

Original Article

A survey of the etiological agents of scalp and nail dermatophytosis in Yazd, Iran in 2014-2015

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Abstract

Background and Purpose: Tinea capitis and tinea unguium are regarded as global public health concerns. The purpose of the present study was to identify the etiological agents of tinea capitis and tinea unguium in patients, referring to the Central Laboratory of Yazd University of Medical Sciences, Yazd, Iran.

Materials and Methods: This study was conducted during 2014-2015. Skin scraping, scalp hair, and nail clipping specimens were collected from 134 patients (80 males and 54 females) with clinical features suggesting fungal involvement. Direct microscopic examinations were carried out, using potassium hydroxide 10%, while culture studies were performed on Sabouraud dextrose agar, containing chloramphenicol and cycloheximide at 28°C for four weeks. Fungal colonies were identified based on their macroscopic and microscopic characteristics, as well as supplementary diagnostic tests.

Results: Among 134 patients, 12 cases showed positive results on direct examination and culture studies. The frequency of infections was equal among male and female subjects. Among 12 affected cases, the frequency of tinea capitis and tinea unguium was 91.6% and 8.4%, respectively. *Microsporum canis* (50%) was the most prevalent species, followed by *Trichophyton verrucosum* (25%) and *Trichophyton mentagrophytes* (25%). Also, tinea unguium, caused by *T. mentagrophytes*, was found in a female patient.

Conclusion: The etiological agents of scalp and nail dermatophytosis have changed in Yazd over the past 13 years. In the present study, replacement of anthropophilic dermatophytes by zoophilic species was noteworthy, highlighting the necessity of efficient surveillance for the management and prevention of infections.

Keywords: Dermatophytes, Iran, Onychomycosis, Tinea capitis

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Introduction

Tinea capitis is a contagious superficial dermatophytic infection, which occurs most exclusively in children and rarely after puberty. On the other hand, tinea unguium is the most common nail infection in adults, accounting for nearly 2-50% of all nail disorders [1, 2]; also, tinea unguium is more frequent in toenails than fingernails.

Despite the topical and systemic treatments for tinea unguium, the relapse rate is relatively high [3]. The clinical presentations of infections depend on the species of the infecting fungus, the site of infection, and response of the host to pathogenic dermatophytes [4, 5].

The etiological agents involved in tinea capitis and tinea unguium vary geographically and can change over time. Tinea capitis, caused by anthropophilic species, has become common in Iran over the past four decades. In fact, in the past few years, there has been an increase in the number of cases affected by tinea capitis, caused by zoophilic agents, in some regions of Iran [6-11].

Further information on the etiological agents and frequency of the mentioned infections is essential for taking preventive and control measures. Therefore, in the present study, we aimed to identify the etiological agents of tinea capitis and tinea unguium in patients, referring

to the Central Mycology Laboratory of Yazd University of Medical Sciences, Yazd, Iran.

Material and Methods

The present study was performed on 134 patients (aged between four months and 74 years), referring to the Central Mycology Laboratory of Yazd University of Medical Sciences due to suspected infections in 2014-2015 (Table 1). Informed consent forms were obtained from the adults, parents, or children's guardians. Demographic characteristics and detailed history of disease onset were also recorded.

Skin scraping and scalp hair samples were obtained from suspected scalp lesions. Samples of nail clipping and subungual debris were collected according to the route of infection. The samples were studied through direct microscopic examinations by potassium hydroxide (KOH) 10%. All the samples were inoculated on Sabouraud dextrose agar, containing chloramphenicol and cycloheximide (Merck, Germany), without any antibiotics. All cultured plates were incubated at 28°C for four

weeks and were assessed on a weekly basis.

The colonies were identified based on their morphological features, using the slide culture method, growth on potato dextrose agar (Merck, Germany) and trichophyton agar (Biomark, India), as well as hair perforation and urease tests.

Statistical analysis

Statistical analysis was performed, using SPSS version 20. Comparison of proportions was performed, using Fisher's exact test. P-value less than 0.05 was considered statistically significant.

Results

Among 134 symptomatic patients (80 males and 54 females), direct examination and culture results were found to be positive for tinea capitis and tinea unguium in 12 (8.9%) cases, among whom six (50%) subjects were male and six (50%) were female (Table 2). Tinea capitis (91.6%) was the most common type of dermatophytosis, followed by tinea unguium (8.4%). Tinea capitis was observed more often in males than females.

