in cattle and poultry.

Significance

Salmonella Heidelberg caused by PFGE type JF6X01.0523 is an emerging problem affecting the US dairy industry. It can cause severe mortality (> 25%) in well managed dairy operations that incorporate best-practices which includes the industry standards for colostrum management, nutrition, space and minimization of heat and cold stress (calf comfort). There are no approved antimicrobial drugs that are effective against this bacterium so treatment of clinically affected animals can only be supportive in nature and it is often not effective. Efforts to control this bacterium should focus on proper cleaning and disinfection of close-up pens, calving pens, calf barns, calf feeding equipment and livestock trailers.