

# An Epidemiological Study of Superficial Fungal Infections in University Hospital, Hatay

## Hatay'da Üniversite Hastanesinde Yüzeysel Mantar Enfeksiyonlarına Ait Epidemiyolojik Bir Çalışma

Meryem ÇETİN, MD,<sup>a</sup>  
Gamze SERARSLAN, MD,<sup>b</sup>  
Didem Didar BALCI, MD,<sup>b</sup>  
Ebru TURHAN, MD<sup>c</sup>

Departments of  
<sup>a</sup>Microbiology and Clinical Microbiology,  
<sup>b</sup>Dermatology,  
Mustafa Kemal University,  
Faculty of Medicine,  
<sup>c</sup>Public Health,  
Antakya State Hospital, Hatay

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Yazışma Adresi/Correspondence:  
Didem Didar BALCI, MD  
Mustafa Kemal University,  
Faculty of Medicine,  
Department of Dermatology, Hatay,  
TÜRKİYE/TURKEY  
didemaltiner@yahoo.com

**ABSTRACT Objective:** Superficial fungal infections are very common worldwide and remain as a major public health problem. The aim of the study was to determine the frequency, the causative pathogens, and the risk factors associated with superficial mycotic infections. **Material and Methods:** Clinically diagnosed 312 patients with dermatomycoses and 313 control subjects were included into the study. Direct microscopic observation of the samples was carried out by examination in 20% potassium hydroxide (KOH). Clinical specimens were cultured on Sabouraud dextrose agar (SDA) for the fungal growth. **Results:** A total of 401 samples were collected from 312 patients suspected to have mycotic infections. Among the 401 samples examined 198 (49.4%) were mycologically culture positive. Of these, 143 (72.2%) samples gave positive results in direct microscopy too. The most frequently isolated species were *Trichophyton rubrum* (48.0%), *Trichophyton mentagrophytes* (20.7%), *Epidermophyton floccosum* (9.1%), and *Candida albicans* (8.6%), *Candida parapsilosis* (5.6%). *Tinea pedis* (34.9%) was the most common type of infection, followed by *Tinea unguium* (31.8%), *Tinea inguinalis* (12.1%), *Tinea corporis* (7.6%), *Tinea cruris* (2.6%) and *Tinea manum* (2.0%). Age of 50 years or older (OR= 11.364; 95% confidence intervals (CI)= 5.815-22.210) and the age between 25-49 years (OR= 3.050; 95% CI= 1.666-5.583), male gender (OR= 1.749; 95% CI= 1.152-2.655), presence of diabetes mellitus (OR= 2.495; 95% CI= 1.342-4.641), lower education level (OR= 2.112; 95% CI= 1.279-3.487), history of mycotic infections in family (OR= 1.677; 95% CI= 1.064-2.645) were found to be a risk factors-associated with the superficial mycotic infections. **Conclusion:** Age, gender, education level, history of mycotic infection in family, and diabetes mellitus appeared to be associated with the occurrence of superficial fungal elements. The distribution of superficial mycotic infections in our study is similar to the literature reports.

