New findings about unwanted fungal growth on dry-cured meat products

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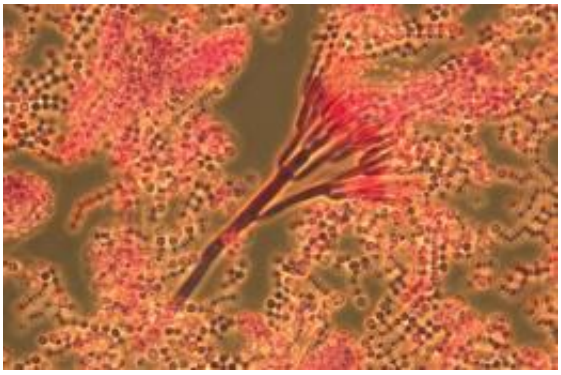

The growth of yeast and mold fungus often poses a threat to the quality of dry-cured meat and is a problem facing producers all over the world. Fungal growth can lead to bad quality products, increased production costs and health issues in consumers.

In Norway, there is a low incidence of fungal growth on dry-cured meat products compared with products from Southern Europe. But producers still want to find out more about which fungi grow on foods of this kind and about their effect on the food's quality and safety.

The research project is the result of a collaboration between a dry-cured meat producer, The Norwegian Veterinary Institute, Nofima, Animalia and The Norwegian School of Veterinary Science and has provided new

knowledge and recommendations about how the industry can combat these problems.

The aim of this doctoral study was to identify the fungi that grow on Norwegian products, appraise their significance, chart sources of contamination and propose measures. The study began by identifying mould fungus associated with Norwegian dry-cured meat products. Moulds of the genus Penicillium predominated in the trials carried out on these products. Most of the species of Penicillium that were found are capable of producing fungal toxins. When they develop on dry-cured meat products, they can potentially affect and reduce the safety and quality of the products.

Fungal growth dynamics

Dereje T. Asefa's doctoral project involved studying cured mutton and two cured ham products made by a Norwegian cured meat manufacturer and taking samples throughout the whole production process in order to gain insight into the growth dynamics of the fungi.

In this way, Asefa managed to identify sources and factors contributing to fungal growth on the products and was able to suggest preventive measures. Of a total of 901 fungal isolates, 57% were mould fungi, while 43% were yeasts. Yeasts predominated on the surface of the meat products, whereas mould predominated amongst the environmental samples.

The diversity of yeast species was greatest before salting, where the yeast fungus Candida zeylanoides was most prevalent. The latter is a species which can under certain circumstances lead to disease. The meat samples taken on arrival at the factory were contaminated with this yeast and the source of contamination was outside the production plant.

But after salting, and especially after smoking, the yeast fungus Debaryomyces hansenii fortunately took over, to the detriment of C. zeylanoides. Yeasts were discovered in 1/3 of the environmental samples. D. hansenii was not detected in the air, but predominated in the samples taken from machines and production equipment.

Twice as many fungal species in the environment as on the products

Mould fungi were detected in the environmental samples taken throughout the production process. Fungal growth on the products themselves was however not detected until the beginning of the drying and maturation process, gradually increasing in numbers thereafter. Of the 39 fungal species isolated, the genus Penicillium predominated. The quality of the air inside the plant was worse than that of the air outside and had a higher concentration of most of the species of mould fungi that were found on the dry-cured meat products.

Penicillium was discovered both on the products and in the production environment, but less than half as many fungal species were detected on the products themselves as in the environmental samples. At the species level, P. nalgiovense was the most prevalent – a species that is known to be able to form penicillin, but no penicillin was detected when the fungus grew on meat.

Sources of contamination

The results of the study show that the main sources of contamination from fungi in the finished products are to be found within the production plant. Local strains of P. nalgiovense and D. hansenii were found in the production plant and preventive measures must focus on these two species.

The charting process uncovered three important elements in the production chain which create favorable conditions for the growth of fungi: the way the meat is pressed, the quality of the air and the sorting process. Measures involving both technical and organisational solutions have been proposed.

Hazard analysis and critical control point (HACCP)-plan

The fact that the yeast fungus D. hansenii and the mold fungus P. nalgiovense predominate towards the end of the production process is considered to be a positive development, since both these species are used as starter cultures for improving the sensory quality of dry-cured meat products in Southern European countries.

These fungi are known for their ability to oust other microorganisms, both toxigenic and pathogenic, and therefore help to improve food safety . But the study also shows that pathogenic yeasts and mould fungi capable of producing fungal toxins can grow on these products and have a potentially detrimental effect on food safety.

All producers should therefore introduce measures to safeguard food safety in this respect. A HACCP plan based on the project's findings was drawn up for the company involved in the study. The plan includes measures to combat both pathogenic yeasts and toxigenic fungal species.

Dereje T. Asefa defended his doctoral thesis on 24th November 2011 at The Norwegian School of Veterinary Science. The thesis is entitled: ”Fungi associated with Norwegian dry-cured meat products and their significance for food safety.”