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Research Article

### Investigation of superficial and cutaneous fungal infections in Arak, Iran

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#### ABSTRACT

Superficial and cutaneous mycoses are caused by fungi that affect the skin, hair, and nails. The main difference between them is that superficial fungal infections cause little or no inflammation, whereas cutaneous mycoses generally trigger an inflammatory response. Differentiation between superficial and cutaneous mycotic infection was essential for appropriate treatment. In the current study we investigated superficial and cutaneous fungal diseases in Arak province. The appropriate samples were taken from suspected patients within June 2011 to June 2012. Fungal isolates were identified with conventional and molecular methods. Out of 436 patients, 232 patients (53.2%) were infected with fungal infection. The infection was manifested more in age groups of 20–29 years, which accounted for 34.1% of cases. 136 patients (57.6%) were infected with dermatophytosis, 50 patients (21.6%) with candidiasis, 44 patients (18.9%) with tinea versicolor and 2 patients (0.4%) with otomycosis. In conclusion, the prevalence of superficial and cutaneous fungal infection is high. Precise differentiation between superficial and cutaneous mycoses and identification of fungal isolates in suspected patients can help to make a correct diagnosis and appropriate treatment.

#### 1. Introduction

Superficial and cutaneous mycotic infections are the common disease that are caused by various fungal agents (Ameen, 2010; Das et al., 2007; Smith and BC-ADM, 2015). These fungi can invade and infect the nails, hairs, ear, eye and stratum corneum of the skin and cause a spectrum of superficial fungal infections in human and animals (Smith and BC-ADM, 2015). Cutaneous mycoses may be classified as dermatophytoses or dermatomycoses. Dermatophytoses are caused by the agents of the genera *Epidermophyton*, *Microsporum*, and

*Trichophyton*. Dermatomycoses are cutaneous infections due to other fungi, the most common of which are *Candida* spp. One of the most cutaneous infections is dermatophytosis or tinea caused by dermatophytes (Hainer, 2003). Besides dermatophytes, other fungal isolates like *Malassezia* species, *Candida* sp, non-dermatophytic moulds may also cause superficial infections. In addition to disease agent in environment, other factors such as high temperature and moisture, age, job, living conditions and breach of hygienic provisions are

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effective on the skin fungal diseases, significantly. The incidence of some dermatomycoses is increasing, despite availability of newer and better topical and systemic treatments. Newer, oral antifungal agents have greatly improved the management of dermatomycoses, but not without consequence. Some antifungal agents are expensive, have more side effects toxicity that may or may not be tolerable, and have significant drug interactions (Kaushik et al., 2015; Vander et al., 2003). So exact identification is necessary for correct diagnosis, treatment and epidemiological information.

## 2. Materials and Methods

### 2.1. Specimens collection

In this descriptive cross sectional study within June 2011 to June 2012 436 patients suspected to one of superficial and cutaneous fungal infections referred to dermatology centers in Arak, were sampled. The questionnaire requested information based on age, sex and the clinical manifestation were recorded. Skin and nail samples were prepared by KOH 10% and lactophenol was used for hair samples. All samples cultured on the Sabord dextrose agar (Merk, Germany) containing chloramphenicol (50mg/L) (SC) and cycloheximide (500mg/L) (SCC).

### 2.2. Fungal identification *Candida* species

Colonies growing on SDA examined via methylene blue staining. Then subcultured on CHROMagar™ *Candida* medium (CHROMagar, France) and incubated at 35°C for 48 hours. Differentiation of *Candida* species was performed according to different colors produced by *Candida* colonies in the chromogenic medium, based on the manufacturer's protocol.

### 2.3. Mould isolates

Dermatophytes subcultured on SDA with cyclohexamide and Potato Dextrose agar (PDA). Slide culture, In Vitro hair perforation test, rice medium and urease test were used for identification of dermatophyte isolates (Robert and Pihet, 2008). Also for saprophyte mould slide culture was used for identification.

