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Synergistic Effect of Garlic and Cinnamon Extract in Combating Dermatophytosis: A Comparative Study with Clotrimazole

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Abstract

The purpose of this research is to determine the fungicidal potential of garlic and cinnamon, and the formulations of the two separately and in combination with clotrimazole for dermatophyte infections. Most often dermatophyton fungi, which cause minor diseases such as athlete's foot or ringworm, greatly contribute to the general decline in patients' health. Medications include clotrimazole, among others, such treatments have emerged challenges like resistant strains to eliminate from the fungi. In the present work, samples were grouped with respect to type of infection, the body part affected, age and sex. When comparing results, both garlic and cinnamon extracts possess antifungal activity with increase effectiveness when used together as a remedy for patients who may not make better responses to conventional antifungal agents.

Keywords: Garlic, Cinnamon, and Dermatophytosis.

1. Introduction

Dermatophyton fungi are areathen definite pathogens causing contagious skin diseases. Affecting the skin, nails, and hair-leading to diseases such as tinea pedis (athlete's foot), tinea corporis (body ringworm), tinea cruris (jock itch), tinea faciei (facial ringworm), and tinea unguium (nail ringworm).

Common manifestations are itching, erythema, desquamation, and even substantial inflammation, which can affect a patient's quality of life [1]. Garlick (*Allium sativum L.*) and cinnamon (*Cinnamomum verum*) are natural raw materials that have been used in traditional medicine because of their antimicrobial activity. That is attributed to substances

such as allicin in garlic and cinnamaldehyde in cinnamon. Both allicin is an effective antifungal compound and cinnamaldehyde that has long been credited as possessing antimicrobial properties [2-3].

Clotrimazole is commonly used antifungal agent which act at ergosterol synthesis level in fungi and kills the fungi cells. However, side effects and resistance to clotrimazole in some fungal stains prove there is need to find other treatments [4]. The present work presents the efficacy of basic carbon compounds like garlic and cinnamon extracts and their synergy to work against dermatophyton infections. Besides, the comparatively evaluate of these natural therapies against clotrimazole to determine their use as supplemental or alternative medicine. The objectives of this study are, firstly to assess the antifungal efficacy of garlic extract against dermatophyton fungi, leveraging allicin's antimicrobial properties. Secondly to evaluate the antifungal efficacy of cinnamon extract and compare it with garlic.

Cinnamaldehyde in cinnamon has shown potential in inhibiting fungal growth. Also to analyse the synergistic effect of combining garlic and cinnamon, as well as to determine the enhances of individual antifungal effectiveness. Finally compare between natural extracts with clotrimazole. Investigating the potential for garlic and cinnamon as alternative or supplemental antifungal agents.

2. Materials and Methods

2.1 Samples Collection

Specimens were enrolled from Al-Karama Teaching Hospital between 20th of November 2023, and 8th of February 2024. The specimen collected were skin scrapings, hair and nail clippings from patients of both sexes, aged between 5 and 57 years old, diagnosed of having dermatophyton infection. Data on patients including demographic and environmental data were also collected.

2.2 Types of Dermatophyton Infections

Infections were categorized according to the type of dermatophyton, and the region of the body infected, categories are combined in (table 1).

2.3 Experimental Design

Patients were divided into four treatment groups. The first group was the treatment group, which was given garlic extract. The second group is the cinnamon extract treatment group. Group three include patients who took a mixture of garlic and cinnamon extracts. Group four

treated with clotrimazole 200 µg/mL treated growth (control).

2.4 Evaluation of The Inhibition Potential of Plant Extracts Against Fungal Growth

Disc diffusion method checked the growth inhibitory zone for the dermatophyte using garlic extracts and cinnamon (aqueous and alcoholic). In this case, sterile 5 mm paper discs were impregnated with different concentrations (25 %, 50 %, 75 %, or 100 %) and placed on SDA that had been inoculated with fungi. Petri plates were incubated at 25 °C for 72 hours and inhibition zones were in mm [5]. Similar procedure was followed for the effects of clotrimazole [6].

2.5 Statistical Analysis

Various age, sex and treatment Chi-square techniques were conducted to infer variables relationship, and to assess treatment outcome in accordance with current statistical methodologies employed in analysing fungal infections [7].

3. Results and Discussion

3.1 Distribution of Dermatophyton Infections by Type and Body Area

Hands and feet were the most affected zones as illustrated in (table 1). Possibly because these parts of the body are most likely to experience exposure to damp conditions that encourage the growth of fungi. The type of tinea infectious seen was tinea manuum (on hands) which was the most predominant type; consistent with a survey of a similar distribution of tinea infectious in other exposed parts of the body reported in other studies [8].

Table1: Distribution of dermatophyton infections by type and body area.