**Key Words:** Dermatomycoses; arthrodermataceae; epidemiology

**ÖZET Amaç:** Yüzeysel mantar enfeksiyonları tüm dünyada yaygın ve temel bir halk sağlığı problemidir. Bu çalışmanın amacı, yüzeysel mantar enfeksiyonlarının sıklığını, etken patojenleri ve ilişkili risk faktörlerini saptamaktır. **Gereç ve Yöntemler:** Klinik olarak dermatomikoz tanısı almış 312 hasta ve 313 kontrol olgusu çalışmaya dahil edildi. Direkt mikroskopik bakı %20'lik potasyum hidrok sit (KOH) kullanılarak yapıldı. Kültür için, klinik örnekler Sabouraud dekstroz agar (SDA)'a ekildi. **Bulgular:** 312 hastadan toplam 401 örnek elde edildi. İncelenen 401 örneğin 198 (%49.4)'ünde kültür pozitifliği. Bunların 143 (%72.2)'ünde direkt mikroskopi de pozitifliği. İzole edilen en sık türler sırasıyla *Trichophyton rubrum* (%48.0), *Trichophyton mentagrophytes* (%20.7), *Epidermophyton floccosum* (%9.1), and *Candida albicans* (%8.6), *Candida parapsilosis* (%5.6) idi. Klinik olarak saptanan en sık yüzeysel mantar enfeksiyonları sırasıyla *Tinea pedis* (%34.9), *Tinea unguium* (%31.8), *Tinea inguinalis* (%12.1), *Tinea corporis* (%7.6), *Tinea cruris* (%2.6) ve *Tinea manum* (%2.0) idi. Elli yaş üstü (OR= 11.364; %95 GA= 5.815-22.210) ve 25-49 yaş (OR= 3.050; %95 GA= 1.666-5.583), erkek cinsiyet (OR= 1.749; %95 GA= 1.152-2.655), diabetes mellitus varlığı (OR= 2.495; %95 GA= 1.342-4.641), düşük eğitim düzeyi (OR= 2.112; %95 GA= 1.279-3.487) ve ailede mantar öyküsü (OR= 1.677; %95 GA= 1.064-2.645) yüzeysel mantar enfeksiyonlarıyla ilişkili risk faktörleri olarak bulundu. **Sonuç:** Yaş, cinsiyet, eğitim düzeyi, ailede mantar enfeksiyonu öyküsü ve diabetes mellitus yüzeysel mantar enfeksiyonları için risk faktörleridir. Çalışmamızdaki yüzeysel mantar enfeksiyonlarının dağılımı literatür verileri ile benzerdir.

**Anahtar Kelimeler:** Dermatomikoz; dermatofitler; epidemiyoloji

Superficial fungal infections are very common worldwide and remain as a major public health problem especially in underdeveloped and developing countries. The superficial mycotic infections affect more than 20-25% of the world's population.<sup>1</sup> The distribution of mycoses and causative pathogens varies with geographic location, climate and demographics. Some of them are widely distributed while others are geographically restricted.<sup>2-5</sup>

The aim of the present study was to determine the causative pathogens, and the risk factors associated with superficial fungal infections.

## MATERIAL AND METHODS

A total of 625 people were enrolled into this study. Between January 2006 and December 2006, 312 consecutive patients with suspected dermatomycoses were clinically diagnosed at Dermatology Out-patient Clinic at the Mustafa Kemal University Hospital. Three-hundred and thirteen patients with unrelated skin diseases were also included in the study as a control group. Study subjects who were receiving systemic steroids, immunosuppressive agents or antibiotics were excluded.

Sharply bordered, peripherally spreading erythematous patches with a scaly border were defined as tinea corporis, inguinalis or cruris according to the localization of lesions. Fine firmly adherent scale on an erythematous background with fissures on a palmar area was defined as tinea manus. Patients who had one or more findings such as white scale, maceration, fissures between the 3<sup>rd</sup> and 4<sup>th</sup> or 4<sup>th</sup> and 5<sup>th</sup> toes, dry thick scales typically covering the heels, the tips of the toes and metacarpal pads, pruritic grouped vesicles and large blisters were diagnosed with tinea pedis. Subungual hyperkeratosis, onycholysis, white-yellow-brown discoloration, dystrophy were defined as onychomycosis.

A total of 401 samples were collected from 312 patients. The age range was 0-86 years and the average age was  $40.34 \pm 16.45$  years.

The age, gender, history of family for mycotic infection, level of education, and status for diabetes

mellitus and vascular diseases were recorded for all the patients with superficial mycotic infections and controls. Education level was grouped as primary (no educated or primary school) and secondary (secondary or high school, university) school. Controls with clinically suspected superficial mycotic infections were excluded from the study. No mycological examination was performed in controls. Controls were matched the patients with suspected superficial mycotic infections in terms of potential risk factors for the development of superficial mycotic infections. After samples of skin, hair or nails infected cleaned with 70% alcohol, suspicious lesions were taken from patients by using a sterile scalpel and then collected in sterile containers.

