

The Distribution of Isolated Dermatophytes from the Cases with Dermatophytosis During Two Years Period Admitted to the Mersin University

Mersin Üniversitesine Başvuran Dermatofitozlu Olgularda İki Yıllık Periyoda Ait Dermatofit Dağılımı

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Geliş Tarihi/Received: 20.12.2011
Kabul Tarihi/Accepted: 28.11.2012

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ABSTRACT Objective: The distribution of dermatophytes varies depending on social and geographical factors. Detecting the dermatophyte species is important to prevent their transmission and is essential for choosing appropriate treatment. The aim of the present study was to determine the causative agents of dermatophytoses among patients examined in Mersin University. **Material and Methods:** A total of 506 patients clinically suspected for dermatophytosis, 258 females and 248 males, were evaluated for the study. A total of 544 samples, taken from different sites of 506 patient's bodies, were examined by direct microscopy with an aqueous solution of 10% potassium hydroxide and were also cultured on Sabouraud dextrose agar, then evaluated irrespective of the negative or positive examination result. **Results:** Out of 506 subjects, 338 (66.79%) patients were affected with dermatophytoses and 366 (67.3%) samples taken from these patients were found to be positive according to the results of direct microscopy and/or culture. *Trichophyton rubrum* (67.04%) was the most frequent isolate followed by *Trichophyton mentagrophytes* (23.86%), *Epidermophyton floccosum* (4.54%), *Trichophyton tonsurans* (3.4%), *Microsporum gypsum* and *Microsporum canis* (0.56% for each). According to the anatomic site involvement of dermatophyte infections, tinea pedis (59.01%) was the most common manifestation of infection, followed by tinea unguium (26.77%), tinea inguinalis (7.37%), tinea corporis (4.37%), tinea capitis (1.09%); tinea manum (1.09%) and tinea fasciei (0.27%). **Conclusion:** Our results were compared to those of the other last studies on dermatophytes in Turkey: It is similarly observed in our study that the most common dermatophytosis is tinea pedis and the most common agent is *T. rubrum*.

Key Words: Dermatomycoses; tinea; trichophyton

ÖZET Amaç: En sık fungal enfeksiyon ajanı olan dermatofitlerin dağılımı coğrafik ve sosyal faktörlere göre değişim gösterebilmektedir. Dermatofit türlerinin saptanması, fungal enfeksiyonların yayılımının önlenmesi ve uygun tedavinin belirlenmesinde önemlidir. Çalışmamızın amacı Mersin Üniversitesi'ne başvuran dermatofitozlu hastalarda etken dermatofit türlerinin belirlenmesi idi. **Gereç ve Yöntemler:** 2008-2010 yılları arasında kliniğimize başvuran 258'i kadın, 248'i erkek toplam 506 dermatofitoz şüphesi olan hasta değerlendirmeye alındı. 506 hastanın farklı vücut bölgelerinden alınan 544 örneğin tümü %10'luk potasyum hidroksid ile direkt mikroskopide incelendikten sonra sonucun negatif veya pozitif olmasına bakılmaksızın Sabouraud kültür ortamında incelenerek değerlendirildi. **Bulgular:** Direkt mikroskopi ve/veya kültür sonucuna göre 506 hastanın 338 (%66,7)'inde; bu hastalardan elde edilen örneklerin 366 (%67,3)'ünde dermatofit etkeni saptandı. *Trichophyton rubrum*, %67,04 oranı ile en sık izole edilen etken olarak belirlendi. İzole edilen diğer dermatofitler sırasıyla: *Trichophyton mentagrophytes* (%23,86), *Epidermophyton floccosum* (%4,54), *Trichophyton tonsurans* (%3,4), *Microsporum gypsum* (%0,56) ve *Microsporum canis* (%0,56) olarak kaydedildi. Anatomik bölgelere göre ele alındığında; tinea pedis (%59,01) en sık rastlanan dermatofitoz olarak saptandı. Bunu sırasıyla tinea unguium (%26,77), tinea inguinalis (%7,37), tinea corporis (%4,37), tinea capitis (%1,09); tinea manum (%1,09) ve tinea fasiei (%0,27) izledi. **Sonuç:** Çalışmamızda, Türkiye'de yapılan diğer dermatofit çalışmalarının sonuçlarıyla karşılaştırıldığında; benzer şekilde tinea pedisin en sık rastlanılan dermatofitoz olduğu ve en sık rastlanılan etkenin de *T. rubrum* olduğu gözlemlendi.

