Antifungal activity of coronarin D against Candida albicans

R. Kaomongkolgit¹, K. Jamdee², S. Wongnoi², N. Chimnoi³ and S. Techasakul²⁴

¹Department of Oral Diagnosis, Faculty of Dentistry, Naresuan University, Phitsanulok 65000, Thailand.
²Dental Science Research Center, Faculty of Dentistry, Naresuan University, Phitsanulok 65000, Thailand.
³Chulabhorn Research Institute, Bangkok 10210, Thailand.
⁴The Center of Innovation in Chemistry, Department of Chemistry, Faculty of Chemistry, Kasetsart University, Bangkok 10900, Thailand.

Introduction and objective: Oropharyngeal candidiasis is the frequent problem within immunocompromised individuals. It is caused by commensal Candida species. The most commonly implicated strain is Candida albicans which is isolated in over 80% of lesions. The drugs used at present to treat oropharyngeal candidiasis include the polyenes and azoles. However, the choices are still rather limited, especially when there is a rise in antifungal resistance caused by an increase in the use of these drugs for the treatment and prevention of opportunistic fungal infection in immunocompromised individuals. The increase in the prevalence of fungal infections and drug resistance have exacerbated a need for new antifungal agents. Hedychium coronarium (Zingiberaceae) is widely available in Southeast Asian countries, Japan, India, South China, and Brazil. Its rhizome has been used as a folk medicine for the treatment of headache, arthritis, diabetes, and hypertension. The use of phytochemicals as natural antifungal agents is gaining popularity. The labdane-type diterpenes are present in many plants. Several labdane-type diterpenes, including coronarin D, were isolated from the rhizomes of H. coronarium. Coronarin D showed a great variety of pharmacological activities. However, the details of its antifungal activity against C. albicans remain unknown. Therefore, the objective of the present study was to determine the antifungal activity of coronarin D against C. albicans. Its activity was compared to clotrimazole and nystatin, which are the topical antifungal agents commonly used in oropharyngeal candidiasis treatment.

Methods: Coronarin D was extracted from the rhizomes parts of H. coronarium by liquid chromatography and used in antifungal testing. The inhibitory effect of coronarin D on C. albicans was determined by cultures and an applied broth dilution test. The rate of fungicidal activity was evaluated by time-kill curves. Morphological alterations of fungal cells were investigated using scanning electron microscopy.

Results: The results showed that coronarin D was effective against C. albicans, the minimum inhibitory concentration (MIC) and the minimum fungicidal concentration (MFC) were 2 and 4 mg/ml, respectively. The time-kill assay, which demonstrated the rate of C. albicans killing, showed that coronarin D was higher than that of clotrimazole and nystatin at 2xMFC and 4xMFC. When compare at the same concentration (2xMFC and 4xMFC) and the same time intervals (10, 20, 30 minutes), significant difference in the number of remaining viable C. albicans was observed between coronarin D treated group and antifungal drugs treated groups (P<0.05). The morphological alterations of fungal cells were observed in the coronarin D treated cells. After 24 hours of exposure, the treated cells had a rough appearance with the formation of invaginations in the cells. After 48 hours of exposure, cells treated with coronarin D showed large surface collapse and wrinkled abnormalities of cell morphology along with small clefts.

Conclusion: Coronarin D showed promising antifungal activity against C. albicans in vitro. It may be suggested that the strong and rapid antifungal activity of coronarin D is a good candidate for further development as antifungal agent for oropharyngeal candidiasis therapy. In clinical applications, coronarin D may be used as one of the essential components of a mouthwash or in topical medication. The results of this study indicated the potential application of coronarin D as an antifungal agent.

Keywords antifungal; candida albicans; coronarin D; oropharyngeal candidiasis