Source and Prevalence of Multi-Drug Resistant *Salmonella* in Dairy Cattle

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Study Completed
June 2006

Funded by The Beef Checkoff
Source and Prevalence of Multi-Resistant *Salmonella* in Dairy Cattle: Project Summary

**Background**
Dairy cattle serve as an important reservoir for *Salmonella* and have been implicated in cases of human salmonellosis. Cattle typically show no symptoms while shedding *Salmonella* into the environment. Previous research conducted by USDA-ARS showed the prevalence of mature dairy cattle shedding this pathogen in their feces varies greatly but can be as high as 100%. Further, serotype prevalence and diversity varies among farms and season.

The development of antimicrobial resistance in pathogenic bacteria species, including *Salmonella*, has been the subject of considerable research in the past decade. *Salmonella* Newport gained attention in 1983 when a multi-drug resistant strain was isolated from several infected people that apparently acquired this *Salmonella* from ground beef originating from beef cattle. In 1985, *Salmonella* Newport was isolated from human patients in California with an unusual resistance pattern (including chloramphenicol) that was traced through hamburger to dairy farms. Other researchers have reported the prevalence of *Salmonella* Newport appeared to be increasing in California and that a chloramphenicol resistant strain was the most common serotype identified in 1986. Most recently, in 2002, numerous people in the Eastern United States were made ill and one later died as a result of a multi-drug resistant (MDR) strain of *Salmonella* which was later implicated as coming from ground beef from dairy cattle. Research conducted previously identified antimicrobial resistant *Salmonella* isolates in dairy cattle, although most resistance patterns were to antimicrobials commonly used in veterinary medicine. However, subsequent dairy research identified multi-resistant *Salmonella* isolates, including serotype Newport, with resistance patterns similar to those reported in Newport isolates in the 2002 outbreak.

The occurrence of MDR *Salmonella* in dairy cattle and the link to human cases of illness in the United States is cause for concern. However, while it is generally recognized that dairy cattle are reservoirs for *Salmonella*, some of which may be MDR, the prevalence and source of MDR *Salmonella* in dairy cattle has not been extensively studied. The hypothesis in this study is that MDR *Salmonella* will comprise a small proportion of all dairy *Salmonella* isolates and they are associated with certain classes of cattle within the dairy operation.

The objectives of this study were as follows:
1. Determine prevalence of multi-resistant *Salmonella* in dairy cattle (calves, heifers, lactating cattle, dry cows, and cull cows).
2. Determine if co-mingling of calves from multiple farms at a heifer feedlot serves as a transmission vector for multi-resistant *Salmonella* back to the dairy.
3. Examine waste milk for multi-resistant *Salmonella* prior to use as calf feed.

**Methodology**
This research was conducted on four large commercial dairies (> 2000 head each) in the southwestern United States. In previous studies, some of the dairies sampled had significant *Salmonella* prevalence in the lactating cattle. All four dairies are located within a small geographical region (approximately 5 miles) and are managed similarly. Mature animals
Fecal pat samples were collected from various groups of cattle on one or two occasions, October 2005 and/or March 2006. The following cattle groups were sampled: Hutch calves (sampled twice); 12 and 24 month heifers (sampled once in October); lactating cows (sampled twice); dry cows (sampled once in March); and cows in sick/fresh pens (sampled once in October).

All fecal samples were tested for the prevalence of *Salmonella* and resistance to multiple antimicrobial drugs. The following antimicrobials were tested: NARMS panel (cefoxitin, amikacin, chloramphenicol, tetracycline, ceftriaxone, amoxicillin/clavulanic acid, ciprofloxacin, gentamicin, nalidixic acid, ceftiofur, sulfisoxazole, trimethoprim/sulfamethoxazole, kanamycin, ampicillin and streptomycin) and Bovine/Porcine panel (ceftiofur, erythromycin, chlortetracycline, oxytetracycline, penicillin, tiamulin, gentamicin, florfenicol, ampicillin, danofloxacin, sulphadimethoxine, neomycin, sulphachloropyridazine, tylosin, sulphathiazole, spectinomycin, tilmicosin, clindamycin, trimethoprim/sulfamethoxazole and enrofloxacin.

**Findings**
Fecal *Salmonella* prevalence varied among groups of cattle and between the two collection periods. Hutch calves and cattle in the sick/fresh pen were more likely to harbor MDR *Salmonella* than heifers or lactating and dry cows. However, a significant number of MDR *Salmonella* were detected in lactating cattle on one farm during the October collection. The MDR *Salmonella* belonged to serogroup B and were predominantly of the serotypes Reading and Typhimurium. No *Salmonella Newport* was identified. A small portion of the isolates examined for antimicrobial resistance were MDR and 30 isolates were resistant to 9 or 10 antibiotics on the NARM’s panel.

**Implications**
While the presence of MDR *Salmonella* is a cause for concern, all isolates examined were susceptible to ciprofloxacin and ceftriaxone, two antibiotics used in the treatment of severe cases of human salmonellosis.

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