Anahtar Kelimeler: Dermatomikozlar; tinea; trikofiton

Dermatophytes are fungi that cause superficial infections of the skin, hair, and nails. They are divided into three genera: *Epi-dermophyton*, *Microsporum* and *Trichophyton*. Dermatophytes are the most common agents of fungal infections worldwide.^{1,2} The distribution of dermatophytes varies in different countries depending on social, environmental and geographical factors and may change with the passage of time.¹⁻³

Dermatophytoses are considered to be one of the major public health problems in the world and are common especially in tropic climates. The average summer temperature ranges from 30 to 35°C with high humidity which is up to 80-90% in Mersin. We investigated the dermatophyte species causing superficial mycoses of skin, hair and/or nails among patients examined in the Department of Dermatology of Mersin University.

MATERIAL AND METHODS

A total of 506 patients clinically suspected for dermatophytosis, 258 (51%) females and 248 (49%) males were examined between May 2008 and May 2010.

Samples, consisting of scales and scrapings, were taken from different sites of patient's body. The samples taken from foot skin were identified according to the type of lesion: TP1 for intertriginous type; TP2 for squamous hyperkeratotic type and TP3 for vesiculobullous type. A total of 544 samples were collected from 506 patients for mycological analysis. These samples were examined by direct microscopy with an aqueous solution of 10% potassium hydroxide (KOH).

A portion of each sample was placed on a slide and a drop of KOH was added. After 10-15 min, the wet preparation was examined under low (x100) and high (x400) magnification. All samples from clinically suspected cases were cultured irrespective of the negative or positive examination result. Cultures were performed on Sabouraud dextrose agar containing chloramphenicol and cycloheximide (bioMérieux, S.A., Marcy l' Etoile, France). Plates were incubated at 25-28°C for 21 days and were examined twice

weekly. Incubation of plates showing no growth in 21 days was prolonged for one additional week before discarding them. Identification of the fungi isolated was based on the macroscopic and microscopic characteristics of the colonies, urea testing, growth on *Trichophyton* agars and hair perforation assays. Cutaneous and adnexal infections caused by nondermatophytic fungi including yeasts or molds were not considered in this investigation.

RESULTS

Out of a total of 506 clinically suspected tinea cases, 338 (66.79%) patients yielded positivity for dermatophytes by direct microscopy and/or culture. Of the 338 proven cases 186 (55.02%) were mycologically positive only by direct microscopy, 7 (2.07%) were positive only by culture and 163 (48.22%) were positive by both methods. One hundred and seventy-seven (52.4%) of the 338 patients were males and 161 (47.6%) were females. The mean age was 46.71±16.02.

Out of 544 clinical specimens obtained from 506 patients with clinical signs of dermatophytoses, 366(67.3) specimens were mycologically positive by microscopy and/or culture (Table 1). Of the specimens, 359(66 %) were found to be positive by direct microscopic examination; 176 (32.4%) cases were positive by culture and 169 were positive by both methods.

Six dermatophyte species were isolated in the study. The most common dermatophyte isolated from the cultures was *T. rubrum* with a rate of 67.04%; followed by *T. mentagrophytes* (23,86%), *E. floccosum* (4.54%), *T. tonsurans* (3.4%), *M. gypseum* and *M. canis* (0.56% for each). With the exception of tinea capitis, in which *T. mentagrophytes* was the predominant isolate; *T. rubrum* was found to be the main causative agent in all forms of dermatophytoses (Table 1).

According to the anatomic site involvement of dermatophyte infections, Tinea pedis (59.01%) was the most frequent clinic form of dermatophytosis, followed by tinea unguium (26,77 %), tinea inguinalis (7.37 %), tinea corporis (4.37%), tinea capi-

TABLE 1: Correlation between mycological and clinical findings.

