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Adhesive properties of the yeast *Candida* sp. in the presence of cytostatics

The yeasts of the genus *Candida* are commensal eukaryotes of the natural microbiota of gastrointestinal, genital and upper respiratory track of mammals. Only a few species of *Candida* are of clinical relevance: *Candida albicans*, *Candida glabrata*, *Candida tropicalis*, *Candida parapsilosis* and *Candida dubliniensis.* Among them, *Candida albicans* is considered the most frequent etiological agent of systemic and invasive candidiasis in humans. Invasions can affect all tissues, organs and systems of human in various stages of development. *Candida* yeasts are considered as the most important causative agent of opportunistic fungal infections, especially in immunocompromised patients, acting by a worldwide public health problem. Although other fungi *Penicillium notatum* were made use of antibiotic production, yeast of the genus *Candida* become a real plague of the XXI century. Treating of serious bacterial infection with broad spectrum antibiotics resulted in desirable bacterial flora destruction and creation of favorable conditions for the fungal development. In the natural environments, yeasts are rarely found as single dispersed cells in the form of plankton. Usually they form multicellular, organized and sessile structure called biofilm. Biofilm protects the microorganisms from the damaging effects of environmental factors including antibiotics, reduces the effectiveness of host defense mechanisms, facilitates foraging, creates the possibility of horizontal gene transfer by providing an evolutionary and genetic diversity and enables the transfer of information between microorganisms' cells.

In the search for new, more effective therapeutic strategies we are still at the beginning of the road. That why the role of natural products derived from medicinal plants as antifungal agents is more and more important. Through different mode of action compared to use antifungal drugs, essential oils may become a valuable support and a powerful weapon in fight against antibiotic-resistant fungi.

The aim of the study was to investigate the adhesive properties of environmental isolates *Candida* sp. yeasts in the presence of cytostatics, including essential oils: tea tree (*Melaleuca alternifolia*), clove (*Syzygium aromaticum* L.) and thyme (*Thymus vulgaris* L.).

Hierarchical cluster analysis applied for similarity assessment of *Candida* isolates according to their biochemical profiles showed differentiation of the strains in three clusters. Distinct biochemical heterogeneity was stated among 24 clinical isolates of *Candida albicans* included *Candida tropicalis* fo/BM/01 isolated from food. At the same time a separate group of 17 foodborne isolates comprises two clinical isolates of *Candida glabrata* and *Candida lusitaniae*.

These studies revealed no significant correlation between cell surface hydrophobicity and aggregation and adhesion to polystyrene and HeLa cells for the clinical isolates. However, all foodborne strains having a high adhesion to polystyrene, were characterized by low aggregation and high cell surface hydrophobicity. The foodborne isolates with low adhesion to polystyrene exhibited low aggregation and high or medium cell surface hydrophobicity. Caspofungin and nystatin caused the reduction of cell surface hydrophobicity of majority of both clinical and foodborne isolates. Also, decrease in surface hydrophobicity of the isolates was observed in the presence of essential oils mixtures. All the tested cytostatic lead to a reduced adhesion of *Candida* isolates to both biotic - HeLa cells and abiotic - polystyrene surfaces while the production of biofilm in their presence was intensified. Mixtures of tea tree, clove and thyme oils caused a decrease of cell surface hydrophobicity of most *Candida* isolates and the reduction of adhesion index to polystyrene and HeLa cells indicating their effect as a disturbing factor in early colonization biotic and abiotic surfaces by yeasts. Although essential oils did not reduce the formation of biofilm on the polystyrene surface, the lack of adhesion of four of the eight *Candida* isolates tested including three clinical isolates to HeLa cells in the presence of selected mixtures of oils, indicates their potential function as factors limiting the colonization.