Table 1. Frequency of scalp and nail dermatophytosis in different age groups in the study population

Age groups (years)	Dermatophytic infections				Total	
	Positive		Negative		N	%
	N	%	N	%		
< 10	8	14.8	46	85.2	54	100
10-19	3	15.8	16	84.2	19	100
20-29	0	0	8	100	8	100
30-39	0	0	15	100	15	100
40-49	0	0	13	100	13	100
50-59	0	0	8	100	8	100
60-69	0	0	9	100	9	100
≥ 70	1	12.5	7	87.5	8	100
Total	12	9	122	91	134	100

N: number

Table 2. Frequency of scalp and nail dermatophytosis with respect to gender in the study population

Gender	Dermatophytic infections				Total	
	Positive		Negative		n	%
	n	%	n	%		
Male	6	7.5	74	92.5	80	100
Female	6	11.1	48	88.9	54	100
Total	12	9	122	91	134	100

Table 3. Frequency of isolated dermatophyte species in relation to the infection site

Clinical forms	Causative fungal organism						Total	
	<i>M. canis</i>		<i>T. verrucosum</i>		<i>T. mentagrophytes</i>		N	%
	N	%	N	%	N	%		
Tinea capitis	6	50	3	27.3	2	22.7	11	100
Tinea unguium	0	0	0	0	1	100	1	100
Total	6	50	3	25	3	25	12	100

N: number, M: *Microsporum*, T: *Trichophyton*

Considering the microscopic pattern of hair fungal invasion, only the ectothrix type of tinea capitis was observed in the current study. The highest incidence of tinea capitis was reported in the age group of < 10 years. One case of tinea unguium was observed in a patient over 70 years.

Microsporum canis from tinea capitis was the predominant causative agent (50%), followed by *Trichophyton verrucosum* and *T. mentagrophytes*. The only case of tinea unguium was caused by *T. mentagrophytes* (Table 3).

Statistical analysis revealed a significant relationship between age under 10 years and dermatophyte infections ($P=0.049$). However, according to the results of Fisher's exact test, there was no significant relationship between dermatophytosis and gender ($P=0.455$) or dermatophyte organisms ($P=0.5$).

Discussion

Dermatophytes are among the most common infectious agents in humans and animals. These fungi are keratinophilic and cause dermatophytosis (ringworm) in the skin, scalp hair, and nails. Dermatophytes are classified as anthropophilic, zoophilic, and geophilic subtypes, depending on their natural habitats.

So far, more than 40 dermatophyte species have been identified, some of which are distributed globally, whereas others are restricted to specific geographical regions. On the other hand, predominant fungi vary from one region to another and can change over time. The clinical presentation of dermatophytosis mainly depends on the strain and species of the infecting fungus, site of infection, immunological response of the host, and other factors such as climate and culture [12].

Tinea capitis is a widespread contagious infection of the scalp hair and skin, which most

exclusively occurs in prepubescent children and rarely in adults. Dermatophytic onychomycosis is another clinical manifestation, which commonly involves adults [13]. However, depending on the geographical region, climatic condition, and behavioral habits, tinea capitis is the most common form of infection in tropical areas, and onychomycosis is the most prevalent infection in Western countries [13].

In consistence with previous findings [14, 15], tinea capitis was the predominant clinical form of dermatophytosis in the present study. Interestingly, we found a notable decline in the frequency of tinea capitis in this study (8.9%), which was significantly lower than the rate (55.1%) reported in a previous study in Yazd, Iran [16].

Similar to a previous study in Yazd [16], we showed that tinea capitis is independent of gender. However, based on studies by Chadeganipour et al. [17], Aghamirian et al. [18], Naseri et al. [19], Falahati et al. [20], Badiie et al. [21], and Ayatollahi Mosavi et al. [22], the majority of cases occurred in males. On the contrary, in studies performed in Karaj and Kashan, Iran, scalp infection was predominant in females rather than males [23, 24].

In the present study, most patients were in the age group of < 10 years, which was in agreement with other reports from Iran [18, 19, 22, 24, 25]. Normally, the frequency of tinea unguium increases with age. This infection is quite rare among children, common in young adults, and highly frequent among the elderly. Also, this infection accounts for nearly 30% of all nail disorders.

Large-scale investigations on onychomycosis in different regions of Iran have revealed inconsistent prevalence rates, which are as follows: 1.2% in Yazd in 2001

[16], 2.4% in southern Tehran [20], 2.8% in Ahwaz [26], 6.9% in south of Iran [10], 7.6% in Tehran [11], 9% in Karaj [24], 9.6% in Mashhad [19], 10% in Kerman [22], 10.55% in Tehran [27], 11.2% in Qazvin [18], 13.9% in Isfahan [17], and 18.5% in Kermanshah [8].

In the present study, similar to a previous report from Iran [10], tinea unguium was observed in a female patient over 70 years of age (1.4%). In 2001, Azizi and Jevad reported dermatophytic onychomycosis in 1.2% of cases with dermatophytosis (n=227) in Yazd [16]; all the patients were female, as well. Although several reports have revealed the predominance of dermatophytic nail infections in females [18, 23, 25, 28], Zaini et al. [27] and Kazemi et al. [29] found males to be more significantly affected by dermatophytes, compared to females. Also, in a study in Tehran, the rate of nail infections was reported to be equal in both genders [30].

