Monitoring the mycobiota of three plants manufacturing Culatello (a typical Italian meat product)

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This study reports the composition of the mycobiota growing on the surface of Culatello (a typical Italian meat product) and occurring in the environments of three processing plants. Samples were collected in both winter and summer. A total of 84 culatelli and 14 samples from the plant environment were examined. A total of 331 (from food samples) and 2030 (from air samples) fungal isolates belonging to six genera and 29 species were identified. The substantial correspondence between air- and product-mycobiota in all the manufacturing plants studied seems to indicate a natural selection of those species that have adapted to the thermal–hygrometric conditions to which meat products were subjected. In particular, all sexual Aspergillus spp. with Eurotium-type ascomata, all Scopulariopsis spp. and Sporendonema casei from culatelli exactly matched with those from air samplings, and a prevalence of xerotolerant and xerophilic species belonging to Aspergillus or Penicillium was observed for both culatelli and environments, depending on the plant considered. Aspergillus candidus (16.0%), Penicillium solitum (19.6%), and Aspergillus cristatus (≡ Eurotium cristatum) (17.2%) were the prevalent species in Plants 1, 2, and 3, respectively. Fungal species producing unsightly spots on the casings (Scopulariopsis spp. and Sporendonema casei) were mainly found in the first steps of the aging, but tended to diminish or to change color throughout the process, so ultimately they did not represent a matter of concern. Fungal species potentially producing ochratoxin A (Penicillium nordicum and Aspergillus westerdijkiae) were the least prevalent species collected from a minor number of culatelli, so their presence could be defined as sporadic and did not represent a risk for consumers’ health. This study reports the dominance of desirable species over undesirable molds on culatelli, but also highlights the importance of monitoring those meat products where no bacterial starter can degrade mycotoxins and where neither fungal starters nor a skin can inhibit fungal development. The control of the so-called "house mycobiota" in such products should be periodically assessed both in artisanal and industrial plants, since it proved to be fundamental to focus the potential risks connected to consumption of these meat products.

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1. Introduction

In meat products distinctive surface colonization by a great number of fungi usually takes place during the maturing process. At the beginning yeasts dominate the surface of meat products, whereas molds tend to develop later in the process.

Mold development is generally tolerated in both dry-fermented and dry-cured meats, since fungal mycelium can exert a positive influence on final products, e.g. preventing oxidation or excessive drying, and contributing to lipolytic and proteolytic processes (Spotti et al., 2008). Nevertheless, when mold growth on meats results from contamination by indoor fungi, surface mold on meat products can also have undesirable effects on final products, such as growth and predominance of fungal species that can cause unsightly colored spots, off-flavors or toxic fungal metabolites.

The main mycotoxin risk in meat products is from ochratoxin A (OTA), a highly toxic secondary metabolite that in such matrices is usually produced by Penicillium nordicum and some selected species belonging to Aspergillus section Circumdati (Frisvad et al., 2004; Gil-Serna et al., 2011; Pitt and Hocking, 2009; Visagie et al., 2014). Growth of ochratoxigenic strains on the casing of dry-fermented products such as dry-fermented sausages and Italian salami, is no longer considered problematic if selected fungal starters are used, as their inoculation on the surface helps to avoid contamination by toxigenic molds (Bernádez et al., 2013; Spotti and Berni, 2007). Moreover, in such matrices OTA inactivation has been partially observed over time, probably due to the action of fermentation microorganisms (Spotti et al., 1999, 2001a). By contrast, ochratoxigenic species growing on the surface of aged products made from a single piece of meat can lead to the accumulation of considerable amounts of OTA (Bertuzzi et al., 2013; Escher et al., 1973; Pietri et al., 2006; Rodriguez et al., 2012). The phenomenon is limited to the skinless area in products with a skin (Rodriguez et al., 2012; Spotti et al., 2001b), but toxin could diffuse throughout in dry-cured encased.