Sample analysis was carried out by both microscopic examination and fungal growth culture. Direct microscopic observation of the samples was carried out by examination in 20% potassium hydroxide (KOH) for 30 min.<sup>6</sup>

Clinical specimens were cultured on Sabouraud dextrose agar (SDA) (Oxoid Ltd, Basingstoke, Hampshire, England) with cycloheximide and without cycloheximide. Slants were incubated at 26 °C for up to 21 days and checked weekly for the fungal growth. Positive cultures were sub-cultured on plates of SDA. Species identification of the isolates was done according to colony morphology, pigment production, biochemical tests (urease activity and rice grain) and microscopy after staining with lactophenol cotton blue (LPCB).<sup>7-9</sup>

Identification of yeasts were performed via germ tube test in serum, chlamyospore formation, and assimilation tests by using API 20C AUX (bio Merieux, Etoile, France).<sup>7,8,10</sup>

The Statistical Package for Social Sciences (SPSS version 12.0) was used for statistical analysis. Descriptive statistics such as means and proportions were calculated. Odds ratios (OR) and 95% confidence intervals (CI) were calculated with the use of logistic regression analysis.

## RESULTS

Based on clinical symptoms, tinea pedis was ranked first with 157 (39.1%) cases, and followed by

foot onychomycosis (82 cases; 20.4%), *Tinea inguinalis* (45 cases; 11.2%), *Tinea corporis* (36 cases; 9.0%), hand onychomycosis (31 cases; 7.7%), *Tinea manum* (23 cases; 5.7%), *Tinea cruris* (13 cases; 3.2%), *Tinea faciei* (7 cases; 1.7%), and *Tinea capitis* (7 cases; 1.7%) (Table 1).

Among a total of 401 clinically suspected samples examined, 198 (49.4%) were mycologically culture positive. Of these, 143 (72.2%) samples gave positive results in direct microscopy too. The most frequently isolated microorganisms were *Trichophyton rubrum* (95 cases; 48.0%), *Trichophyton mentagrophytes* (41 cases; 20.7%), *Epidermophyton floccosum* (18 cases; 9.1%), *Candida albicans* (17 cases; 8.6%), and, *Candida parapsilosis* (11 cases; 5.6%). The distribution of mycologic elements according to the anatomic site was as follows: *Tinea pedis* (69 cases; 34.9%), *Tinea unguium* (10 cases fingernail and 35 cases toenail involvement, 45 cases; 27.7%), *Tinea inguinalis* (24 cases; 12.1%), *Tinea corporis* (15 cases; 7.6%), *Tinea cruris* (5 cases; 2.6%), *Tinea manum* (4 cases; 2.0%). Dermatophyte species isolated from cases of tinea is demonstrated in Table 1.

The risk of having a mycotic infection was increased at the age of 50 years or older (OR= 11.364; 95% CI= 5.815-22.210) and the age between 25-49 years (OR= 3.050; 95% CI= 1.666-5.583). Superficial mycotic agents were more frequent in males than females (OR= 1.749; CI= 95% 1.152-2.655). The patients with diabetes mellitus had a higher

risk of mycotic infection (OR= 2.495; CI= 95% 1.342-4.641). Another risk factor for the development of mycotic infections was having a lower education level (OR= 2.112; CI= 95% 1.279-3.487). The patients with a history of mycosis had also a higher risk of mycotic infections compared with those without any history of mycotic infections in the past (OR= 1.677; 95% CI= 1.064-2.645) (Table 2). There was no association between vascular disease and mycotic infection (P= 0.342).

## DISCUSSION

Knowing the distribution of mycotic species and information on the other epidemiologic parameters are necessary to reduce the incidence of fungal infections and to prevent their transmission. This is also essential for choosing appropriate anti-mycotic agents for treatment.