Tineas	DM [§] +; culture-	Aetiological agent*						Total isolation
		Tr	Tm	Tt	Ef	Mg	Mc	
Tinea pedis 1	6	3	2	-	-	-	-	5
Tinea pedis 2	53	36	5	2	2	-	-	45
Tinea pedis 3	50	39	13	4	1	-	-	57
Tinea unguium	63	21	11	3	-	-	-	35
Tinea inguinalis	8	11	4	-	4	-	-	19
Tinea corporis	7	6	1	-	1	1	-	9
Tinea manum	2	2	-	-	-	-	-	2
Tinea capitis	-	-	2	1	-	-	1	4
Tinea fasciei	1	-	-	-	-	-	-	0
[†] Total	190	118 (67.04%)	38 (21.59)	10 (5.68%)	8 (4.54%)	1 (0.56%)	1 (0.56%)	176

†: The 366 positive samples were derived from 338 patients, as 190 samples yielded positivity only by direct microscopy. §: DM, direct microscopy; *: Aetiological agent; Tr, Trichophyton rubrum; Tm, T. mentagrophytes; Tt, Trichophyton tonsurans; Ef, Epidermophyton floccosum; Mg, Microsporum gypsum; Mc, Microsporum canis.

tis (1.09%), tinea manum (1.09%), and tinea fasciei (0.27%) (Table 2).

The most common type of tinea pedis infection was intertriginous type (TP1) (50%); followed by squamous hyperkeratotic type (TP2), (45%), vesiculobullous type (TP3) (5%).

Among 338 patients diagnosed as with tinea infection, 22 patients (6.5%) had both infections simultaneously. All of them had tinea pedis; of these 20 patients had concomitant infection of the nail and 2 patients had infection of the groin.

Out of the 20 patients with nail infection, the patients number with TP1 or TP2 were more than the patients with TP3. The difference between them was statistically significant (p<0.05).

The frequency of dermatophytosis was significantly higher in the 15-64 year age group (83.88%) than the “over 65 year” age group and the 0-14 year age group (12.84% and 3.28% respectively; p<0.05) (Table 3).

DISCUSSION

Dermatophytes are the most common aetiological agents isolated from superficial cutaneous mycoses. Epidemiological studies concerning dermatophyte infections have been performed in many countries and differences in the incidence and the aetiological agents have been reported in different geo-

TABLE 2: Frequency of tineas in the study group.

Tineas	No	%
Tinea pedis	216	59.01
Tinea unguium	98	26.77
Tinea inguinalis	27	7.37
Tinea corporis	16	4.37
Tinea capitis	4	1.09
Tinea manuum	4	1.09
Tinea fasciei	1	0.27
Total	366	100

TABLE 3: Classification of the various dermatophytosis in relation to sex and age.

Tineas		0-14 year	15-64 year	65+ year	Total
		age group (n=12)	age group (n=307)	age group (n=47)	
Tinea pedis	(M/F)	3/2	97/86	16/12	116/100
Tinea unguium	(M/F)	1/0	38/42	10/7	49/49
Tinea manum	(M/F)	0/0	3/1	0/0	3/1
Tinea corporis	(M/F)	0/0	9/7	0/0	9/7
Tinea inguinalis	(M/F)	2/0	14/9	1/1	17/10
Tinea capitis	(M/F)	1/3	0/0	0/0	1/3
Tinea fasciei	(M/F)	0/0	1/0	0/0	1/0
Total	(M/F)	7/5	162/145	27/20	196/170

graphical locations.⁴⁻¹⁰ These studies have been demonstrated that an increase in the incidence of *T. rubrum* over the last few decades has been de-

tected in many countries including Turkey.^{7-9,11,12} Our present study also showed that *T. rubrum* has been isolated from 67.04% of culture positive cases and was the commonest organism on all body sites except the scalp.

T. rubrum was not so prevalent in Turkey in the past. In the studies performed in the 1950s, *Tr. schoenleinii* was the most common dermatophyte in Turkey.^{13,14} In 1956 in a study performed on tinea unguium, Aksungur and Demirörs reported that *E. floccosum* was the most frequent dermatophyte isolated, affecting 45% of the cases; while *T. rubrum* represented 1% of the cases. In his another study conducted 10 years later at the same region, he reported *T. rubrum* to be the main aetiological agent.¹⁵ After the 1970s an increase in the prevalence of *T. rubrum* has occurred. *T. rubrum* was isolated at a rate of 36.7-93.8% and was found to be over 50% in many studies in different regions of Turkey. In these studies; the factors such as old age, male sex, keeping an animal, low education level, diabetes mellitus, HIV infection, rheumatoid arthritis, soldiering, being forestry workers and farmers, performing ablution, living in boarding school were reported as predisposing factors.¹⁶⁻²⁶

