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Fungal and mycotoxins burden in Portuguese bakeries

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Flour is a complex organic dust consisting of one or a mixture of several cereal grains (wheat, rye, millet, barley, oats or corn cereal) that have been processed or ground by milling. In addition, flour may contain a diverse number of contaminants, such as fungi and mycotoxins.

The aim of this study was to assess the exposure to fungal burden (fungi and mycotoxins) on 13 Portuguese artisanal bakeries applying active and passive methods as sampling strategy. Air samples of 100 liters (impaction method) and 600 liters (impinger method), surface samples, settled dust samples, and electrostatic dust cloths (EDC) were collected in each bakery. Quantification and morphological identification by culture-based methods as well as molecular detection of the toxigenic *Aspergillus* sections Flavi, Fumigati, Circumdati and Versicolores were performed in all collected samples. Mycotoxins in the air and settled dust samples were analyzed by LC-MS/MS system. Separation and detection was carried out using high performance liquid chromatograph (HPLC) Nexera (Shimadzu) with a mass spectrometry detector API 4000 (Sciex).

Fungal load in indoor air ranged from 0 to 2590 CFU·m−3 on MEA, with 30 out of the 49 (61.2%) air samples collected presenting higher fungal load when compared to the outdoor sampling. *Cladosporium* sp. was the most prevalent species in indoor air samples in both media (29.7% MEA; 48.7% DG18), followed by *Penicillium* sp. (22.3% MEA; 30.5% DG18). *Aspergillus* spp. was observed on air samples on MEA and DG18 (0.3 and 1.2%, respectively). Among *Aspergillus* genera, section Candidi was the most prevalent (62.5%) on MEA followed by Nigri (25%), whereas sections Candidi and Circumdati (37.9%) were more prevalent on DG18. *Aspergillus* section Fumigati was possible to detect in 22.4% on air, 27.8% on surface swabs and in 7.4% on EDC samples; section Versicolores was detected in one air sample through molecular tools. Only settled dust samples contained mycotoxins: ochratoxin A was detected in the settled dust from 10 bakeries, deoxynivalenol-3-glucoside in 9 bakeries, and deoxynivalenol and zearalenon in all the settled dust samples.

Considering the fungal and mycotoxins burden found is proposed that fungal and mycotoxins assessment should be always performed in order to guarantee an accurate risk characterization in this occupational environment.