The microbiological art of making a better sausage

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Fermented sausages can vary in taste quality depending on whether the fermentations begin "spontaneously", or using a commercial starter culture. A team of Italian investigators found that commercial starter culture produced sausages with higher acidity, and inferior taste, as compared with spontaneous fermentation. The research is published December 1 in *Applied and Environmental Microbiology*, a journal of the American Society for Microbiology.

Spontaneous fermentation is primed by the bacteria that are endemic to the sausage. "Usually, initial conditions select 'good microbiota,' which start the fermentation," said corresponding author Luca Cocolin, PhD, Professor of Food Microbiology, Agricultural Microbiology, and Food Technology Sector, Department of Agricultural, Forest, and Food Sciences, University of Turin, Italy. But "it is hard to control spontaneous fermentation, because even if the conditions for their development are correct, the bacteria don't always initiate the process."

Additionally, "more rigorous controls have to be implemented in order to guarantee the product's safety," said Dr. Cocolin. All this is "why the use of starter cultures makes fermentation much easier!"

The study's purpose was to gain a better knowledge of the microorganisms, metabolic pathways, and biochemical reactions in each process, knowledge that might be used to mitigate their shortcomings, and improve the sensory qualities of the final product—taste, smell, mouth feel, etc.

Using Next Generation Sequencing techniques, the investigators identified the relevant microbes and mapped the metabolic pathways, said Dr. Cocolin. Additionally, they used another methodology that couples gas chromatography with mass spectrometry (GC-MS), to determine and quantify the metabolites produced during fermentation.

"Next generation sequencing makes it possible to determine which microbes are present in complex ecosystems, and what they are doing," said Dr. Cocolin.

For example, the investigators found an increase in the density of lactic acid bacteria and Staphylococcaceae in the inoculated meat samples, as compared to the meat that fermented spontaneously. In the latter, Lactobacillus sakei, and L. curvatus were the most abundant taxa. The so-called KEGG analysis the investigators performed (Kyoto Encyclopedia of Genes and Genomes), mapped 1,774 genes within 21 metabolic pathways.

"The over-activity of the starter culture-inoculated sausages resulted in increased acetic acid and short chain fatty acids," said Dr. Cocolin. These compounds added notes that Dr. Cocolin described as "pungent, vinegar, cheesy, and weedy," that resulted in a final product that was less than salutary. Conversely, "the greater presence of medium and long chain fatty esters enhanced the sensory profile of these sausages," by imparting a scent incorporating notes of "fruity wine, waxy sweet apricot, and banana brandy," said Ilario Ferrocino, PhD, a post-doctoral student in Dr. Cocolin's lab.

"My laboratory has been involved in meat fermentation since the '90s, and considering the importance of the fermented sausage in Italy, at gastronomic, traditional, and economic levels, we wanted to investigate better the role of spontaneous biota and inoculated starters in the fermentation process," said Dr. Cocolin.

"A deeper knowledge of the fermentation process allows the food producers to control better the microbiota, generating final products with high quality and safety," said Dr. Cocolin. By modulating the activity of the microorganisms it will be possible to produce fermented products with different sensory profiles, which will enable production of a larger diversity of products.

Foods produced through well-known microbial processes will improve food safety and public health.

Provided by American Society for Microbiology