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THE PREVALENCE OF SUPERFICIAL MYCOSIS (TINEA PEDIS AND ONYCHOMYCOSIS) IN ELEMENTARY SCHOOL CHILDREN IN ISTANBUL

İSTANBUL' DA İLKÖĞRETİM ÇAĞINDAKİ ÇOCUKLARDA YÜZEYEL MİKOZ (TİNEA PEDİS VE ONİKOMİKOZ) PREVALANSI

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ABSTRACT

Objective: The purpose of this study was to determine the prevalence of tinea pedis and onychomycosis in children of elementary school age and to examine socio-demographic features that might influence the existence of both types of mycosis.

Materials and methods: A total of 3390 female and 3768 male children aged between 6 and 14 years have been examined in seven schools. Skin scrapings and nail samples were taken from 13 students who were suspected to have tinea pedis and from 49 students who were suspected to have onychomycosis. Suspicious skin scrapings and nails were clarified in 10-15% KOH + calcofluor white through the direct microscopic method and then examined under a fluorescent microscope and assessed as positive or negative according to the existence of mycelium and / or spores. Afterwards, these samples were placed on test cultivation places onto SDA and DTM and incubated for a period of 21 days at 26-30^{0}C.

Results: 11 students were diagnosed as tinea pedis and 24 were diagnosed as onychomycosis. Trichpohyton rubrum was isolated from 3 students with tinea pedis whose culture was positive, and five Candida albicans, five Candida glabrata and one Candida tropicalis cases were isolated from 11 samples with onychomycosis. Tinea pedis prevalence has been found to be 1.5% and onychomycosis prevalence has been found to be 3.3%. Differences between onychomycosis prevalence based on age have been found to be statistically significant ($p<0.001$).

Conclusion: In conclusion, it has been determined that the prevalence of tinea pedis and onychomycosis among children is low. Candida spp. was isolated from all of the 14 samples diagnosed as onychomycosis. Our study shows similar results with previous studies done in Turkey and T.rubrum continues to be the most common isolated agent.

Key words: Tinea pedis, onychomycoses, superficial mycoses, epidemiology, elementary school children

INTRODUCTION

The real prevalence rate of tinea pedis and onychomycosis is not known because patients do not seek a medical advice unless their quality of life is affected, as these are not life threathening diseases (14, 29). This may be one of the reasons why we see differences in prevalence rates among various studies. Other factors are the differences in methodology, population sample (healthy general population or dermatological patients) and sample size in these studies (29, 30). According to Elewski (14) onychomycosis prevalence in the USA is 2 to 3 %. In Spain, tinea pedis prevalence is 2.9% and onychomycosis prevalence is 2.8 % in general population (30). Onychomycosis prevalence varies from 0% in the USA, Wales and Finland to 2.6% in Guatemala (12)

Tinea pedis and onychomycosis prevalence rates are also affected by social status, occupation, climate, travel, living environment, age, and predisposing factors. Tinea pedis and onychomycosis are rarely seen in children. Gupta et al. (18) reports that the prevalence rates in children are 30 times less than those in adults.

In this study, we aimed to estimate the prevalence rates, etiology and the effect of age, sex and social status on the prevalence rates of tinea pedis and onychomycosis in elementary schools in Istanbul.

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Table 1. Questionnaire results in schools with different socio-economical status

Socio-economical status	H level (n= 200)		M level (n=200)		L level (n=300)		Total (n=700)		p value
	n	%	n	%	n	%	n	%	
Educational level of mother									
≤ 5 year	144	72	154	77	-	-	298	42.5	p <0.001
> 5 year	56	28	46	23	300	100	402	57.5	
Educational level of father									
≤ 5 year	164	82	176	88	102	34	442	63.1	p<0.001
> 5 year	36	18	24	12	198	66	258	36.9	
House									
Self belonging	160	80	116	58	234	78	510	72.8	p>0.05
Leased property	40	20	84	42	66	22	168	27.2	
Monthly average income	750 million		250 million		175 million		298 million		p<0.001

H:High, M:Medium, L:Low
In April 2001 1 USD= 1 232 000 Turkish Liras (TL)

