Meat products sold in U.S. stores are less likely to be contaminated with antimicrobial-resistant organisms if they were produced and processed according to Certified Organic standards set by the U.S. Department of Agriculture. That conclusion, from the authors of a new paper published in *Environmental Health Perspectives*, is not surprising, given evidence from prior research. But according to the new study, the picture for conventionally produced meat is more nuanced.

Antibiotic-resistant bacteria and fungi are a growing concern in the United States. In its first *Antibiotic Resistance Threats in the United States* report in 2013, the Centers for Disease Control and Prevention (CDC), estimated that at least 2 million Americans acquire an antibiotic-resistant infection each year, and 23,000 of those people die. In 2019, the agency updated these figures to 2.8 million and 35,000, increases of 40% and 52%, respectively.

For the new study, the authors looked at three categories of meat: conventionally produced meat processed at conventional facilities (conventional/conventional), conventionally produced meat processed at "split" facilities that handle both conventional and organic meat (conventional/split), and organically produced meat processed at split facilities (organic/split). They also considered organically produced meat processed at organic-only facilities but had data for only five samples.

The authors found that conventional/split meat had significantly less overall bacterial contamination than conventional/conventional meat. However, the likelihood of conventional/split meat being contaminated specifically with multidrug-resistant organisms (MDROs) was similar to that of conventional/conventional meat.

The research drew upon data from nearly 40,000 samples collected and tested between 2012 and 2017 by the National Antimicrobial Resistance Monitoring System (NARMS). Participants in this collaborative program include state and local public health departments, universities, the Food and Drug Administration, the CDC, and the U.S. Department of Agriculture.

According to the authors, this is the first large-scale, multistate U.S. study to investigate bacterial contamination of retail meats in association with both production and processing practices. The possibility that both production and processing may influence bacterial contamination levels of retail meats "opens up a whole series of possible research studies that you can conduct at any level of the farm-to-fork pathway to be able to better elucidate best practices," says senior author Meghan Davis, an associate professor in the Johns Hopkins Bloomberg School of Public Health.

The equipment at split facilities is cleaned between organic and conventional batches to prevent commingling. "[Based on our new results,] we hypothesize that cleaning between conventionally and organically produced meats may be a significant driver for the lower prevalence of overall bacteria," says first author Gabriel Innes, antimicrobial resistance surveillance coordinator with the New Jersey Department of Health. This additional cleaning step may not lower the prevalence of MDRO bacteria to the same extent, however, because of a possible colocation of antimicrobial resistance genes with disinfection resistance genes, Innes explains. In other words, the same germs that are genetically resistant to antimicrobial therapeutics may also be able to survive the cleaning agents used between conventional and organic batches of meat.

Maurice Pitesky, an associate specialist in cooperative extension at the University of California, Davis, School of Veterinary Medicine, supports further investigation of the hypothesis that disinfectant use at split processing facilities could affect the
prevalence of MDROs in retail meats. “There is a well-established correlation between tolerance to disinfectants and resistance to antibiotics,” he says. “Interestingly, in Salmonella the development of increased tolerance to disinfectants and the simultaneous increased resistance to antibiotics after stepwise exposure to disinfectants is known. So if this phenomenon is a major cause of multidrug resistance and antimicrobial resistance, then disinfectant selection and usage should get more attention than it currently does.” Pitesky was not involved in the study.

The authors note that disinfection is only one possible explanation for their findings, and future studies involving direct sampling of processor and production facilities is needed to replicate and further examine these results. They add that their analyses were limited by the very small number of samples from NARMS that were processed at organic-only facilities. In addition, the fact that none of the organic samples were contaminated with MDROs meant the authors could not compare organic to conventional samples (or organic/split to conventional/conventional samples) for some meats.

Russ Daly, an extension veterinarian and professor at South Dakota State University, says the researchers should be commended for sifting through such an extensive and complex national database. Daly was not affiliated with the research but has worked with a local NARMS-cooperating lab to help communicate test results. He acknowledges that the findings “seem to fit the narrative maintained by those in favor of organic meat production relative to conventional production.”

But major changes to antibiotic use in animal production that began in 2017, the final year of the study’s data set, may soon render this distinction less important, Daly notes. Under new legislation, producers can neither buy medically important antibiotics over the counter nor use them for growth promotion or feed efficiency. “In my experience working with food animal producers and veterinarians,” Daly says, “I think the years to come will see a narrowing of these differences between organic and conventional production simply due to lower antibiotic use rates.”

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