### 2.4. Molecular identification

All fungal isolates that cannot identified with conventional methods identified with DNA sequencing of internal transcribed spacer (ITS) ribosomal DNA (rDNA) regions by panfungal primers including ITS 1 (5'- TCC GTA GGT GAA CCT GCG G- 3') and ITS 4 (5'-TCC TCC GCT TAT TGA TAT GC - 3') (Falahati et al., 2003).

## 3. Results

Among 436 patients that suspected to superficial and cutaneous fungal infections, 232 (53.2%) were positive in direct smear examination and/or culture. 156 (67.2%) were males and 76 (32.8%) were females. The ages ranged between 1 to 79 years and the infection was manifested more in age groups of 20—29 and 30—39 years, respectively (Table 1). In different seasons of the year, the highest rate of fungal infections was related to the autumn season with 73 people (31.6%), and the spring season was the lowest with 40 people (17.2%).

Of the 232 patients, 136 (58.6%) have dermatophytosis and 50 (21.6%), 44 (18.9%) and 2 (0.9%) have candidiasis, tinea versicolor and otomycosis, respectively. Tinea unguium/onychomycosis (21.8%) was the most common type of fungal infection followed by tinea versicolor (18.9%), tinea cruris (18.9%), tinea corporis (12.9%), tinea manum (7.3%) tinea capitis (6.5%), tinea pedis (3.4%), tinea barbae (2.6%) and otomycosis (0.9%) (Table 2)

In a total of 50 patients with candidiasis, 50 (100%) were positive on direct examination and culture on SDA. *C. albicans* (22; 9.5%), *C. glabrata* (14; 6%), *C. parapsilosis* (10; 4%) and *C. tropicalis* (4; 1.7%) were identified on Chrome agar *Candida* medium. Thirty-five *Candida* isolates were obtain from onychomycosis and 15 isolates taken from cutaneous candidiasis.

The distribution of dermatophyte species is summarized in Table 2. *T. mentagrophytes* was the most common dermatophyte species recovered (48; 20.7%), followed by *E. floccosum* (37; 15.9%) and *T. verrucosum* (31; 13.4%) (Table 3).

**Table 1.** Distribution of clinical forms of superficial and cutaneous fungal infections in the study with respect to the age-groups and gender

Clinical form	Age group							Gender		Total, n (%)
	0-9	10-19	20-29	30-39	40-49	50-59	>60	Male, n(%)	Female, n(%)	
Otomycosis	-	-	-	-	-	1	1	2	-	2 (0.9)
Tinea versicolor	1	11	18	10	2	1	1	26	18	44 (18.9)
Dermatophytosis	15	19	35	24	16	18	9	98	38	136 (58.6)
Candidiasis	1	9	26	8	3	2	1	30	20	50 (21.6)
Total (%)	17 (7.3)	39 (16.8)	79 (34.1)	42 (18.1)	21 (9.0)	22 (9.5)	12 (5.2)	156 (67.2)	76 (32.8)	232 (100)

**Table 2.** Frequency of fungal isolates according to the clinical form in this study.

Species	Clinical form										Total (%)
	Otomycosis	Candidiasis (Cutaneous)	Tinea versicolor	Tinea Capitis	Tinea barbae	Tinea corporis	Tinea manuum	Tinea cruris	Tinea pedis	Tinea unguium/onychomycosis	
<i>A. niger</i>	2	-	-	-	-	-	-	-	-	-	2 (0.9)
<i>A. flavus</i>	-	-	-	-	-	-	-	-	-	2	2 (0.9)
<i>C. albicans</i>	-	8	-	-	-	-	-	-	-	14	22 (9.5)
<i>C. glabrata</i>	-	3	-	-	-	-	-	-	-	11	14 (6.0)
<i>C. parapsilosis</i>	-	3	-	-	-	-	-	-	-	7	10 (4.0)
<i>C. tropicalis</i>	-	1	-	-	-	-	-	-	-	3	4 (1.7)
<i>Malassezia sp.</i>	-	-	44	-	-	-	-	-	-	-	44 (18.9)
<i>T. mentagrophytes</i>	-	-	-	2	1	15	6	12	4	8	48 (20.7)
<i>E. floccosum</i>	-	-	-	-	-	3	2	31	1	-	37 (15.9)
<i>T. rubrum</i>	-	-	-	-	-	2	1	-	1	4	8 (3.4)
<i>T. verrucosum</i>	-	-	-	8	3	8	7	1	2	2	31 (13.4)
<i>M. canis</i>	-	-	-	5	2	2	1	-	-	-	10 (4.3)
Total (%)	2 (0.9)	15 (6.5)	44 (18.9)	15 (6.5)	6 (2.6)	30 (12.9)	17 (7.3)	44 (18.9)	8 (3.4)	51 (21.8)	232 (100)

