# Transgenic Goats' Milk Helps Fend off E. coli-related Illness in Pigs

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Pigs fed goats' milk that was genetically modified to carry an important antibacterial enzyme found in human breast milk showed signs of better resisting attack by common E. coli bacteria than did pigs fed unmodified goats' milk without the human enzyme, report researchers at the University of California, Davis.

The findings, published in the May issue of the *Journal of Nutrition*, provide evidence that milk carrying high levels of the human lysozyme enzyme -- produced by genetically modified, or transgenic, goats -- may improve the gastrointestinal health of pigs and other animals that consume the milk. Pigs were used in this study because they have digestive systems that are similar to those of humans.

"These results demonstrate that biotechnology can be used to improve the healthfulness of the milk of dairy animals by introducing beneficial properties of human milk," said James Murray, who led the study with animal scientist Elizabeth Maga.

"We are hopeful that milk with similar benefits one day will be available to protect infants and children against diarrheal illnesses, which every year kill millions of children around the world," Maga said.

The enzyme lysozyme is found in the tears, saliva and milk of all mammals. While lysozyme is found at high levels in human breast milk, goats' milk contains only 0.06 percent as much lysozyme as does human milk. In this study, the transgenic goats produced milk with 67 percent as

much lysozyme as human milk.

Lysozyme inhibits the growth of bacteria by destroying the bacterial cell wall, causing the cell contents to leak out. Because lysozyme limits the growth of bacteria that cause intestinal infections and diarrhea, and encourages the growth of beneficial intestinal bacteria, it is considered one of the main human-milk components that contribute to the health of breast-fed infants.

In this study, the researchers gave the young pigs solid feed and pasteurized, lysozyme-rich milk produced by transgenic dairy goats. A control group of young pigs received solid feed and pasteurized regular, non-transgenic goats' milk that did not have human lysozyme.

Half of the pigs were also given a dose of enteropathogenic Escherichia coli (E. coli), a common bacterial strain known to cause gastrointestinal illness. During the study, the researchers found that the pigs fed the lysozyme-rich milk from transgenic goats had significantly lower levels of coliform bacteria, including E. coli, in their small intestines, than did the control group of pigs fed regular goats' milk.

Furthermore, the pigs receiving the lysozyme-rich milk and the pigs in the control group demonstrated normal weight gain, growth and blood composition.

These results substantiated findings from a similar 2006 study by the researchers, which investigated the impact of transgenic goats' milk with human lysozyme on young goats and pigs.

The researchers note that further studies are needed to more completely characterize and understand the full impact of transgenic lysozyme-rich goats' milk on young pigs' intestinal bacteria, including potential positive effects on beneficial bacteria.

Source: UC Davis