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Evaluation of Anti-Candida Properties of 2,4-Diethoxycarbonyl-5-Hydroxy-5-Methyl-3-Phenyl-N-Oxyethyl-1-Cyclohexenylamine

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Abstract

Antimicrobial resistance is serious health problem in modern era. Functionally substituted organic compounds could at as potential antimicrobial agents of future. We report antifungal properties of 2,4-diethoxycarbonyl-5-hydroxy-5-methyl-3-phenyl-N-oxyethyl-1-cyclohexenylamine against *Candida tropicalis* BDU LK30, Candida pelliculosa BDU KT55 and Candida pseudotropicalis BDU MA88. Agar well diffusion assay was used to determine *in vitro* antifungal properties of above-mentioned compound. Three different concentrations; 0.3%, 0.1% and 0.05% of test compound were applied to determine antifungal effects. Test compound derivatives exhibited substantial antifungal properties against different Candida species. Candida pseudotropicalis BDU MA88 was found to be most sensitive among all the test cultures. These results show that test compound has vast potential to be probable anti-Candida agent in future. Furthermore, our findings accentuate the need of determining minimum inhibitory concentrations to further prove the antifungal capabilities of cyclohexane derivative.

Keywords: Antimicrobial resistance; Cyclohexane derivatives; Antifungal properties; Agar well diffusion method; Candida species

Introduction

During last decade, development of antimicrobial resistance has increased at an alarming rate. Due to ever increasing antimicrobial resistance and shortage of novel classes of antimicrobial drugs has accentuated the importance of drug development studies [1]. Due to their diverse biological properties, functionally substituted organic compounds serve as most probable alternatives for finding new antimicrobial compounds. Functionally substituted derivatives of cyclohexane have exhibited substantial antimicrobial properties against different pathogens [2].

Candida species are the most common cause of fungal infections in humans. These fungi cause invasive diseases and infections of skin and mucus membranes [3]. Mechanisms for development of resistance to antifungal drugs include absorption of antifungal agents, expression of drug efflux pumps, drug inactivation, biofilm production etc. [4]. In order to ameliorate antifungal resistance and explore novel antifungal drugs, we report the antifungal properties 2,4-diethoxycarbonyl-5-hydroxy-5-methyl-3-phenyl-N-oxyethyl-1-cyclohexenylamine against three Candida species.

Materials and Methods

Functionally substituted cyclohexane derivative i.e. 2,4-Diethoxycarbonyl-5-hydroxy-5-methyl-3-phenyl-N-oxyethyl-1-cyclohexenylamine was taken from Department of Organic Chemistry, Baku State University Azerbaijan. The structure of test compound is shown in Figure 1. *In vitro* antifungal properties were determined against three Candida species. All the test cultures were obtained from our own collection at Department of Microbiology, Baku State University Azerbaijan. Test cultures included Candida tropicalis BDU LK30, Candida pelliculosa BDU KT55 and Candida pseudotropicalis BDU MA88.

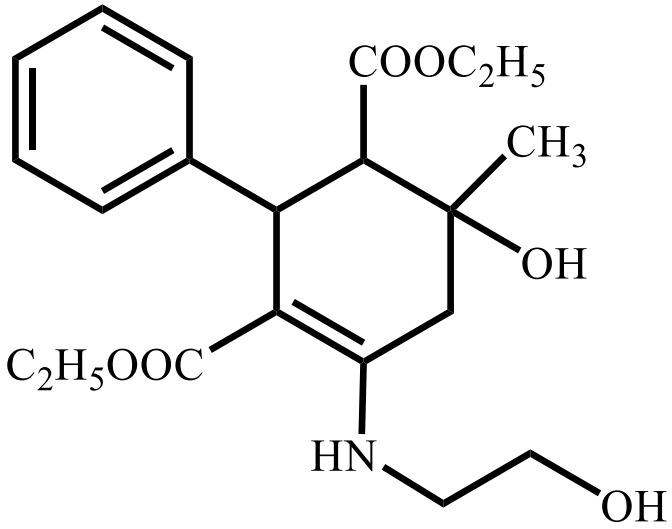

Figure 1: Structure of 2,4-diethoxycarbonyl-5-hydroxy-5-methyl-3-phenyl-N-oxyethyl-1-cyclohexenylamine [5].

