

Original Research Article

COMPARATIVE EVALUATION OF ANTIFUNGAL ACTIVITY OF
COCOS NUCIFERA OIL AGAINST CANDIDA ALBICANS

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ABSTRACT:

Candidiasis is a fairly frequent clinical finding in patients with xerostomia, radiotherapy patients, patients under steroid therapy and denture wearers. Edible coconut oil is a readily available substance readily available around the world with ability to reduce burning sensation in mouth and also some amount of lubrication in oral cavity. This study was carried out with the aim of assessing antifungal activity of virgin coconut oil and to determine its efficiency in treatment of oral candidiasis as a natural antifungal agent. Our study showed that virgin coconut oil exerts an antifungal effect on *Candida albicans*. The findings as reported in the present study indicate a strong potential therapeutic value of virgin coconut oil against Candidal infections.

Keywords: Virgin Coconut oil, Oral Candidiasis, Antifungal activity, Agar well diffusion technique

INTRODUCTION

Candida albicans is a dimorphic yeast that can be either a commensal or an opportunistic pathogen with the ability to cause a variety of infections, ranging from superficial to life threatening.^{1,2} *C. albicans* lives as a normal commensal in the oral cavity in 30 to 60% of healthy individuals.³ *C. albicans* can cause infections under altered physiological and pathological conditions such as infancy, pregnancy, diabetes; prolonged broad spectrum antibiotic administration, steroidal chemotherapy as well as AIDS.^{4, 5} The difficulty associated with the management of Candidal infections necessitates the discovery of new antifungal agents in order to widen the spectrum of activity against *Candida*.

Widespread use of limited antifungal agents to treat infections has led to the rapid development of drug-resistant strains. Another important reason for the low success rate in treating candidiasis is with cells in biofilms displaying characteristics dramatically different from their free-living planktonic counterparts. Of all the strategies which have been identified to overcome resistance to antifungal drugs the search of new and effective natural products showing antifungal activity against biofilm cells with low cytotoxicity.^{6,7,8}

Coconut oil is an edible extract from the nut of *Cocos Nucifera*. In Ayurveda coconut oil is used internally & externally as part of several treatment procedures. The lauric acid content of coconut endows it with antimicrobial properties. As such, coconut

oil is used in the treatment of digestive tract infections. It is also used to expel intestinal parasites like tapeworms and *Helicobacter pylori*, which are responsible for indigestion and ulcer.^{9,10}

AIM:

The main purpose of our study is to evaluate the in vitro antifungal activity of virgin coconut oil and to determine its efficiency in treatment of oral candidiasis as a natural antifungal agent.

MATERIALS AND METHODS:

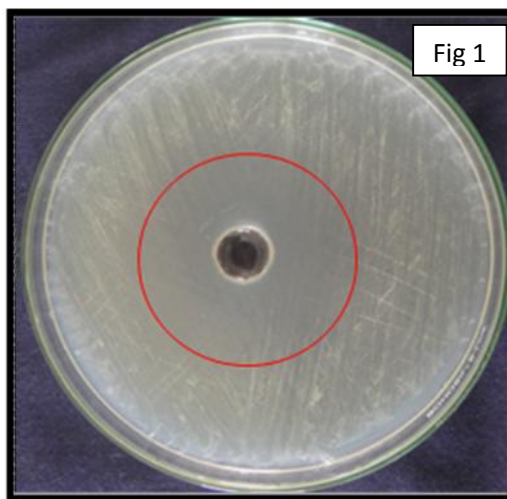
The antifungal activity was evaluated by the agar-well diffusion method. *Candida albicans* ATCC 66396 were sub-cultured onto Sabouraud Dextrose Agar and incubated for 18 hours at 37°C. The yeast cultures were harvested and then suspended in sterile saline (0.8% NaCl) and the cell density was adjusted to 10⁷ cells/ml. Six millimeters – diameter wells were punched into the agar plate.

In Group A: 500 µl of virgin coconut oil was dispensed into the wells. Same volume of clotrimazole (1%) was used on another plate as control (Group B). The plates were then incubated at 37°C for 24 hours. The diameters of the zones of inhibition around each disc were examined, measured and recorded as the mean diameter (mm) of complete growth inhibition. Tests were done in triplicate and the results are given as the mean average

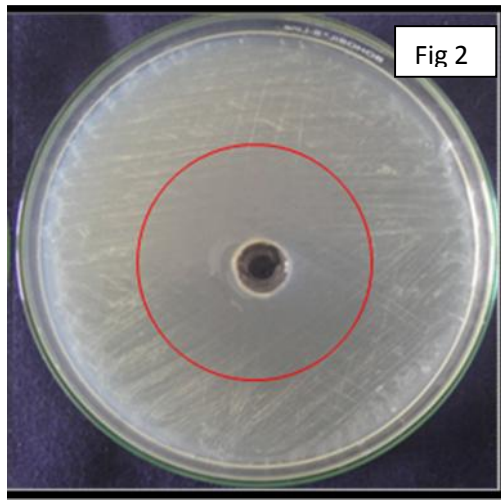
RESULTS:

Zone of inhibition measured at 24 hours in test groups (A1, A2, and A3) with a mean average of 19.6mm [fig 1]. Zone of inhibition of the control group of clotrimazole (B1, B2 and B3) with a mean diameter of 23.2mm [fig 2]

Culture Plates showing Agar Disc Diffusion Method



Zone of inhibition measured at 24 hours in test groups i.e. with Virgin Coconut Oil (A1, A2, and A3) with a mean average of 19.6mm zone of inhibition[fig 1]



