Safe-Zone Project: Cow and Calf Pathogen Survey

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Project Brief

Foodborne illnesses in the United States (US) are caused by a wide variety of microorganisms and are estimated to cause 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths annually (Mead et al., 1999).

In the United States, *E. coli* O157:H7 is the most common microbial cause of bloody diarrhea and hemolytic uremic syndrome (HUS), which can lead to acute renal failure and death among humans (CDC 2009; Garg et al., 2003). Undercooked or raw ground beef (hamburger) has been implicated in many Center of Disease Control (CDC) documented outbreaks resulting in a substantial health burden in the United States. Cattle feeding practices have been identified as either the main source of infection or indirectly through contaminated irrigation water. Direct contamination of meat occurs when contaminated hides come in contact with carcasses during skinning and illness in humans is frequently associated with consumption of undercooked hamburger. Effective preharvest intervention strategies that will reduce the proportion of cattle carrying pathogenic *E. coli* may reduce human exposure to this pathogen.

Of all food borne pathogens that affect humans, *Salmonella* is widely considered to be one of the most important. A foodNet report estimated *Salmonella* related infections in the US to be 1.4 million illnesses, 15,000 hospitalizations and 400 deaths annually (Voetsch et al., 2004). .

Among the many *Salmonella* serotypes, the most common associated with infection in humans are S. typhimurium and S. enteritidis. *Salmonella* can live in the intestinal tracts of humans, other animals, and birds. Foods of animal origin may be contaminated with *Salmonella*; therefore, eating raw or undercooked eggs, poultry, or meat can cause infection. Foods prepared with raw eggs can be an unrecognizable origin of contamination. Meat from poultry and ground beef are sources of contamination that should be well cooked before consumption.

The ability of Salmonella to become resistant to antimicrobials has hampered efforts in treating illnesses caused by this pathogen and has made the production and tracking of food products, especially those from cattle, more important. Antimicrobial resistance is the ability of microorganisms to evade the effects of antimicrobials through newly developed biological mechanisms (CDC, 2008). The ability of microorganisms to evade or to become resistant to antimicrobials can be acquired through integrons, which are genes that consist of a central variable region that often harbors antibiotic-resistance gene cassettes (Amita et al., 2004).

Using cow-calf pairs located at the Dickinson Research Extension Center, the purpose of this pathogen survey project is to track the prevalence of pathogenic *E. coli* and *Salmonella* serotypes through the production continuum beginning on fall native range and ending at final harvest (steer calves). *Objectives*: (1) Determine seasonal prevalence change for pathogenic *E. coli* that carry shiga toxin genes and *Salmonella* spp., (2) Determine the level of antimicrobial resistance (AMR) and multidrug resistance in Salmonella strains isolated from beef cattle at different stages of production, and (3) Determine the association between the presence of Integron-1and AMR to 15 different antimicrobials (amikacin, amoxicillin/ clavulanic acid, ampicillin, ceftiofur, chloramphenicol, ciprofloxacin, gentamicin, kanamycin, nalidixic acid, streptomycin, sulfizoxazole, and trimethprim-sulfamethoxazole) in isolated *Salmonella* strains.

Fecal grab samples and rectoanal swab samples are being collected beginning before weaning on fall pasture and continuing through weaning, mid-winter (Feb), at spring pasture turnout on improved crested wheat, and on pasture mid-summer. The calves will be sampled on fall pasture, at weaning, at the end of unharvested corn grazing, midway through the finishing period (Feb), and just prior to final harvest. Laboratory isolation and definitive PCR serotype determinations will be conducted under the direction of Dr. Margaret Khaitsa, Veterinary Epidemiologist, NDSU Veterinary and Microbiological Sciences Department.

Expected outcomes include: (1) Establishment of seasonal shedding patterns for shiga toxin producing *E. coli* serotypes and *Salmonella* spp., (2) Establishment of antimicrobial resistance patterns of Salmonella isolated from beef cattle throughout the production continuum, (3) Establish the connection between Integron-1 presence and resistance patterns to the antimicrobials tested.

Information obtained from the survey will be used to develop intervention strategy research originating at the ranch level and carrying over into the feedlot.

When this research brief was prepared, the spring and summer cow samples remained to be collected. For the feedlot steers, fecal grab, rectoanal swab, and mid-line hide samples remain to be collected prior to final harvest. Data will be presented in the next annual report.

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