#### 4. Discussion

In the present study, we determined the frequency of superficial and cutaneous mycoses and their etiologic agents during a one-year period in Arak, Iran. The majority of the patients with superficial and cutaneous fungal infection were male (67.2%), which was consistent with other studies (Berenji et al., 2016; Farokhipor et al., 2018; Gamage et al., 2020; Salari et al., 2017). Tinea unguium/onychomycosis (21.8%), tinea versicolor (18.9%), tinea cruris (18.9%) and tinea corporis (12.9%) were the most clinical forms of mycotic infection in this study. In consistent our study, Kim *et al.*, show that dermatophytosis showed a higher prevalence than the other superficial mycoses within the

study period (Kim et al., 2015). In epidemiologic surveillance of cutaneous fungal infections in the USA from 1999 to 2002 dermatophytes remain the most commonly isolated fungal organisms (Foster et al., 2004). However, there are reports contradicting this study. Khodadadi et al. (2021) reported that *candida* infection and tinea versicolor were the two most clinical form of superficial and cutaneous infection.

According to other studies in Iran (Aghamirian and Ghiasian, 2008; Didehdar et al., 2016; Falahati et al., 2003; Rezaei-Matehkolaei, 2013), in the present study dermatophytosis was manifested more in the age group of 20–40 years and males were affected more than females. The main dermatophytes

causing dermatophytosis were *T. mentagrophytes*, *E. floccosum* and *T. verrucosum*. Similar to other studies, *T. mentagrophytes* isolated from various form of dermatophytosis but *E. floccosum* more isolated from groin (Abastabar et al., 2013; Ansari et al., 2019; Didehdar et al., 2013; Falahati et al., 2003). The prevalence of tinea versicolor was also significant in this study. The high prevalence of this disease in the present study and other studies (Salari et al., 2017; Zarei et al., 2009), as well as its different treatment from other fungal diseases, requires correct diagnosis and differentiation. Pityriasis versicolor is a common superficial mycosis, which is characterized by hypopigmentation or hyperpigmentation of skin of the neck, shoulders, chest, and back. Pityriasis versicolor is due to *Malassezia furfur* which involves only the superficial keratin layer. In general, the disease is more prevalent in tropical countries and up to 40% of the population may be infected with this disease (Gosh et al., 2008). For example, a study in Sweden showed a 0.5% prevalence of pityriasis versicolor; however, in tropical countries, the prevalence can be more than 50% (Heidrich et al., 2015; Renati et al., 2015; Rios-Yuil, 2016). The prevalence of cutaneous candidiasis was also significant in this study. Cutaneous candidiasis is a common disease that affects all ages and accounts for approximately 1% of all outpatient and 7% of all inpatient visits to dermatological clinics (Taudorf et al., 2019). A variety of *Candida* species may be responsible, of which *C. albicans* most commonly cause human infections (Gupta et al., 2010). Clinical forms of candidiasis are somewhat similar to dermatophytosis and these infections should be differentiated. The causative agents can be easily isolated from culture and be differentiated from other organisms such as malassezia and dermatophytes.

## Conclusion

The prevalence of superficial and cutaneous fungal infection is high in suspected patients. Considering that the clinical symptoms of superficial and cutaneous fungal infections are similar, precise diagnosis of infection and identification of fungal isolates in suspected

patients can help to make a correct diagnosis and appropriate treatment.

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