T. rubrum was reported as 8.6-93.8% in the world literature; usually as the most prevalent agents of dermatophytoses.^{10-12,18,27} The reason for this could be partially attributed to the fact that *T. rubrum* spores can remain viable for long periods and it seems that widespread migration facilitates the spreading of the infection. In some other surveys: *M. canis* in Spain, *T. mentagrophytes* in Italy, *E. floccosum* in Iraq and *T. tonsurans* in USA have been reported as the predominant dermatophyte agents.²⁷⁻³⁰

Various studies have indicated that in Turkey *T. mentagrophytes* was reported to be the second predominant species causing tinea infections. It has been reported as a rate of 4.5-42.9% frequency.^{8,18,21,31-34} Our study also showed that *T. mentagrophytes*, with 21.59% of total isolation, has been the second most frequent aetiological agent of different tinea types.

The third common isolated dermatophyte in Turkey was reported as *E. floccosum*, *T. violaceum* or *M. canis*.^{3,17-24} In our study, *E. floccosum* was the third most common agent with a rate of 4.54%, a finding that is similar to those reported from Denizli, Konya, İstanbul.^{17,33,35}

We detected the rate of *T. tonsurans* to be 3.4%. All cases of which pathogens were *T. tonsurans* have been observed to be tinea pedis or tinea unguium.

M. canis and *M. gypseum*, each one was isolated in only one case.

According to the anatomic site involvement of dermatophyte infections, we observed that tinea pedis (59.01%) was the most common manifestation of infection, followed by tinea unguium (26.77%), tinea inguinalis (7.37%), tinea corporis (4.37%); tinea capitis and tinea manum (1.09% per each); tinea fasciei (0.27%).

TINEA PEDIS

In Turkey, tinea pedis is the most common dermatophytosis.^{3,7,8,16-18,33,34} Our results are in agreement with those other studies from Turkey and some studies from Jordan, Brazil, New Zealand, Japan, Germany, Spain.^{4-6,9,11,27}

Concerning the incidence of tinea pedis, widely varying figures have been recorded by authors from different countries.^{18,28,29,36-38} These variations could be attributed to climatic and hygienic conditions.

The frequency of tinea pedis in our patients is one of the highest in the world. The high prevalence of tinea pedis observed in our study is compatible with the climatic condition of which characteristic feature is high temperature and high humidity especially in long lasting summer period.

The pattern of tinea pedis infection varies depending on location, the strains of endemic dermatophytes, cultural habits and migration. The intertriginous form was the most frequently found type of tinea pedis in our study. This may have been due to the moist condition of the feet and occlusion caused by the high temperatures and religious habits such as performing ablution.

Our study has indicated *T. rubrum* and *T. mentagrophytes* respectively to be the predominant species causing tinea pedis. This is in agreement with observations made in many studies in Turkey and similar reports from several parts of the world.^{4,8,9,16,21,24,26,31-33,37}

TINEA UNGUIUM

Tinea unguium is a common dermatophytosis in many part of the world including Turkey. It has been demonstrated to account for 38-85% of onychomycosis in the studies performed in our country.^{8,17,31,39,40} In a study lastly performed in Istanbul; it was found out that onychomycosis was the first common superficial mycoses, 74% of which the dermatophytes were responsible.³⁵ Tinea unguium detected as the first common agent in Greece and in Lebanon; second in Spain; third in Jordan and Poland.^{4,10,37,38,41}

We found the frequency of tinea unguium with the 26.77% rate as the second most common type of dermatophytosis in a parallel manner of the frequency of tinea pedis that is to say the infection started as a tinea pedis and then involved toe nails. The higher infection rate with tinea unguium can also be explained by a greater concern on the part of the patients to seek medical attention for unguinal dystrophies, leading to an increase in the diagnosis of tinea unguium. The co-occurrence of tinea unguium and tinea pedis is a frequent phenomenon.^{14,16,36} In our study, out of 98 cases with nail infection, 20 patients had concomitant infection of the foot. These data are comparable with that of Şahin et al. from Düzce, in North of Turkey.³⁴ It was noted that the association of tinea unguium and intertriginous type or squamous hyperkeratotic type tinea pedis was more common than that of the vesiculobullous type. In Turkey, before 1960s, the most common agent of tinea unguium was *E. floccosum*. Nowadays, *T. rubrum* has been the most common species followed by *T. mentagrophytes* and respectively *E. floccosum*.^{8,15,31,39} Comparing this results with those from different countries; Kazemi found only two cases of *T. rubrum* infection among 41 cases with tinea unguium in North-West of Iran while other many authors have found