Frequency of mycotic fungal infections and distribution of etiologic agents may show differences because of geographic location, socioeconomic status, climatic conditions, lifestyle conditions, migration of people and environment.<sup>2-5</sup>

In the present study we found that 198 (49.4%) of the specimens were culture positive, and 143 (72.2%) of them were also positive by direct microscopy. Similar to the prevalence in Duzce, Turkey the percentages of positivity by culture and also the direct microscopy were found to be 44.1% and 86.7%, respectively.<sup>11</sup> Another study from Ahwaz, Iran indicated the culture and direct micros-

**TABLE 1:** Dermatophyte species isolated from cases of tinea.

Species isolated	<i>Tinea corporis</i>	* <i>Tinea cruris</i>	<i>Tinea pedis</i>	<i>Tinea manum</i>	<i>Tinea unguium</i>	<i>Tinea inguinalis</i>	Total
<i>Trichophyton rubrum</i>	7	5	38	3	28	14	95
<i>Trichophyton mentagrophytes</i>	4	-	18	1	11	7	41
<i>Trichophyton verrucosum</i>	-	-	1	-	-	-	1
<i>Trichophyton tonsurans</i>	-	-	1	-	1	-	2
<i>Trichophyton violaceum</i>	-	-	1	-	-	-	1
<i>Microsporium species</i>	3	-	-	-	-	-	3
<i>Epidermophyton floccosum</i>	-	-	10	-	5	3	18
<i>Microsporium gypseum</i>	1	-	-	-	-	-	1
Total	15	5	69	4	45	24	162

\**Tinea cruris*: Tinea infection of the crural areas except of inguinal region (axillary, intergluteal or inframammar area ).

**TABLE 2:** Risk factors associated with fungal elements.

Characters of sociodemographic	Number of mycotic agents/total (%)	Odss ratio	95% Confidence interval	P
<b>Age</b>				
0-24 years	24/169 (14.2%)	1.00		
25-49 years	82/361 (22.7%)	3.050	1.666-5.583	0.000*
50 years or older	53/95 (55.8%)	11.364	5.815-22.210	
<b>Education level</b>				
Secondary	98/408 (24.0%)	1.00		0.003*
Primary	61/217 (28.1%)	2.112	1.279-3.487	
<b>Diabetes mellitus</b>				
No	128/561 (22.8%)	1.00		0.004*
Yes	31/64 (48.4%)	2.495	1.342-4.641	
<b>Gender</b>				
Female	50/255 (19.6%)	1.00		0.009*
Male	109/370 (29.5%)	1.749	1.152-2.655	
<b>History of mycosis</b>				
No	104/466 (22.3%)	1.00		
Yes	55/159 (34.6%)	1.677	1.064-2.645	0.026*
<b>Vascular diseases</b>				
No	140/581(24.1%)	1.00		
Yes	19/44 (43.2%)	1.458	0.670-3.170	0.342

\*A significant association with fungal elements.

copy positivity rates as 37% and 40.1%, respectively.<sup>12</sup>

*T. rubrum* was the most prevalent dermatophyte isolated in our study (48%). It was mainly isolated from cases of Tinea pedis (40%) followed by foot onychomycosis (21%), Tinea inguinalis (14.7%), hand onychomycosis (8.4%), Tinea corporis (7.4%), Tinea cruris (5.3%), Tinea manuum (3.2%). Ozkurtuk et al reported a 56% isolation rate for *T. rubrum* from Tinea pedis in Turkey.<sup>13</sup> Metintas et al found that *T. rubrum* (43%) was the most frequent dermatophyte in students living in rural areas of Turkey.<sup>14</sup> Sahin et al indicated *T. rubrum* (62.2%) as the most encountered etiologic agent for Tinea pedis in Duzce, Turkey.<sup>11</sup> Another study from Turkey demonstrated *T. rubrum* (47.46%) to be most prevalent isolated agent for dermatophytosis.<sup>15</sup> Prevalence rates ranging from 37% to 55% for *T. rubrum* have been reported from different regions of the world including Mexico, Portugal, and India.<sup>16-18</sup>

