

Probiotics Yield PROHEALTH, ANTIODOR *Benefits*

By Charmain Tan Courcelle

Dietary supplements of certain species of good bacteria reduce the population of harmful microorganisms in chickens and provide environmental benefits as well.

MAFES poultry scientist T.C. Chen and his group have found that feeding poultry live lactobacilli cultures, a practice called probiotic treatment, can turn the tide against pathogenic bacteria, such as *Campylobacter jejuni*, both in the guts of chickens and in their fecal material.

Probiotics are feed supplements that contain living bacterial species found naturally in the intestinal tracts of healthy animals. One way these bacteria work to help their hosts is by occupying sites in the intestine that could otherwise harbor harmful microbes. This process, known as competitive exclusion, shifts the balance of microorganisms in the host's intestines toward friendly bacteria.

Chen said the concept of using probiotics to promote health has been around since the 1960s.

Examples of probiotic food products include yogurt and sauerkraut. In the poultry industry, probiotics have been touted as performance enhancers, but consistent reports on the benefits of these supplements in chickens have not been available.

Chen's group set out to determine the effects of probiotics in chickens. They chose to use a mix of lactobacilli species as a probiotic because these bacteria are safe — they are found naturally in poultry intestines — and they survive passage through the chicken oral cavity and gut, which produce enzymes for digestion of food and neutralization of microbes.

Using a simulated chicken digestive tract, the team studied changes in the survival of *C. jejuni* in the poultry gastrointestinal system with probiotic treatment. They also compared the intestinal and fecal microbial content of broilers fed a control diet with birds on the control diet supplemented with lactobacilli cultures.

Results from these studies showed probiotics reduce *Campylobacter* loads in the simulated chicken digestive tract. The team observed a similar reduction in *Campylobacter* numbers in the intestines and fecal material of broilers treated with probiotics compared with control birds.

“The lactobacilli species that we tested had an antagonistic effect on *Campylobacter*,” Chen said.

He added that probiotic products, such as the lactobacilli mix used in his group's studies, could be used to lessen the risk of *Campylobacter* contamination during poultry processing. *C. jejuni* is the leading cause of bacterial food poisoning in the U.S., and the U.S. Department of Agriculture has mandated a program to reduce contamination of meat and poultry products by this food-borne pathogen. Probiotics could help poultry producers and processors meet this goal by removing the chicken gastrointestinal tract as a source of this pathogenic bacterium.



Yusrizal, a doctoral candidate who works on the probiotics project, examines chickens used in the study.

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Probiotic treatment was also effective at reducing pathogenic bacteria in excrement even when the waste came from animals that weren't treated with lactobacilli, Chen said. "Spraying probiotics onto fecal material reduced the population of *E. coli* by 99 percent and lowered *Campylobacter* and *Salmonella* numbers too. So, probiotics could be used to reduce potential contamination of water supplies from pathogenic bacteria found in poultry waste as well."

In another study, the researchers set out to verify claims that probiotics reduce bad odors from animal operations. The team fed two groups of chickens either a control diet or the control diet supplemented with lactobacilli.

"Most of the subjects on our sniff panel could tell a real difference in odor intensity and unpleasantness by the 38th day of probiotic treatment," Chen said. "Using various chemical assays, we found that the concentration of ammonia and other organic volatiles associated with malodor were reduced with treatment."

While Chen's group did not observe any long-term improvements in broiler performance following direct treatment with lactobacilli, their results with a product designed to stimulate growth of these bacterial species were more promising.

Fructooligosaccharide (FOS), a probiotic product, selectively stimulates the growth of lactobacilli species in the intestine. Lactobacilli use this molecule to grow and produce metabolites, which further acidify the intestinal environment. *Salmonella*, *E. coli* and *Campylobacter*, which are Gram-negative bacteria, are susceptible to these acidic conditions.

The team found that supplementing poultry diets with FOS improved broiler body weight gain, feed



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One phase of the research involves measuring volatile ammonia from the collected fecal materials. Concentrations of these and other organic volatiles were reduced with probiotic treatment.

conversion, carcass weight and carcass percentage.

Chen believes the improvement in broiler performance was related to the increase in the length of the birds' small intestines.

"The results indicate that a longer gut improved nutrient absorption in broilers and led to better performance in the birds," Chen said.

Other results from the study of FOS treatment suggest producers won't be the only ones benefiting from better performing chickens. Consumers may see benefits to their health from this type of treatment.

"Some of our observations suggest that FOS reduces serum cholesterol in broilers. This could translate to lower cholesterol levels in eggs, which would provide consumers with a healthier product," Chen said.