Sabouraud Dextrose Agar (SDA) was used to determine antifungal activities of test compound. Standard agar well diffusion method [6] was used to determine antibacterial properties of test compound at three different concentrations i.e. 0.3%, 0.1% and 0.05%. Due to its inert nature, Dimethyl sulphoxide (DMSO) was used as solvent to dissolve the test compounds. Briefly, 100 µL of 24-hour fresh broth culture (0.5 McFarland) of each fungal species was aseptically spread over agar surface. Wells with diameter 8 mm were punched aseptically in the agar plate by cork borer and 150 µL of test compound was added in each well. Agar plates were incubated at 30°C for 72 hours. After incubation, zone of inhibition was recorded carefully. All the experiments were performed thrice and DMSO was used as control.

Results and Discussion

2,4-Diethoxycarbonyl-5-hydroxy-5-methyl-3-phenyl-N-oxyethyl-1-cyclohexenylamine have demonstrated substantial antifungal properties against different Candida species. Results of agar well diffusion method are shown in Figure 2. Test compound exhibited antifungal properties against all the test cultures at 0.3% and 0.1% concentration. Candida pseudotropicalis BDU MA88 was found to be most sensitive among all the test cultures (average zone of inhibition 20.3 mm and 16.3 mm at 0.3% and 0.1% concentration respectively). Test compound was found to be even active at 0.05% concentration against Candida pseudotropicalis BDU MA88. Candida tropicalis BDU LK30 and Candida pelliculosa BDU KT55 were found to be resistant at 0.05% concentration. Candida tropicalis BDU LK30 was found to be least sensitive (average zone of inhibition 15.3 mm and 13 mm at 0.3% and 0.1% concentration respectively) test compound. Test compound was moderately active against Candida pelliculosa BDU KT55 (average zone of inhibition 19.7 mm and 16 mm at 0.3% and 0.1% concentration respectively).

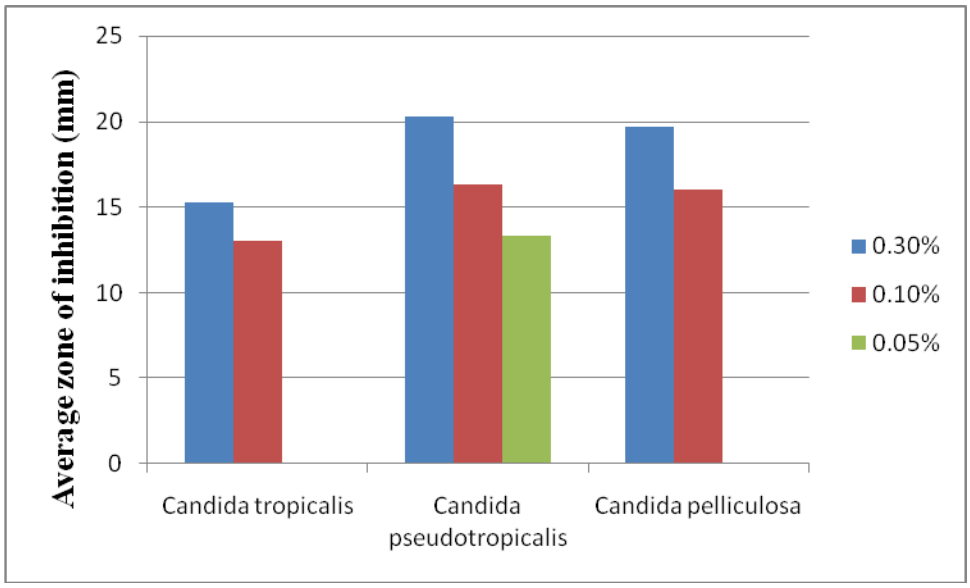

Figure 2: Antifungal properties of test compound.

Our results are concurrent with findings of Shoaib 2019, who also showed that Candida pseudotropicalis BDU MA88 was most susceptible yeast against cyclohexane tosyloxyimine derivative. Our findings contradict with results of [7,8]. Both of these studies demonstrated that functionally substituted cyclohexane derivatives were found to be inactive against three different Candida species. This might be attributed to difference in nature of substituted functional group on cyclohexane ring. Thus, antifungal profile of 2,4-diethoxycarbonyl-5-hydroxy-5-methyl-3-phenyl-N-oxyethyl-1-cyclohexenylamine exhibits that test compound has huge potential to act as probable anti-Candida agent in future.

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