SS4b
Terrestrial Cu-Zn-Fe nanoparticles induced apoptosis and cell cycle arrest in multidrug-resistant Candida auris

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Background: Candida species are opportunistic fungi that can cause serious infections, particularly in immunocompromised populations. The number of fungal infections has increased steadily with Candida species being responsible for ~70% of these infections, particularly in hospitalized patients with significantly underlying conditions. Pharmacological resistance in Candida species and the advent of Candida auris have elevated candida to a major public health concern. Candida auris is an emerging opportunistic fungal species, that can cause bloodstream/bone marrow infections and high-fidelity rate, particularly in hospitalized patients with major medical issues. Antifungal study of terrestrially-derived NPs (TNPs) of various types have been studied as a therapy option for efficacious and safe control of Candida. These NPs were highlighted for being environmentally friendly and safe, with potential therapeutic properties.

Objectives: To work mainly to synthesize and characterize novel Cu-Zn-Fe terrestrially NP and determine their in vitro antifungal activity and mechanism of action against Candida auris isolates.

Methods: The synthesis and characterization of Cu-Zn-Fe terrestrially NPs were done by standard methods. The antifungal capability of these NPs were determined by calculating minimum inhibitory concentrations (MIC) and minimum fungicidal concentrations (MFC) following CLSI recommended guidelines. Susceptibility on planktonic cells and biofilms was further confirmed by MitisTM cell count and viability assays and scanning electron microscopy (SEM) respectively. For in vitro antifungal activity, planktonic and cell cycle arrest were studied by employing different antifungal markers and MitisTM cell assays.

Results: Characterization by Fourier-transform infrared spectroscopy (FTIR), differential UV-visible nm, X-ray diffractometry (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM) determined the successful biosynthesis of Cu-Zn-Fe terrestrially NPs. Susceptibility assay confirmed the fungicidal activity of Cu-Zn-Fe NPs with MIC and MFC values of 12 fL and 2.5 µg/mL respectively. These results were further confirmed by viability assays reporting the cell viability of 41.5%, 13.5%, and 1.8% when C. auris cells were treated with 1/2, 1/4, and MFC respectively. Cell cycle analysis revealed that ~91.3% of the treated cell cultures were arrested in G1 phase, whereas ~7.2% and 3.7% of cells were in the S phase and G2/M phase, respectively. In contrast, untreated cells were observed to be arrested in S phase with ~38.4% of cell culture when cell death caused by NPs, we investigated intracellular nucleosome potential (dpi), with cells having a stable of 57µm when treated cells showed lose of (dpi). Another important parameter of apoptosis in yeast cells is the release of cytochrome C from the mitochondria to the cytoplasm and NP-treated cells receiving in decreased mitochondrial transmembrane and cytochrome C levels. Both results confirmed the intracellular NPs in causing apoptotic cell death in C. auris.

Conclusions: From these results, Cu-Zn-Fe terrestrially NPs displayed strong antifungal activity against C. auris, with a potential to arrest the cell cycle by S-phase, which could be linked to the DNA damage. Importantly, yeast apoptotic markers suggested that the NPs have a potential to cause apoptosis in C. auris. All these findings suggest the potential of these terrestrially NPs to be taken to the next level of research in the development of novel antifungal medications.

SS4c
Diverse environmental inputs mediate changes in γ-glucosidase expression at the Candida albicans cell surface during systemic infection

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Candida albicans adaptation to host stresses offers access to the exposure of key pathogenic-associated molecular patterns (PAMPs) on its cell surface and, consequently, the detection by D. candida cells of the immune system. Using a combination of fluorescent microscopy, flow cytometry, and cytochrome assay, and then analysed certain conditions in diverse environmental environment and microtime-time and temporal and spatial changes in γ-glucosidase activity of C. albicans-planktonic cultures. We found that some nutrients, microenvironment limitation, stress, and antifungal drop trigger γ-glucosidase masking, whereas other inputs, specifically, including the stress of the cell cycle and cell death, stimulate γ-glucosidase exposure. In particular, both  

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SS4d
Main environmental inputs mediate changes in γ-glucosidase expression at the Candida albicans cell surface during systemic infection

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Objective: Drosophila melanogaster are a good model to study certain aspects of disease mechanisms. Here we report an increase in the transcription level of γ-glucosidase during drosophila infection. 

Methods: A total of 678 skin and hair samples from animals including sheep (n = 199), cows (n = 79, goats (n = 9), camels (n = 15) and domestic animals (n = 272, for 21 species), a bird (n = 5), bighogge (n = 2), and poults (n = 8) were subjected to direct microscopy and culture on Mueller Hinton. Most animals had skin lesions, though some stray cats and dogs were asymptomatic. Molecular identification of dermatophyte cultures was done by ITS DNA sequencing. The isolates were subjected to 18S rDNA sequencing. 

Results: We isolated 154 dermatophyte cultures. ITS-18S2 and ITS-2 rDNA sequencing revealed the species T. verrucosum (n = 62; all four cases), T. mentagrophytes Type III (of, 22; 50% of cases), T. mentagrophytes Strain II (n = 6; 15% of cases), T. mentagrophytes Strain V (n = 5; 12.5% of cases), T. verrucosum (n = 1; 2.5% of cases), T. interdigitale (n = 2; 5% of cases). In total, we found 154 dermatophyte species and seven dermatophyte species were isolated from sheep and goats.

Conclusions: The study of sheep and goats is important because they are kept outdoors and thus are likely to be exposed to a higher proportion of dermatophytes. Further studies are required to determine the prevalence of these dermatophytes in different species and in different locations.