Table 2. Tinea pedis and onychomycosis according to age

Mycosis	Age≤11		(n=5090)	Age>11		(n=2068)	p_b
	n	%	(95% CI)	n	%	(95% CI)	
Tinea pedis	5	0.98	(0.73-1.29)	6	2.9	(1.1-6.3)	p=0.123
Onychomycosis	7	1.4	(0.6-2.8)	17	8.2	(4.8-13.1)	p<0.001

p: p value b: Yates' Chi Square test CI: confidence interval

MATERIALS and METHODS

Study population

This is a prospective study, carried out in Istanbul, between September 2000 and May 2002. Istanbul has a population of over ten million and it is the most crowded city in Turkey. For this study, seven elementary schools with different socio-cultural and economic status were selected by random sampling. Two schools with middle and higher socio-economic status were on the European side and two were on the Asian side. One school with lower socio-economic status was on the Asian side and two were on the European side. Istanbul Board of Education and the school managements gave the permission to carry out this study.

From each school, approximately 1000 students between the ages of 7 and 14 years were randomly selected and we had a study population of 7158 students. 100 students, ages 11 and up from each school (total 700) selected randomly (38) and filled a survey form about their socio-economic status. This survey helped us to evaluate the socio-economic differences between the schools. In the questionnaire there have been questions on the educational background of the parents, the situation of their residence and monthly income

Survey methods

The public health physicians, pediatricians and microbiologists from Istanbul University Medical Faculty did students' physical exams during the school hours. Any areas suspicious for tinea pedis and onychomycosis were first cleaned with 70% alcohol and then samples were taken from skin (by scraping) and nail. Specimens were collected into small sterile petri dishes and sent to Istanbul Universtiy Microbiology Department laboratory. Clinically suspected skin scrapings and nails were clarified in 10-15 % KOH + calcofluor white through the direct microscopic method and then examined under a fluorescent microscope and assessed as positive or negative according to the existence of mycelium and / or spores. Afterwards, these samples were placed on test cultivation places onto Saboraud dextrose agar (SDA) and dermatophyte test medium (DTM) and incubated for a period of 21 days at 26-30^{0}C

The identificaton and specification of the agents were made according to their morphological, microscopic and specific test characteristics of growing colonies.

Statistical methods

Statistical analyses were done at the Istanbul University Department of Public Health. The survey forms filled by 100 students from each school were statistically analyzed and the socio-economic differences between the schools were evaluated. Socio-economic status, mycosis prevalence according to

Table 3. Tinea pedis and onychomycosis according to sex

Mycosis	Female		(n=3390)	Male		(n=3768)	p_b
	n	%	(95% CI)	n	%	(95% CI)	
Tinea pedis	8	2.4	(1.0-4.0)	3	0.8	(0.2-2.3)	p=0.166
Onychomycosis	16	4.7	(2.7-7.2)	8	2.1	(0.9-4.2)	p=0.091

p: p value b: Yates Chi Square test CI: confidence interval

Tablo 4: Tinea pedis and onychomycosis according to socio-economic status

Mycosis	High SES		(n=2100)	Medium SES		(n=3768)	Low SES		(n=3228)	p_b
	n	%	(95% CI)	n	%	(95% CI)	n	%	(95% CI)	
Tinea pedis	2	1.0	(0.1-3.4)	3	1.6	(0.3-4.8)	6	1.9	(0.7-4.0)	p=0.421
Onychomycosis	4	1.9	(0.5-4.9)	5	2.7	(0.9-6.4)	15	4.6	(2.6-7.7)	p=0.152

p: p value, a: chi square test(for trend), SES: socio-economic status, CI: confidence interval

Table 5. Distribution of tinea pedis and onychomycosis according to direct microscopy, culture and isolated strains

Mycoses	s	m.pos.	m.pos. c. pos	m.neg. c. neg	Isolated strains			
					T.rubrum	C.albicans	C.glabrata	C.tropicalis
T. pedis and onychomycosis	13	8	3	-	3			
Finger	18	4	4	5		1	2	1
Toe	31	9	7	6		4	3	
Total	62	21	14	11	3	5	5	1

s: clinically suspicious students m.pos, c.pos: microscopic, cultural exam positive
m. neg., c. neg microscopic, cultural exam negative

age and sex, and 95% confidence interval were defined. Chi-square test was used in order to define the relationship between the categorized variables. P values less than 0.05 were considered as statistically significant.

RESULTS

In our study, tinea pedis prevalence was 1.5% and onychomycosis prevalence was 3.3%.