Zone of inhibition of the control group of clotrimazole (B1, B2 and B3) with a mean diameter of 23.2mm [fig 2]

Table 1: Showing diameter of zone of inhibition for virgin coconut oil and clotrimazole at 24 hours:

Group	A1	A2	A3	B1	B2	B3
Inhibition zone	18±0.8 mm	21.5±0.5 mm	19.3±0.7 mm	23.5±0.5 mm	24.1±0.8 mm	22.2±0.7 mm
Average	19.6 mm			23.5mm		

DISCUSSION:

Candida albicans is a harmless commensal yeast-like fungus in healthy humans, which can cause superficial as well as life threatening systemic infections in immunocompromised situations. C. albicans can colonize or infect virtually all body sites because of its high adaptability to different host niches by the activation of appropriate sets of genes in response to complex environmental signals. Oral candidiasis is common in the elderly, and in HIV infected patients. Secondary candidiasis also occurs in patients with long-term use of broad-spectrum antibiotics, corticosteroids, and immune-

suppressants.^{11, 12} In these cases, antifungal agents are often prescribed. Recently *Candida* species have been shown increasing resistance to antifungals.

Coconut oil is edible oil prolific globally in tropical countries. The oil can be processed and extracted as an organic product which, is employed in the cosmetic industry for skin care to moisturize the skin, relieve dryness, flaking and prevent stretch marks. It is used for wounds, bruises, burns, rashes, eczema, and dermatitis. It also supports the natural chemical balance of the skin and provides protection from the damaging effects of ultraviolet radiation from the sun. Coconut, due to its contents of caprylic acid, which is fungicidal, is used in the treatment of fungal skin infections such as athlete's foot, thrush, ringworm and candidiasis.^{10, 13}

Virgin coconut oil is derived from the milk obtained from fresh coconut, by processes like fermentation, centrifugal separation and enzyme actions. They grate the fresh coconut, extract the coconut milk, and then let the coconut milk stand in a covered container for about a day. After 24-36 hours, the oil naturally separates from the water producing crystal clear oil that retains the full scent and taste of coconuts. The active ingredients in Coconut Oil are Caprylic Acid, Capric Acid and Lauric Acid. These medium-chain saturated fatty acids are potent antimicrobial agents.¹⁴ Lauric acid is the precursor of monolaurin (Pereira et al., 2004), which has been shown to modulate immune cell proliferation (Witcher et al., 1996) and possess antimicrobial activity (Bergsson et al., 2002). They kill bacteria, viruses and fungi by causing their cell walls to disintegrate. Several studies show how all the fatty acids demonstrate antifungal activity against *C. albicans*. Our present study shows virgin coconut oil as an effective alternative to Clotrimazole with the added advantage of being less costly, having no side effects, better acceptability by patients, easy availability and ease of application.

CONCLUSION:

The results of this study indicate that virgin coconut oil exerts an antifungal effect on *Candida albicans*. The findings as reported in the present study indicate a strong potential therapeutic value of virgin coconut oil against Candidial infections. Oral therapeutic products from coconut oil should be safe, effective and efficient alternative in antifungal therapy clinically. This will certainly increase the quality of life and decrease morbidity of the chronic fungal oral lesion that are seen associated with several debilitating diseases especially in the extremes of life.

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They then screened the anti-fungal activities of nine naturally derived oils using strong biofilm-producer, fluconazole-resistant or dose-dependently susceptible clinical isolates of *C. albicans* ATCC 10231. These oils included fennel oil, chamomile oil (*Chamaemelum nobile*), jojoba oil (*Simmondsia chinensis*), black cumin oil (*Nigella sativa*), fenugreek oil (*Trigonella foenum-graecum*), cod liver oil (*Gadus morhua*), peppermint oil (*Mentha piperita*), clove oil (*Syzygium aromaticum*) and ginger oil (*Zingiber officinale*).¹ None of the tested clinical isolates was sensitive to fluconazole. Fennel oil showed much higher anti-fungal activities against the tested *C. albicans* than any of the other oils. Using *Candida albicans* in broth cultures and a micro dilution method, comparative efficacy of origanum oil, carvacrol, nystatin and amphotericin B were examined in vitro. Origanum oil at 0.25 mg/ml was found to completely inhibit the growth of *C. albicans* in culture. Growth inhibitions of 75% and >50% were observed at 0.125 mg/ml and 0.0625 mg/ml level, respectively.²

¹Manohar V, Ingram J, Gray N, Talpur B, Echard D, Bagchi H, Preuss H. Antifungal activities of origanum oil against *Candida albicans*. *Molecular and Cellular Biochemistry*. 2004; 228: 111-117. The anti-fungal properties of fennel oil. Microorganisms are known to form biofilms or consortia on different surfaces, such as those of the skin or teeth. To screen the biofilm production of *C. albicans* and its susceptibility to the anti-fungal, fluconazole, the researchers used tissue culture plate method and disk diffusion method, respectively. They then screened the anti-fungal activities of nine naturally derived oils using strong biofilm-producer, fluconazole-resistant or dose-dependently susceptible clinical isolates of *C. albicans* ATCC 10231. Keywords: *Aspergillus niger*; *Candida albicans*; *Cryptococcus neoformans*; essential oil; antifungal; minimum inhibitory concentration; natural product; exclusionary principle; phytochemicals; bioactivity; drug discovery.

²Introduction. Worldwide, invasive fungal infections are responsible for greater than 1.5 million deaths annually [1-3]. The antifungal activity of essential oils with MIC. Using bigger data approaches to analyze antifungal activity of essential oils was constrained by the uniqueness of the major constituents which generated a large, but sparse data set.