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ANTIFUNGAL ACTIVITY OF SYMPLOCOS RACEMOSA(LODHRA) AND CINNAMOMUM VERUM (CINNAMON) BARK FORMULATION MEDIATED ZINC OXIDE NANOPARTICLES AGAINST CANDIDA ALBICANS

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ABSTRACT:

Introduction: Zinc oxide nanoparticles have a role in cell apoptosis as they trigger excessive reactive oxygen species formation and release zinc ions. The aim of this research is to assess the anti-fungal activity of *Symplocosracemosa* (Lodhra) and *Cinnamomum verum* (Cinnamon) bark formulation mediated zinc oxide nanoparticles against Candida albicans .

Materials & Method: Candida albicans (*C.albicans)* is used as a test pathogen by agar well diffusion assay. The prepared and sterilized medium was swabbed with test organisms and nanoparticles with different concentrations (25µL, 50 µL ,100 µL)were added to the wells and in the fourth well standard antibiotic fluconazole was loaded & the zones of inhibition was measured.

Results & Discussion: The minimum inhibitory concentration of zinc oxide nanoparticles synthesized from Lodhra and cinnamon extract was compared with a standard antibiotic fluconazole. It was observed that the optical density of the ZnO nanoparticles was higher at the 1st hour at different concentrations and decreased subsequently.

Conclusion: It was proved that the effects of the standard antibiotic against C.albicans was relatively lower as compared to ZnO nanoparticles. Hence, Lodhra& cinnamon bark mediated ZnO nanoparticles can be used as a potent antifungal agent against *C.albicans* in the future.

INTRODUCTION-

Lodhra, whose scientific name is Symplocosracemosa, belongs to the Magnoliophyta division and Subdivision Spermatophyta. It is common in northeastern India, in Assam and Pegu regions of India. Its chemical composition is Loturine, colloturine&Loturidine. In Ayurvedic medicine, it is well known as an ancient medicinal herb. Lodhra has powerful anti-inflammatory, anti-androgenic, antioxidant, anti-diabetic and anti-ulcer properties. Cinnamon bark is obtained from the inner bark of several species of the cinnamon genus. It is well-known to stimulate gastrointestinal purposes, diarrhea and appetite (1,2). It has antioxidant, anti-diabetic and anti-inflammatory properties. Cinnamon contains catechins and procyanidins (2).

Nanoparticles are small particles ranging in size from 1 to 100 nanometers. It exhibits physical and chemical properties that are markedly different from their larger physical counterparts. Most nanoparticles consist of only a few hundred atoms (3). Similarly, zinc oxide nanoparticles are less than 100 nm in diameter and are known to have a large surface area relative to their high catalytic activity (4). It is involved in cell apoptosis by inducing excessive formation of reactive oxygen species and releasing zinc ions.The synthesis of zinc oxide nanoparticles using plant extracts appears to be simple, safer, sustainable and more environmentally friendly compared to physical and chemical routes (5).

The objective of the study is to assess the antifungal activity of *Symplocosracemosa* (Lodhra) and *Cinnamomum verum* (Cinnamon) bark formulation mediated zinc oxide nanoparticles against *Candida albicans*.

MATERIALS & METHODS-

Antifungal activity

Candida albicans is used as a test pathogen by agar well diffusion assay. Rose Bengal Agar is used to prepare the fungal medium. The prepared and sterilized medium was swabbed with test organisms and nanoparticles with different concentrations (25µL, 50 µL ,100 µL)were added to the wells and in the fourth well standard antibiotic fluconazole was loaded. The plates were incubated at 37°C for 48-72hours. After the incubation time the zone of inhibition was measured.

RESULTS:

The results obtained from the study were plotted in the form of graphs. At 25 µl concentration, the minimum inhibitory concentration at the 1st, 2nd, and 3rd hour were 0.488, 0.487, & 0.333 respectively. At 50 µL, it was observed to be 0.401, 0.336, and 0.200 at the 1st, 2nd & 3 rd hour. The minimum inhibitory concentration at 100 µL was found to be 0.402, 0.374, & 0.204 at 1st, 2nd & 3rd hour. Figure 1 represents the minimum inhibitory concentration against Candida albicans plotted in the form of graphs.

µL	1st hour	2nd hour	3rd hour
25 µL	0.488	0.487	0.333
50 µL	0.401	0.336	0.200
100 µL	0.402	0.374	0.204
standard	0.286	0.149	0.107

