



Growth Responses of Coliform Bacteria to Antibodies Against the Ferric Citrate Receptor FecA

Joseph S. Hogan, Animal Sciences
Kenneth L. Smith, Animal Sciences

Mastitis in dairy cows is the most costly animal agriculture disease. Clinical coliform mastitis costs Ohio dairy farmers more than \$21 million annually in lost milk production, veterinary expenses, discarded milk, and drug costs. Of the multitude of microbial agents that cause bovine mastitis, the coliform bacteria *Escherichia coli* and *Klebsiella pneumoniae* are the leading causes of clinical mastitis in well-managed herds. These pathogens are notoriously resistant to chemical disinfectants and antibiotic treatment commonly used to control the incidence of mastitis.

The possibility of developing a mastitis vaccine that inhibits growth of the coliform bacteria in mammary glands by preventing the bacteria from using iron was investigated. Mammary secretions contain very low concentrations of available iron; however, coliforms have unique mechanisms for utilizing that iron to use in the metabolic processes needed for multiplication. Coliform bacteria can alter their external surface in milk to express iron-regulated outer-membrane proteins (IROMP) that act as receptors for allowing iron into the cell. These membrane proteins were excellent molecules from which to formulate vaccines because they were expressed on all coliforms and caused an antibody response when injected in laboratory animals and dairy cows. More important, the antibodies reduced the uptake of iron and bacterial growth.

OBJECTIVES

The primary objective of this project was to determine the feasibility of developing a mastitis vaccine that would inhibit growth of coliform bacteria in mammary glands by preventing the bacteria's uptake of iron.

CHALLENGES

The challenge in this research was to improve milk quality and safety by enhancing the dairy cows' natural defenses against coliform bacterial infections. Once this is accomplished, the associated costs for treating these infections should decrease substantially.

ACHIEVEMENTS

A vaccine was developed that produced antibodies against the ferric citrate receptor of *Escherichia coli* that causes bovine mastitis.

These experiments provided basic information relative to antibody responses following immunization and supplemented our understanding of the role iron acquisition plays in bacteria causing mastitis.

THE FUTURE

With additional funding from our industry partner in the amount of \$276,048, this research will continue. Plans are to continue looking at specific iron uptake systems in coliform bacteria that cause mastitis and to continue work on vaccine development.

This research was funded through the OARDC Research Enhancement Competitive Grants Program, which receives funding from dollars appropriated by the state of Ohio.

photo courtesy Jodi Miller