T. rubrum to be the principle or one of the main dermatophyte in other countries.^{3,10,37,39,42} Gupta et al. reported that *T. mentagrophytes* was the main etiological agent followed by *T. rubrum* in tinea unguium.⁴³ According to the idea of some authors, all dermatophyte species are probably capable of nail invasion; therefore it is probable that the incidence of dermatophyte species in tinea unguium reflects their prevalence in that region of the world.⁴⁴ Our results and many other epidemiologic studies are also in agreement with this that *T. rubrum* followed by *T. mentagrophytes* were the most frequently isolated fungus from tinea unguium in Turkey.^{20,22,31}

TINEA INGUINALIS

According to the reports from Turkey, tinea inguinalis was found to be the third or fourth common dermatophytic infection.^{18,23,33,34,45}

We found it to be 4.54%; as the third most common infection. A study from eastern Anatolia revealed that tinea inguinalis was the first dermatophytosis and a study from Ankara it was reported to be second.^{46,47} A study from India, tinea inguinalis was reported to be the most common dermatophytic infection while various studies in Japan, Iraq, Brazil and China reported it to be the second or third in prevalence.^{9,29,48-50}

E. floccosum is the most frequent aetiological agent of tinea inguinalis in most parts of Turkey as being in most parts of the world.^{2,8,17,24-26,46,47,51,52} However in the present study, among the dermatophytes causing tinea inguinalis *T. rubrum* had the highest frequency, while both *E. floccosum* and *T. mentagrophytes* were the second most common pathogens.

The frequency rate of tinea inguinalis was higher in males than in females, which is in accordance with the reports that tinea cruris is a dermatophytoses that is almost exclusively found in males.^{8,51}

TINEA CORPORIS

Tinea corporis was the fourth common dermatophytosis in our study and accounted for 4.37% of all infections. *T. rubrum* was the major isolate causing

tinea corporis in this study. *T. mentagrophytes* was the other most common pathogen in tinea corporis reported from Turkey by other authors.^{17-19,35}

Various studies from Poland, Iraq, Spain, Brazil and China have indicated that tinea corporis was reported to be the most common dermatophytosis.^{10,29,41,49,50} *E. floccosum* was isolated in Iraq; *M. canis* was in Spain; *T. rubrum* was in Brazil and China; *T. mentagrophytes* was in Poland, in these studies.

TINEA CAPITIS

Tinea capitis is most prevalent in Africa, Asia, and Southern and Eastern Europe.^{1,2,53-55} Many studies in Iran have demonstrated that tinea capitis was the most prevalent dermatophytosis of which most frequent causative agents were reported as *M. canis* and *T. violaceum*.^{51,55,56} In the studies performed in Europa and in Middle East; especially in Mediterranean countries, *M. canis* has been demonstrated to be the mainly isolated pathogen of tinea capitis in last years.^{53,55-58}

In Turkey, before 1970s tinea capitis was an important health problem, represented 39% of superficial mycosis, and *T. schoenleini* was the primary cause of tinea capitis.^{13,14} After long lasting studies on treating of it a significant decrease in the incidence of *T. schoenleini* in the last few decades has been observed. Nowadays, *T. schoenleini* is observed sporadically especially in the rural areas of middle and eastern Anatolia. The other agents of tinea capitis varies from region to region: *T. violaceum*, *M. canis*, *T. verrucosum* have been reported as the most common agents of tinea capitis: *M. canis* mostly in Aegean Anatolia, *T. violaceum* in Mediterranean and southeast Anatolia; *T. verrucosum* in middle and eastern Anatolia regions.^{35,54,58}

Tinea capitis is predominantly a disease of preadolescent children.⁵⁹ In our present study, the frequency of tinea capitis was detected as 1.09% and all cases were below 14 years of age.

Comparing our results with those from different studies; we isolated *M. canis* in one of four cases, while some other authors have found *M. canis* to be the principle or one of the main dermatophyte responsible for tinea capitis. *T. mentagrophytes* was isolated in two cases. *T. mentagrophytes* is the frequent causes of tinea capitis in Poland and Italy, as in Çukurova region, including Mersin.^{10,28,58}

T. violaceum was not isolated which is known to be one of the most frequent pathogen of tinea capitis in our region but the number of our cases with tinea capitis were not sufficient for a rationalist comment.