Infection Type	Affected Body Area	Frequency	Percentage
Tinea Pedis	Feet	8	22.9 %
Tinea Unguium	Nails	2	5.7 %
Tinea Corporis	Body	3	8.6 %
Tinea Cruris	Thighs	4	11.4 %
Tinea Manuum	Hands	10	28.6 %
Tinea Faciei	Face	6	17.1 %
Tinea Barbae	Beard	2	5.7 %
Total	**All Areas**	**35**	**100 %**

3.2 Infection Distribution by Gender

Men are infected by 60 %, in comparison to women 40 %. This conclusion can be substantiated through research that indicates that male individuals might be more likely to present themselves to environments that may lead to contamination by fungus such as workplaces, or sports complexes [9].

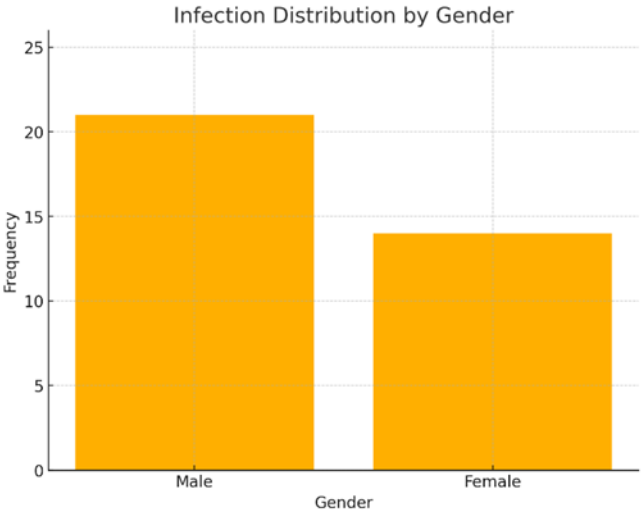

Figure 1: Chart of Infection distribution by gender indicates that there are a higher number of infections among the male as compared to the female individuals.

3.3 Age Distribution of Infections

It identified that age group from 21 to 30 years old have the highest infection rate of 51.4%. That is due to the age group exposing to social, and occupational settings in public shared area as shown in (table 2).

Table 2: Age distribution of infections.

Age Group / year	Frequency	Percentage
≤10	5	14.3 %
11-20	3	8.6 %
21-30	18	51.4 %
31-40	5	14.3 %
41-50	3	8.6 %
51-60	1	2.8 %
Total	35	100 %

3.4 Environmental and Residential Factors

A significant percentage of infected participants mentioned cat contact (65.7 %). This implicates that contact with animals, which are confirmed carriers of dermatophytes could contribute to the risk of the infection [10]. Furthermore, being an urban population, being a trimodal transportation system and involving crowded public areas, contributed to 80 % of cases as shown in (table 3).

Table 3: Environmental and Residential Factors.

Factor	Frequency	Percentage
Animal Exposure (Yes)	23	65.7 %
Animal Exposure (No)	12	34.3 %
Urban (City)	28	80.0 %
Rural (Outside City)	7	20.0 %

3.5 Antifungal Effectiveness of Treatments

Besides garlic and mostly cinnamon a combination of the two were proven to have quite efficient antifungal effect. The cinnamon and garlic showed the inhibition zone of 42.20 ± 0.20 mm which was significantly close to that of clotrimazole at (46.94 ± 0.10) thus indicating that garlic and cinnamon has synergistic effect in enhancing the respective antifungal effects [11]. This conclusion substantiates that the yields of natural extracts may be used as replacements or co-therapies to traditional

antifungal drugs, particularly for individuals who have developed resistance to such medications.Table 4

Table 4: Synergistic Effect of Garlic and Cinnamon Extracts on Enhancing Antifungal Effectiveness.

Treatment	Extract Type	Concentration	Inhibition Zone (mm)	Control
Cinnamon	Alcoholic	100	29.57	0
		75	22.24	
		50	15.11	
		25	7.53	
	Aqueous	100	21.92	0
		75	15.15	
		50	11.97	
		25	6.14	
Garlic	Alcoholic	100	35.96	0
		75	26.67	
		50	17.69	
		25	8.61	
	Aqueous	100	25.65	0
		75	17.64	
		50	12.76	
		25	6.67	
Cinnamon + Garlic	Alcoholic	50	42.20	0
Clotrimazole	Alcoholic	100	46.94	
LSD 0.05			0.330	
P-value			0.001**	

4. Conclusion

The experiment result of the study reveals that garlic and cinnamon extracts, especially the mixture of both, possess significant activity against dermatophyton fungi. Given the fact that they provided zones of inhibition comparable to those of clotrimazole, these compounds could be considering potential candidates for the development of alternative therapies. More investigations are suggested in terms of dose standardization and determination of the possible therapeutic uses of this compound.

5. Acknowledgment

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