

Inhibitory Effect of Ginger Extract on *Candida albicans*

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Abstract: Problem statement: The fungal infections could be life-threatening in immunocompromised patients. *Candida albicans* is the most frequent fungi in the oral cavity. **Approach:** The first step for treatment could be done using topical antifungal agents. Nystatin is a choice for mentioned usage but there are some problems in its using including: unfavorable taste, frequency of usage, etc. Finding better replacements is the subject of many studies. **Results:** This study was carried out to find an alternative for Nystatin. The study was designed based on laboratory investigations to investigate the antifungal activity of *Zingiber officinale* (Ginger) on *Candida albicans*. *Candida albicans* (PTCC 5027, ATCC10231) was obtained from Iranian microbial collection and was confirmed by Germ Tube formation test. Ethanolic ginger extract was prepared. The antifungal activity of the extract was determined using Agar dilution and disc diffusion techniques. Data were analyzed by ANOVA test. **Conclusion/Recommendations:** The results showed that the ethanolic extract was effective on *Candida albicans* (2 mg mL^{-1}) at the concentration of 1:5. The study indicates that ginger extract might have promise in treatment of oral candidiasis.

Key words: *Zingiber officinale*, antifungal activity, *Candida albicans*

INTRODUCTION

The incidence of serious infections caused by yeast, particularly species of *Candida*, has increased dramatically during the past decade. Oral candidiasis, formerly dismissed as a simple infection occurring in denture wearers, is now one of the most common opportunistic infections in immunocompromised patients such as those undergoing chemo therapy, HIV-infected persons and transplant recipients^[1,2].

There are topical and systemic antifungal agents that may be indicated to control oral candidiasis, but, the development of resistance is an emerging trend that may threaten their clinical effectiveness^[1-4]. For millions of people that traditional medicine serves as the only opportunity for health care, plants are vital sources. Safety and lower side effects of many herbal extracts have also suggested them as sources of new pharmaceuticals^[5-8]. History of ginger and its applications are well documented^[9,10]. It has been in medical use since ancient times. Ginger is listed in modern pharmacopoeias and repertories and has a wide

range of confirmed pharmacological properties^[11-13]. More recently studies have shown the antifungal properties of ginger extract, Gingerol^[13].

In this study the antifungal activities of ethanolic extract of the rhizomes of “*Zingiber officinale*” on *Candida albicans* was investigated.

MATERIALS AND METHODS

The fungi used in this study, *Candida albicans* (PTCC 5027 and ATCC 10231), was purchased from Iranian microbial collection (Tehran, Iran). *Candida albicans* was cultured and maintained on subouraud's dextrose agar medium at 30°C. Inoculums of yeast like fungi were prepared for disc diffusion assays. Sterile 705 mm diameter paper discs (3M, USA) were impregnated with 2 mg (10 µL) ethanolic plant extract, allowed to air dry and placed face down on the inoculated agar surface. Nystatin solution 100000U/CC used as positive control. Discs impregnated with 10 µL of 1% normal saline and allowed to air dry served as negative control. Plates were then incubated at 30°C in dark for 48 h, after which the diameter of the fungal

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growth inhibition zone was measured. The well containing the highest dilution of ginger extract that still showed a zone of inhibition around it was considered to be MIC^[14,15].

Extracts were prepared by blending approximately 500 g of the preserved plant material in 99% ethanol (1:3 (W/V) ratio). The mixture was filtered and the filtrate was retained and the residue was again stored in fresh ethanol and processed as above. The filtrates were collected and the solvent was rotary evaporated at 45°C to near dryness, whereupon the extract was freeze-dried for 48 h to achieve complete dryness.

The process yielded approximately 35-45 g of dried extract. The dried extract (200 mg) was reconstituted in 1 mL of 99% ethanol for a final concentration of 10 mg mL⁻¹ for antifungal disk assays. Data were analyzed by ANOVA test.

RESULTS

The ginger extract was effective in inhibiting the growth of *Candida albicans*. The positive control (Nystatin) produced significantly sized inhibition zones with *Candida albicans*, while the negative control produce no observable zones. The inhibitory zone was measured with respect to the extract concentration in 24 and 48 h. This assay showed that the inhibitory zone was reduced while decreasing the concentration (Fig. 1).

There was significant difference between the extract and Nystatin in their inhibition activity in comparison with *Candida albicans* ($p<0.01$). Minimum Inhibitory Concentration (MIC) of the ginger extract was obtained for the concentration at 2 mg mL⁻¹ (1:5 dilution).

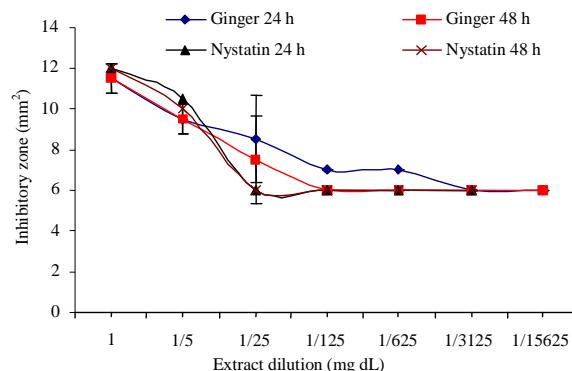


Fig. 1: Inhibitory zone in comparison with dilution

DISCUSSION

Members of the *Zingiberaceae* family are important in traditional medicine for the treatment of many diseases such as inflammation, morning sickness in pregnancy and many infective diseases. Significant antifungal activities were evident with extracts from members of the *Zingiberaceae*^[16-18]. This study showed that the extract of rhizomes of *Z.officinale* has pronounced inhibitory activities against *Candida albicans*. This result is comparable with other studies^[5,9,10,12] suggesting that different antifungal agents are present in the *Ginger extract*. In the ginger rhizome there are several components which have antibacterial and anti fungal effects. The gingerol and shagelol identified as more active agents^[13].

Ginger extract containing Gingerol inhibits the growth of many bacteria and fungi *in vitro* and the activity might be contributed to the preventive effects of its different agents^[13,18-21].

Recent studies have focused on the effect of Ginger on the oral bacteria and fungi. Park et al. showed that crude extract of the ginger can inhibit the growth of oral bacteria *in vitro*^[23] which is in good agreement with our results.

CONCLUSION

Antifungal activity of the ginger extract has been reported before^[1-13]. Our study focused on the effect of ginger extract on the oral species of *Candida* (Albicans) and showed the significant anticandidal effect the extract. Although species belonging to the *Zingiberaceae* family are generally regarded safe for human consumption^[22], further bio-assay guided analysis and clinical trial studies are required to approve it as an anti fungal agent for oral species. Our results suggest the ginger components as promising candidates for development of antifungal agents for topical applications.

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