In this study, dermatophytoses was found to be more frequent in 15-64 year age groups. The number of male cases was higher than the females. Higher frequency in males may be because of being more exposed to outdoors with greater physical activity and are more prone to trauma. In the cases with tinea inguinalis the number of male patients was twofold of the females. It could be explained by the anatomical differences between two sex.

The number of cases was not sufficient for all types of tinea for the statistical analysis according to the age distribution. When the cases will reach the sufficient number for the statistical analyses, we are planning to present these data in a new study in the future.

As a result, *T. rubrum* was determined as the most frequently isolated dermatophyte and tinea pedis was the most frequently observed clinical form in our study. Knowledge on the ecology of dermatophytes is helpful, both in tracing the source of infection and in preventing reinfection. Detecting the dermatophyte species is also important for choosing appropriate anti-mycotic agents for treatment. Therefore, periodic epidemiological investigations are required which has an important role to prevent and reduce the incidence of dermatophytoses by early and accurate diagnosis.

REFERENCES

- Havlickova B, Czaika VA, Friedrich M. Epidemiological trends in skin mycoses worldwide. *Mycoses* 2008;51(Suppl 4):2-15.
- Hay RJ, Moore MK. *Mycoses*. In: Burns T, Breathnach S, Cox N, Griffiths C, eds. *Rook's Textbook of Dermatology*. 7th ed. Oxford: Blackwell Scientific Publications, 2004. p.31.1-31.101.
- Dursun R. [Superficial and deep fungal infections of the skin: Epidemiologic characteristics in the world and Turkey]. *Turkiye Klinikleri J Dermatol-Special Topics* 2008; 1(2):3-12.
- Abu-Elteen KH, Abdul Malek M. Prevalence of dermatophytoses in the Zarqa district of Jordan. *Mycopathologia* 1999;145(3):137-42.
- Chinelli PA, Sofiatti Ade A, Nunes RS, Martins JE. Dermatophyte agents in the city of São Paulo, from 1992 to 2002. *Rev Inst Med Trop Sao Paulo* 2003;45(5):259-63.
- Singh D, Patel DC, Rogers K, Wood N, Riley D, Morris AJ. Epidemiology of dermatophyte infection in Auckland, New Zealand. *Australas J Dermatol* 2003;44(4):263-6.
- İlkit M. [Epidemiology of dermatophytes in Turkey]. *Türk Mikrobiyol Cemiyeti XXXII. Türk Mikrobiyoloji Kongresi Kitabı*. Birinci Baskı. Ankara: Sim Matbaacılık; 2006. p.243-58.
- Köktürk A, Delialioğlu N, Kaya Tİ, Baz K, İki-zoğlu G, Demirsiren DD, et al. [The dermatophyte flora of Mersin city]. *Turkiye Klinikleri J Dermatol* 2002;12(3):135-9.
- Kasai T; Epidemiological Investigation Committee for Human Mycoses in the Japanese Society for Medical Mycology. [1997 Epidemiological survey of dermatophytoses in Japan]. *Nihon Ishinkin Gakkai Zasshi* 2001; 42(1):11-8.
- Nowicki R. Dermatophytoses in the Gdańsk area, Poland: a 12-year survey. *Mycoses* 1996;39(9-10):399-402.
- Seebacher C. [The change of dermatophyte spectrum in dermatomycoses]. *Mycoses* 2003;46(Suppl 1):42-6.
- Shibaki H, Shibaki A. [Analysis of dermatophyte flora at a private clinic in Sapporo during the period 1992 to 2001]. *Nihon Ishinkin Gakkai Zasshi* 2003;44(3):209-16.
- Erkmen H. [About dermatophytes of our country]. *Türk Hij Tec Biyol Derg* 1958;18(2-3):275-81.
- Gürçan S, Tikveşli M, Eskiocak M, Kiliç H, Otkun M. [Investigation of the agents and risk factors of dermatophytosis: a hospital-based study]. *Mikrobiyol Bul* 2008;42(1):95-102.
- Aksungur L, Demirörs E. [Onychomycotic flora in the Middle Anatolia and the distribution of it according to age and sex]. *Journal of Ankara University Faculty of Medicine* 1967; 19(4): 820-32.
- İlkit M, Tanir F, Hazar S, Gümüşay T, Akbab M. Epidemiology of tinea pedis and toenail tinea unguium in worshippers in the mosques in Adana, Turkey. *J Dermatol* 2005;32(9):698-704.
- Ergin Ç, Ergin Ş, Kaleli İ, Erdoğan BŞ, Cevahir N, Kaçar N. The agents of dermatophytoses in patients attending the dermatology outpatient clinic of Pamukkale University Hospital. *Turk J Infect* 2004;18(3):339-42.