Overall, three dermatophyte species, mainly zoophilic species, were isolated in our study. *M. canis* was the predominant cause of tinea capitis, followed by *T. verrucosum* and *T. mentagrophytes*. This finding was in contrast with a study performed in 2001 in Yazd, which introduced *T. violaceum* as the most common species isolated from tinea capitis, followed by *M. canis*, *T. verrucosum*, and *T. schoenleinii*.

A significant finding of the present study was the disappearance of anthropophilic *T. violaceum* and *T. schoenleinii*. In 2001, scalp infection with these two species was considerably more frequent in Yazd [16] and several parts of Iran [7, 18, 19, 31]. In the present study, zoophilic dermatophytes were the main etiological agents of tinea capitis. Our findings were in agreement with observations from Kerman [22] and Karaj [24].

The causative agents of tinea capitis vary in different regions of Iran. During 2000-2005, the causative dermatophytes of tinea capitis were reported as follows: *T. tonsurans*, *T. violaceum*, *T. schoenleinii*, and *M. canis* in Tehran [7], *T. verrucosum*, *T. violaceum*, and *T. schoenleinii* in Qazvin [18], *T. violaceum*, *M. canis*, and *M. gypseum* in south of Tehran [20], *T. violaceum*, *T. verrucosum*, *T. schoenleinii*, and *T. tonsurans* in Hamadan

[25], *M. canis*, *T. rubrum*, *T. verrucosum*, and *T. mentagrophytes* in Karaj [24], *T. interdigitale*, *M. canis*, *T. tonsurans*, and *T. rubrum* in south of Iran (i.e., Shiraz, Ahwaz and Yasuj) [10], *T. violaceum*, *T. schoenleinii*, *T. verrucosum*, *M. vanbreuseghemii*, and *T. mentagrophytes* in Mashhad [19], *T. verrucosum* in Ahwaz [26], and *T. verrucosum*, *M. canis*, and *T. violaceum* in Shiraz [21].

In the present study, tinea capitis was followed by tinea unguium in terms of prevalence. Additionally, Gerami Shoar et al. reported cases of tinea unguium, caused by *T. mentagrophytes* and *T. rubrum* in Tehran [30]. Similar to the present study, *T. mentagrophytes* was the most prevalent causative agent of tinea unguium in Tabriz [31]. Also, Badiee et al. introduced *T. violaceum* and *E. floccosum* as the causative agents of tinea unguium in Shiraz [21]. Moreover, Aghamirian et al. described cases of tinea unguium, caused by *T. rubrum*, *T. interdigitale*, and *T. mentagrophytes* in Qazvin [18].

Furthermore, in previous research, the etiological agents of tinea unguium were reported as follows: *T. interdigitale*, *T. mentagrophytes*, *T. verrucosum*, *T. rubrum* [11], *T. mentagrophytes*, *T. rubrum* [29], *T. mentagrophytes*, *T. rubrum*, *E. floccosum* [8], *T. mentagrophytes*, *T. verrucosum* [22], *T. schoenleinii* [25], *T. verrucosum* [24], *T. interdigitale*, *E. floccosum*, *T. rubrum*, *M. gypseum* [17], *T. rubrum*, *T. mentagrophytes* [26], *T. rubrum*, *T. interdigitale* [10], *T. mentagrophytes*, and *E. floccosum* [19].

In addition, Hayette and Sacheli in a review on the current global status of dermatophytosis noted marked changes in the epidemiology of dermatophyte infections throughout America, Middle East, Africa, Asia, and Europe. They concluded that these changes resulted from increased immigration, travelling, improved lifestyle, and some other influential factors. Their report introduced *T. rubrum* as a common and major cause of tinea unguium in the world. However, *M. canis* and anthropophilic dermatophytes were believed to be the main etiological agents of tinea capitis in Mediterranean regions, Europe, and America, respectively [13].

Conclusion

Analysis of the present results revealed a notable increase in zoophilic dermatophytes as causative agents of infection in Yazd, Iran. Fluctuation in the etiologic dermatophytes of tinea capitis is believed to be a result of changes in lifestyle, environment, migration, and close contact with animals.

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Authors' Contributions

F.Z. designed and managed the study. P.K., M.F., and MS provided practical and scientific consultation, H.ST. and S.R. performed the specimen collection and practical experiments, and M.M. performed the statistical analysis of the data. The primary draft of the manuscript was prepared by FZ and S.M., and the final version was revised by F.Z. and S.M.

Conflicts of Interest

There was no conflict of interest in the present study.

Financial Disclosure

There was no financial interest related to the materials of the manuscript.

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