Pathogenesis, Transmission, and Control of Salmonellosis in Swine

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The objectives of our project at the National Animal Disease Center are:

1. To identify virulence factors important in the pathogenesis of Salmonella choleraesuis and Salmonella typhimurium in swine
2. To define the epidemiology and transmission of Salmonella in swine
3. To define the porcine immune response to acute and chronic Salmonella infection focusing on mechanisms to reduce or eliminate the pathogenic organism
4. To identify methods to control Salmonella in swine

Progress for these objectives has resulted in the following information:

1. We produced soluble antigen extracts for the development of indirect ELISA assay which may be used to monitor the immune response and identify carrier animals. A mixed ELISA format, as described by the Danish researchers and designated SalAD, was developed. The sensitivity and specificity of the test is >95% and >85%, respectively. A comparison with the Danish mix ELISA will be conducted.
2. The survival and transmission of Salmonella choleraesuis was investigated. Feces was collected from swine infected with Salmonella choleraesuis and was stored in either a dried or wet form. Bacterial survival was significantly longer in feces that had been dried. Swine also became infected following challenge by intranasal inoculation with dried feces. These data indicate that appropriate sanitation measures are critical when designing control plans in swine units and that any dried organic matter may serve as a reservoir for Salmonella.
3. We conducted a survey of Salmonella in feed transport trucks. Twenty-five culture swabs were taken from 22 trucks from 3 states; feed samples were also cultured from 17/22 trucks. Results indicate that 5/22 (22.7%) of the trucks were positive for Salmonella spp. Salmonella was isolated from approximately 4/540 swabs (0.7% sample prevalence). Three trucks had positive swabs (13.6%) and 4/22 feed samples (18.1%) were positive. Feed and swabs were positive for 2 trucks. More samples were positive from trucks containing meat, bone or fishmeal than those containing vegetable based feed which correlates with an FDA report. Four serotypes were identified and 3/4 are listed in the top 20 serotypes isolated from humans. These data indicate that while the sample prevalence of Salmonella in feed trucks is low (0.7%) the overall contamination rate for feed trucks is much higher (22.7%). Additionally, it may be important to monitor levels of Salmonella in feed transport trucks and devise methods for sanitizing between loads.
4. The carrier state of Salmonella choleraesuis in swine has been characterized. We have determined that route of inoculation impacts duration and magnitude of shedding, dose impacts on development of the carrier state, and shedding of Salmonella from naive animals exposed to a challenge group occurs within 24 h post-exposure.
5. Segregated early weaning was investigated as a means to reduce/eliminate vertical transmission of Salmonella. Salmonella isolations decreased under high health conditions.
Future studies include:

1. Participation with FSIS, APHIS, and FDA to generate baseline antimicrobial susceptibility data from *Salmonella* isolates which have been recovered from several NAHMS and FSIS surveys. These efforts are being coordinated for use in a national monitoring surveillance program with the FDA, CVM, APHIS, and CDC.
2. Monitoring swine on several farms from farrow to finish to determine when pigs become infected with *Salmonella* and if/when they clear *Salmonella*.
3. The interaction between PRRS/*Salmonella*.
4. Role of alveolar macrophages in infection.