- Özhak B, Kaya Ç, Ögünç D, Öngüt G, Yerebakan Ö, Başaran E, et al. [Diagnosis and treatment of dermatophytoses of the patients in the dermatology department of Akdeniz University Hospital]. *Turk J Infect* 2005;19(2):229-33.
- Özbiçe H, Zeyrek FY, Mızraklı AU. [Dermatophytoses and dermatophytes in Şanlıurfa, Turkey]. *Turk J Infect* 2005;19(2):235-8.
- Aşçı Z, Kizirgil A, Seyrek A, Yılmaz M. [Causative agents of mycoses in the workers of Elaziğ Cement Factory]. *Turk J Infect* 1996;10(3):279-81.
- Celik E, İlkit M, Tanir F. Prevalence and causative agents of superficial mycoses in a textile factory in Adana, Turkey. *Mycoses* 2003;46(8):329-33.
- Saniç A. [Dermatophytes]. Ustaçelebi Ş, editör. *Temel ve Klinik Mikrobiyoloji*. Birinci Baskı. Ankara: Güneş Kitabevi; 1999. p.1031-43.
- Ozkutuk A, Ergon C, Yulug N. Species distribution and antifungal susceptibilities of dermatophytes during a one year period at a university hospital in Turkey. *Mycoses* 2007; 50(2):125-9.
- Taniş H, Aksoy G, Aşçı Z. The dermatophytic flora ratio of dermatophytes. *Tr J Medical Sciences* 1991;29(2):181-5.
- Metin A, Turanlı AY, Peksarı Y, Cantürk MT. [Dermatophytic flora in and around Samsun]. *Turkiye Klinikleri J Dermatol* 1997;7(1):27-32.
- Sürücüoğlu S, Türker M, Üremek H, Ellidokuz H, Kıpıcı A. [Evaluation of 660 cases of superficial fungal infection caused by dermatophytes and yeast species in Izmir area.]. *Turk J Infect* 1997;11(1):63-5.
- Padilla A, Sampedro A, Sampedro P, Delgado V. [Clinical and epidemiological survey of dermatophytoses in Jaen (Spain)]. *Rev Iberoam Micol* 2002;19(1):36-9.
- Aste N, Pau M, Aste N, Biggio P. Tinea pedis observed in Cagliari, Italy, between 1996 and 2000. *Mycoses* 2003;46(1-2):38-41.
- Muhsin TM, al-Rubaiy KK, al-Duboon AH. Characteristics of dermatophytoses in Basrah, Iraq. *Mycoses* 1999;42(4):335-8.
- Weitzman I, Summerbell RC. The dermatophytes. *Clin Microbiol Rev* 1995;8(2):240-59.
- Değerli K, Kurutepe S, Sezgin C, Ecemiş T, Özbakkaloğlu B. [Agents of onychomycosis in and around Manisa]. *Turk J Infect* 2001;15(3): 345-8.
- Yeğenoğlu Y. [Evaluation of dermatophytosis agents in the patients of our clinic in the last one year]. *Turkderm* 1996;30(Suppl):16-8.
- Findik D, Mevlutoğlu İ, Kaya M, Arslan U, Yüksel A. [The agents isolated from the cases with the prediagnosis of dermatophytosis in the mycology laboratory of Selçuk University Medical Faculty, in the period of 1994-2000]. *Journal of Adnan Menderes University Medical Faculty* 2001;2(2):19-22.
- Sahin I, Oksuz S, Kaya D, Sencan I, Cetinkaya R. Dermatophytes in the rural area of Duzce, Turkey. *Mycoses* 2004;47(11-12): 470-4.
- Koksal F, Er E, Samasti M. Causative agents of superficial mycoses in Istanbul, Turkey: retrospective study. *Mycopathologia* 2009; 168(3):117-23.
- Perea S, Ramos MJ, Garau M, Gonzalez A, Noriega AR, del Palacio A. Prevalence and risk factors of tinea unguium and tinea pedis in the general population in Spain. *J Clin Microbiol* 2000;38(9):3226-30.
- Maraki S, Tselentis Y. Dermatophytoses in Crete, Greece, between 1992 and 1996. *Mycoses* 1998;41(3-4):175-8.
- Araj GF, Racoubian ES, Daher NK. Etiologic agents of dermatophyte infection in Lebanon. *J Med Liban* 2004;52(2):59-63.
- Kiraz M, Yeğenoğlu Y, Erturan Z, Anç O. The epidemiology of onychomycoses in Istanbul, Turkey. *Mycoses* 1999;42(4):323-9.
- Aksungur L. Dermatophytic flora of tinea capitis of eastern Anatolia. *Turk J Pediatr* 1968; 10(2):23-31.
- Fortuño B, Torres L, Simal E, Seoane A, Uriel JA, Santacruz C. [Dermatophytes isolated in our clinics. 5-year-study in Zaragoza]. *Enferm Infecc Microbiol Clin* 1997;15(10):536-9.
- Kazemi A. Tinea unguium in the north-west of Iran (1996-2004). *Rev Iberoam Micol* 2007; 24(2):113-7.
- Gupta AK, Ryder JE, Summerbell RC. Onychomycosis: classification and diagnosis. *J Drugs Dermatol* 2004;3(1):51-6.
- Alberhasky RC. Laboratory diagnosis of onychomycosis. *Clin Podiatr Med Surg* 2004; 21(4):565-78, vi.