Tinea pedis prevalence was 1.8% for 5090 students aged 11 years and younger, 2.9% for 2068 students older than 11 years. Onychomycosis prevalence was 1.4% for students aged 11 years old and younger and 8.2% for students older than 11 years. For both tinea pedis and onychomycosis, the rates were higher in the students 11 years and over. The relationship between age and tinea pedis prevalence was not statistically significant, but the relationship between age and onychomycosis prevalence was highly significant (95% CI : 4.8-13.1, p<0.001) (Table 2).

In table 3, sex versus tinea pedis and onychomycosis prevalence is shown. The prevalence rates for both tinea pedis and onychomycosis were higher in females but these were not statistically significant. Three female students had co-existing tinea pedis and onychomycosis infection.

In table 4, tinea pedis and onychomycosis prevalence is displayed in schools with different socio-economical background. Although the prevalence rates in schools with lower socio-economic status were higher than those in the schools with middle and upper socio-economic status, the differences between prevalence rates in schools with any of three economic status were not statistically significant.

Of the samples taken from 13 students clinically suspicious for tinea pedis, 8 samples were diagnosed by direct microscopy and 3 samples were diagnosed by culture as tinea pedis. Trichopyton rubrum was isolated from these 3 samples.

49 students were found clinically suspicious for onychomycosis. Of the finger nail samples taken from 18 students, 4 samples were diagnosed by direct microscopy and the other 4 were diagnosed by both direct microscopy and culture as onychomycosis . From these samples; 1 Candida albicans, 2 Candida glabrata and 1 Candida tropicalis were isolated. Toe nail

samples were taken from 31 students and 9 of these samples were diagnosed as onychomycosis by direct microscopy, 7 samples were diagnosed as onychomycosis by both direct microscopy and culture. 4 Candida albicans and 4 Candida glabrata were isolated from these samples (Table 5).

DISCUSSION

In this research, the study population consisted of 7158 students between the ages of 6 and 14 years. 62% of these students were considered suspicious for mycosal infections after the physical examination and samples were taken. Twenty-one of the samples (33%) were diagnosed by direct microscopy and 14 of them were diagnosed by both direct microscopy and culture dermatpohyte and yeast Tinea pedis prevalence was 1.5%, onychomycosis prevalence was 3.3% (8 finger nails, 16 toe nails).

In studies carried out in school age children; Inanir et al. (19), Popescu et al. (31), Ekanem et al. (10), Bahamdan et al. (2), Schmeller et al. (34), Leibovici et al. (24) showed tinea pedis prevalence between 0 and 6.9%; Inanır (19), Ekanem (10), Schmeller (34) et al. showed onychomycosis prevalence between 0 and 0.2%. Gupta et al. (18) chose a study population among patients from a dermatology clinic and despite this, found a very low onychomycosis rate (0.44%) in children 18 years old and younger.

Our study shows similarities with other studies and low prevalence rates are also seen. However, in contrast to other studies, we found onychomycosis prevalence rate higher than the tinea pedis prevalence rate.

Tinea pedis prevalence was 1.8% for students aged 11 years old and younger, 2.9% for students older than 11 years. This was not statistically significant. Onychomycosis prevalence was 1.4% for students aged 11 years and younger and 8.2% for students older than 11 years which was highly significant ($p<0.001$). Ogasawara et al. (29), Leibovici et al. (24) Gupta et al. (18) show that tinea pedis and onychomycosis prevalence rate increased in children older than 10 years. In Spain, in general population tinea unguium prevalence rate increased as the age increased, but there was no such correlation with tinea pedis (30). In Australia, the tinea pedis prevalence rates were found 2.1% among 4 and 6 year-old children and 9.7% among 16 and 18 year-old adolescents (27).

Reddy et al. (32) and Jesudanam et al. (21) reported that the onychomycosis incidence rate was the highest among those who were 21 and 30 years old.

In a study performed in general population, onychomycosis incidence rate differences were highly significant between the ages 0 and 14, 15-34, and 35 and over (36).

Ogasawara et al. (29), Velez et al. (39) showed high prevalence rates in persons 50 years old and over. Reasons for the age-related increase in onychomycosis might include poor peripheral circulation, diabetes, repeated nail trauma, longer exposure to pathogenic fungi, suboptimal immune function, inactivity, inability to cut the toenails, or maintain good foot care (8, 13).