In the present study Tinea pedis (34.9%) was the most prevalent disease. Tinea pedis prevalence, reported from different cities of Turkey, was

49.1% in Duzce, 47% in Izmir, 59.3-45% in Eskişehir, and 29.5% in Adana.<sup>11,13-15,19</sup> Similar studies reported from other countries for Tinea pedis's prevalence rates 35.2% in Zarqa, 30.2% in Mexico, 10.6% in Iran.<sup>16,20,21</sup>

Yeast was isolated in 36 (18.2%) samples in our study. In a study from Slovenia, the prevalence of yeast isolation was reported to be 27.2%.<sup>22</sup> Our study showed that the most frequent *Candida* species were isolated from cases of hand onychomycoses (10 cases; 5.0%) and foot onychomycoses (8 cases; 4.0%). *C. albicans* was the most common species (17 cases; 8.6%) followed by *C. parapsilosis* (11 cases 5.6%), *Candida sake* (3 cases; 1.5%), *Candida tropicalis* and *Candida curvata* and *Candida kefyr* and *Candida crusei* and *Candida glabrata* (1 cases for each; 0.5%). Similarly, in a study from Singapore, *Candida* species were the most frequent pathogens isolated from fingernail infections.<sup>23</sup> *Candida* species and *C. albicans* were isolated at ratios of 16.7% and 4.1%, respectively by Das et al from India.<sup>18</sup> The prevalence of *Candida albicans* in two other stu-

dies was found to be 10% Libya, and 5.2% in Turkey.<sup>11,24</sup>

In our study, the distribution of superficial mycotic agents was higher in males than females, and the risk of having mycotic infection was also higher in males. However, the cause of this increase in males is not known at this point. Men may be more susceptible than women to mycotic infections.<sup>25</sup> Similar observations were also reported from Turkey and other countries including Iran, Thailand, and India.<sup>11,12,14,18,26</sup>

Dermatomycosis may be seen in lifelong, but may show differences according to the form of tinea, climatic changes, and occupation.<sup>12</sup> We found that the odds for the presence of mycotic agents were higher in both those 50 years of age or older and the age between 25-49 years compared with the younger generations. The odds ratio for those 50 years of age or older was higher than those age between 25-49 years old. According to our findings, aging is a risk factor for the development of superficial mycotic infections. Mahmoudabadi et al found that mycotic agents are more frequent in age group of 21-30 years.<sup>12</sup> Sahin et al showed that the prevalence of superficial mycosis is higher in 15-64 years old age group.<sup>27</sup> Welsh et al reported that dermatophytoses are more prevalent in ages under 25 years.<sup>16</sup>

We found an increased risk of mycotic infection in people having lower education level. This

finding was in agreement with a study reported by Szepietowski.<sup>28</sup> We have also demonstrated that the presence of history of mycotic infection in family is a risk factor for mycotic infections.

In our study, the increased risk of mycotic infections was also observed in patients with diabetes mellitus, as has been reported elsewhere.<sup>29</sup> The prevalence of mycotic infection in the group with vascular disease was higher than that in the group without vascular disease. However, no significant association was determined between vascular disease and mycotic infection.

There is a limitation of the present study. We did not investigate the factors that might affect superficial mycotic infections such as the history of contact with soil or animals and patients' occupations.

In conclusion, age, gender, education level, history of mycotic infection in family, and diabetes mellitus appeared to be associated with the occurrence of superficial fungal elements. The results of the present study also indicated that the distribution of superficial mycotic infections in our hospital is similar to the literature reports. Knowledge on distribution of mycotic agents and the associated risk factors may help to decrease the prevalence and transmission of mycotic infections.

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