Table 1:MIC at 1st , 2nd , 3rd hour

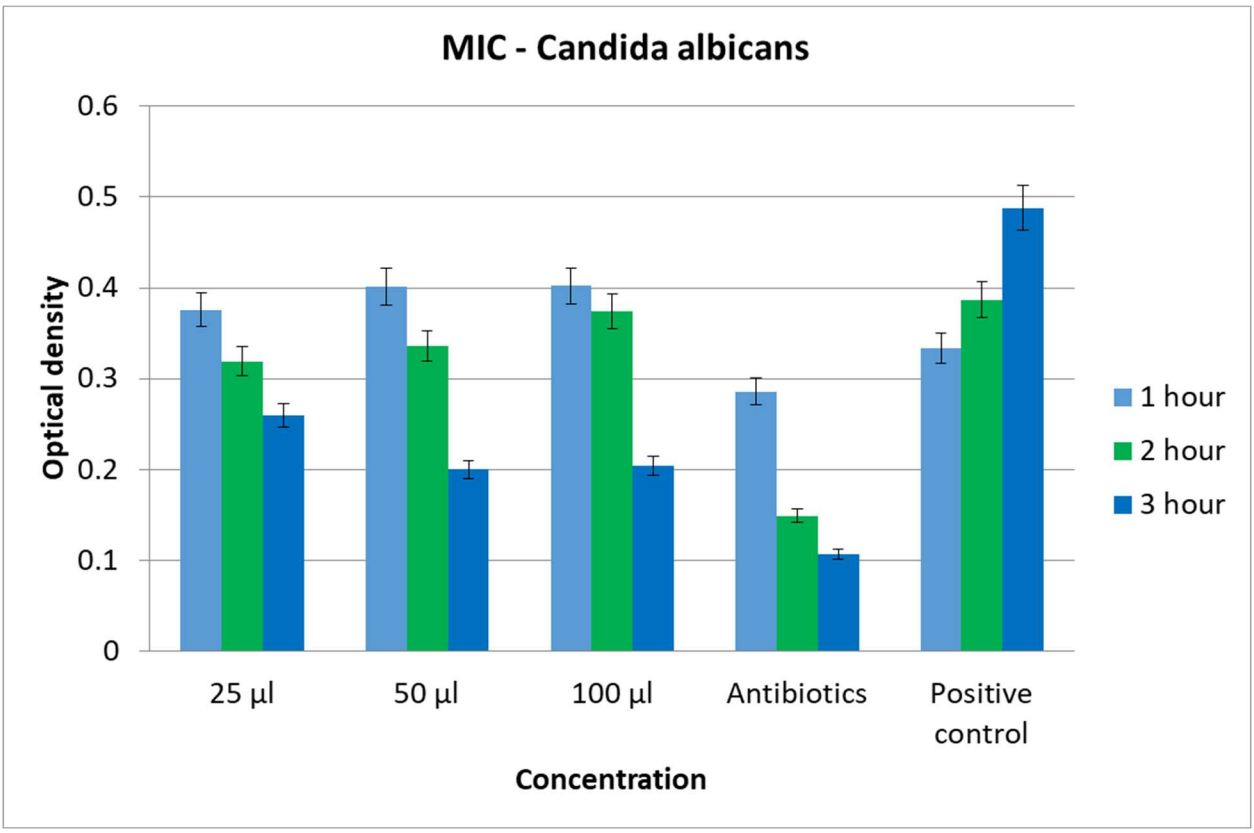

Figure 1: represents the antifungal activity of Lodhra& cinnamon bark formulation mediated zinc oxide nanoparticles against *C.albicans*. Y-axis represents the concentration of the extract in µl and X-axis refers to the optical density of Lodhra& cinnamon bark formulation mediated zinc oxide nanoparticles & the standard antibiotic fluconazole in mm. Sky blue colour represents the minimum inhibitory concentration at the 1st hour; green represents the minimum inhibitory concentration at the 2nd hour & dark blue denotes the 3 rd hour. The minimum inhibitory concentration of the prepared extract was compared to the standard value of fluconazole.

DISCUSSION:

The minimum inhibitory concentration of zinc oxide nanoparticles synthesized from Lodhra and cinnamon extract was assessed and was compared with a standard antibiotic fluconazole. It was observed that the optical density of the ZnO nanoparticles was higher at the 1st hour at concentrations of 25µL , 50µL , 100µL and decreased subsequently in the 2nd & 3rd hour. The antifungal activity of Lodhra& cinnamon bark formulation mediated zinc oxide nanoparticles against *C.albicans*seemed to be precisely higher than that of the standard antibiotic fluconazole.

Zinc oxide nanoparticles are known to possess antifungal properties especially against *C.albicans*. It exhibits an inhibition of over 95% in the growth of C. albicans. The research conducted with alkaloidal fraction of Enantiachlorantha stem bark was proven to exhibit significant in vitro and in vivo antifungal activities against different species of *Candida*, dermatophytes and plant fungi (6), whereas another study has shown that zinc oxide nanoparticles synthesized from B. ovalifoliolata stem bark extract proved to show better antibacterial activity than antifungal activity (7).

Candida albicans are categorized as an opportunistic pathogenic yeast that can cause infection in the oral cavity and on skin (8). They are also one of the microbial species that result in the formation of dental plaque and are associated with the occurrence of dental caries (9). According to previous research, it was stated that *C.albicans* is more prone to cause early childhood caries. It was observed that it was prevalent in 24%-100% of saliva, 44%-80% in plaque, and 60%-100% in carious lesions in case of children affected with ECC (10).

The consideration of only one fungal agent was involved while assessing the antifungal activity of the zinc oxide nanoparticles synthesized using lodhra& cinnamon bark. Similarly, the antifungal potential of the nanoparticles was evaluated based on its action against *C.albicans* only. Many more fungi residing in the oral cavity can be taken into account in the upcoming studies for more precise results.

The future scope of this research is that the biosynthesis of nanoparticles using an eco-friendly approach and its action against microbes can extensively be used in the field of medicine in the future. It is a fast economic process which eliminates the production of any kind of side product in the nucleation and synthesis reaction of nanoparticles (11,12).

CONCLUSION:

From the research conducted, it was concluded that the effects of standard antibiotics against C.albicans was relatively lower as compared to ZnO nanoparticles. Hence, Lodhra& cinnamon bark mediated ZnO nanoparticles can be used as a potent antifungal agent against. C.albicans in the future.

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