In our study, tinea pedis was seen in 2.4% of the female students and 0.8% of the male students. Onychomycosis prevalence was 4.7% in female students and 2.1 % in male students. The prevalence rates were higher in female students than those in males for both types of mycosis, but this difference was not statistically significant. It is known that tinea pedis and onychomycosis are seen more in males (29, 30, 32), but in contrast Jesudanam et al. (21), Bokhari et al. (4), Velez et al. (39), Blank et al. (3), Mercantini et al. (26) found higher prevalence rates in females.

According to some researchers, life style is a more important determinant than social status for tinea pedis and onychomycosis infections (29). They are seen more often in people who do wet work (14), use swimming pools, go to gyms (16), wear tight and close shoes (14,21), who are immunosuppressed, wash their feet frequently and in Muslim population as they need to wash their feet five times a day (24, 36) and in boarding school students (16). They are seen rarely in populations who do not wear shoes (11, 34). On the other hand, Inanır et al. (19), Metintas et al. (28), Enweani et al. (15 stressed that like in other skin infections, lower socio-economical status, bad hygiene, lower mother education levels and lower income were important factors for having cutaneous tinea infections.

In our study, tinea pedis prevalences in schools with different socio-economical status (higher, middle, and lower) were 1.0%, 1.6%, and 1.9%, respectively and onychomycosis prevalences were 1.9%, 2.7%, and 4.6%, respectively. These differences were not statistically significant, but especially the onychomycosis prevalence rates in lower socio-economical status schools were remarkable.

The reasons for superficial mycosis are dermatophyte, yeast and non-dermatophyte filamentous fungi. Yeast and non-dermatophyte filamentous fungi are resistant to antifungal medicines and the identification of their types are very important for infection control and public health. In the literature, we see that different dermatophyte types (etiological agents) show differences from year to year and region to region. These differences are due to geographical and climate conditions and immigration (1, 5, 9, 23).

In this study, tinea pedis was found in 11 samples and 3 of these were diagnosed by culture. T. Rubrum was isolated in all samples. Elewski et al. (14) mentioned T. rubrum as the major agent for tinea pedis and onychomycosis. In studies carried out in Turkey, Inanır et al. (19), Sahin et al. (36), Erbagcı et al. (16), Metintas et al.(28), Findik et al. (17) showed T. rubrum as the most common agent seen in dermatophytoses other than tinea capitis. In other studies carried out in different parts of the world, Trichophyton rubrum was also the most commonly isolated agent (4, 6, 12, 20, 23. 25, 27, 29, 30, 37, 39).

Candida spp. (5 C. albicans, 5 C. glabrata, 1 C. tropicalis) were isolated from all of the 14 samples diagnosed as onychomycosis. Candida albicans was the most common species causing candidal onychomycosis. According to Elewski et al.(14) and Crissey (7), unless there are immunsupression (acquired immunodeficiency syndrome, chemotherapy, congenital immunodeficiency syndromes), extensive cutaneous

mycosis (tinea capitis or pedis) or a strong family history of onychomycosis, it is very rare to see onychomycosis in children.

Tan (37) and Scher et al.(33) reported that candidal onychomycosis is seen more in finger nails than in toe nails and more in females than in males. Domestic activity involving wet work associated with constant trauma to the nails could probably explain higher prevalence among women (14). Candidal onychomycosis was the most prevalent clinical type (58. 82%) followed by distal subungual onychomycosis (21). In Lahor, candidal onychomycosis was reported as the most prevalent clinical type (6). In Poland, 69.8% of Tinea isolated from 14295 patients was Candida spp (35). Jesudanam et al.(21) isolated most commonly Candida spp.from finger nails and dermatophyte from toe nails. In Turkey, Kiraz et al.(22) showed that onychomycosis prevalence was the same in females and in males (44.6% and 44.4%, respectively) and Candida spp was the most commonly isolated agent from finger nails and Trichophyton rubrum was the most commonly isolated agent from toe nails.

CONCLUSION

The results of this study indicated that tinea pedis and onychomycosis are seen rarely in children. Tinea pedis and onychomycosis prevalence rates were higher in females with lower socio-economical status and in those above 11 years compared to males, to those with higher socio-economical status and to those below 11 years. The prevalence rate according to age was highly significant. T.rubrum was the agent isolated from T.pedis and Candida spp. was the agent isolated from onychomycosis. Our study showed similar findings with those of the previous studies done in Turkey and showed that T.rubrum continues to be the most common agent.

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