45. Çetin M, Serarslan G, Balcı DD, Turhan E. An epidemiological study of superficial fungal infections in university hospital, Hatay. *Türkiye Klinikleri J Dermatol* 2009;19(2):73-8.
46. Özel MF, Mete M, Mete Ö, Gül K, Suay A. [Dermatomycosis agents in and around Diyarbakır]. *Turkish Journal of Infection* 1996; 10(3): 275-8.
47. Kuştimur S, El-Nahi H. [Dermatomycosis agents isolated from Balgat and surrounding areas, Ankara]. *Türk Mikrobiyol Cem Derg* 1993;23(1):116-8.
48. Sentamilselvi G, Kamalam A, Ajithadas K, Janaki C, Thambiah AS. Scenario of chronic dermatophytosis: an Indian study. *Mycopathologia* 1997-1998;140(3):129-35.
49. Costa TR, Costa MR, da Silva MV, Rodrigues AB, Fernandes Ode F, Soares AJ, et al. [The etiology and epidemiology of dermatophytoses in Goiânia, GO, Brazil]. *Rev Soc Bras Med Trop* 1999;32(4):367-71.
50. Suo J, Li H, Liang J, Chen S, Yu R. [Study of dermatomycosis and survey of pathogens in troops of Hainan area]. *Wei Sheng Wu Xue Bao* 1997;37(4):316-8.
51. Aghamirian MR, Ghiasian SA. Dermatophytoses in outpatients attending the Dermatology Center of Avicenna Hospital in Qazvin, Iran. *Mycoses* 2008;51(2):155-60.
52. Omar AA. Importance of mycological confirmation of clinically suspected cases of tinea corporis, tinea pedis and tinea cruris. *J Egypt Public Health Assoc* 2004;79(1-2):43-58.
53. Romano C. Tinea capitis in Siena, Italy. An 18-year survey. *Mycoses* 1999;42(9-10):559-62.
54. Altindis M, Bilgili E, Kiraz N, Ceri A. Prevalence of tinea capitis in primary schools in Turkey. *Mycoses* 2003;46(5-6):218-21.
55. Khosravi AR, Aghamirian MR, Mahmoudi M. Dermatophytoses in Iran. *Mycoses* 1994;37(1-2):43-8.
56. Omidynia E, Farshchian M, Sadjjadi M, Zamanian A, Rashidpouraei R. A study of dermatophytoses in Hamadan, the governmentship of West Iran. *Mycopathologia* 1996;133(1):9-13.
57. Svejgaard EL. Epidemiology of dermatophytes in Europe. *Int J Dermatol* 1995;34(8):525-8.
58. Gümüşay T, Ilkit M. Epidemiology of tinea capitis in Ceyhan district, Adana in Cukurova region, Turkey. *Mycoses* 2006;49(4):346-9.
59. Lange M, Nowicki R, Barańska-Rybak W, Bykowska B. Dermatophytosis in children and adolescents in Gdansk, Poland. *Mycoses* 2004;47(7):326-9.