ORIGINAL ARTICLE

Prevalence and risk factors of tinea capitis and tinea pedis in school children in Turkey

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Abstract

Objective: To evaluate the prevalence and risk factors of tinea capitis and tinea pedis in school children in Turkey.

Methods: The study included 8122 students from 24 schools in the rural and urban areas around Kayseri, Turkey. We asked every student for their personal identification and also for their sanitation in order to get an idea about dermatophytosis. Samples taken from suspicious lesions were collected and inoculated onto Sabouraud dextrose agar slants. For identification of grown fungi, macroscopic appearance of colonies, microscopic examination and biochemical tests were used.

Results: There were 41 (0,5%) suspicious lesions in feet and 31 (0,3%) in scalp and 22 (0,2%) students were diagnosed as tinea pedis and 9 (0,1%) as tinea capitis by fungal culture. The predominant etiologic agents in feet were Trichophyton rubrum 8 (36%), Trichophyton mentagrophytes 1 (4%), Rhodotorula 8 (36%), Trichosporon 2 (9%), Candida glabrata 2 (9%), Candida albicans 1 (4%), while Trichophyton verrucosum 8 (88%) and Trichophyton mentagrophytes 1 (12%) were identified in scalp samples. School settlement was found as risk factors on the frequency of tinea pedis and capitis. Age and gender were also found as risk factors on the frequency of tinea pedis.

Conclusion: The results of this study demonstrate a low prevalence of tinea capitis and tinea pedis in school children of central Anatolia of Turkey. School settlenment is a very important factor affecting the prevalence of tinea capitis and pedis in school children in central Anatolia of Turkey.

Keywords: Prevalence, Tinea pedis, Tinea capitis, School children. (JPMA 64: 514; 2014)

Introduction

Tinea or dermatophytosis is a superficial fungal infection caused by invasion of keratinised tissues such as hair, nails and corneal layer of the skin by filamentous fungi called dermatophytes.[1] Tinea capitis is dermatophytic infestation of hair and scalp. It is common under the age of 12 and frequently seen in boys.[2] Tinea pedis is fungal infection of foot and is generally seen in adolescents and young population. It is rarely seen among children less than 4 years old.[3]

As dermatophytes remains the single most common cause of human fungal infections worldwide, and of those tinea capitis is the most contagious of all the tinea infection caused by dermatophytes, it is important to know the prevalence, route of transmission and risk factors of these infections for prevention and treatment of this disease.[4,5] The aim of the present study was to demonstrate the prevalence and risk factors of tinea capitis and pedis in the school children of Kayseri, Turkey.

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Subjects and Methods

The cross-sectional school-based epidemiological study was performed between April and June 2007 in Kayseri. The permission to conduct the study was obtained from the Governorship of Kayseri and parents of the children. The study was approved by the Erciyes University Ethics Committee in Kayseri. Kayseri is a city with a total of 139,422 school children and is settled in central Anatolia. The climate in Kayseri is cold, snowy and wet in winters, while it remains dry and hot in summer. The lowest and highest recorded temperature in Kayseri are minus 5.2 and plus 25.7 celcius (mean 7.73 degrees celcius). Mean humiditiy is 69.3%. A total of 8,122 elementary school children, aged 5-16 years, in Kayseri were selected by cluster sampling method and examined for the presence of tinea pedis and capitis. Clinical examination of feet and scalp was performed by a paediatrician. Each child's head was examined for broken hair and/or alopecia, scaling, crusting, desquamation, inflammation, capillary fragility after disinfection with a 70% alcohol solution; if such areas were apparent, a sample was obtained by vigorously rubbing the affected scalp with a cotton swab. Each child's feet were examined for desquamation and/or scaling, plantar fissures, discolouring, groove and when

tinea pedis was suspected, a sample from the feet skin and interdigitale surfaces was collected after disinfection with a 70% alcohol solution, by scraping with a sterile scalpel. The samples were preserved in transport medium and stored at 6-8°C until the processing of samples. Samples from suspected areas were examined directly with 15% potassium hydroxide (KOH) and cultured on Sabouraud dextrose agar (SDA) and SDA-containing chloramphenicol and cycloheximide, and SDA-containing only chloramphenicol. After incubation at 25 and 35°C, cultures were examined every other day for 4 weeks. Fungal isolates were identified based on the microscopic morphological and colonial characteristics in pure culture on SDA. Additional tests included those for the ability to produce a red pigment when the strains were grown on Potato Dextrose Agar (PDA) and for the ability physiologic tests (in vitro hair perforation test, special nutritional requiretments, urea hydrolysis, temperature tolerance and temperature enhancement test) in conjunction with morphology to identify the species correctly.[1] Isolated yeast which did not form germ tube were identified by the growing properties in corn-meal agar and by using ID 32°C (Bio-Merieuxi, Marcy l'Etoile, France).

Details recorded for each child included gender, age, school grade, number of siblings, parents' education level, parent's occupation status, family income, frequency of having bath (per week), animal husbandry and school settlement. The children aged 5-10 years old completed the questionnaire with the aid of the team, whereas older children did it alone. History of dermathophytic infections in parents were not evaluated.

Statistical analysis was conducted using SPSS 15.0. Categorical variables were defined as frequency and percentage and analysed using chi-square test. Multivariable logistic regression analysis was performed in which variables having a significant effect on tinea capitis and pedis were included using the Backward LR method. A p value less than 0.05 was accepted as statistically significant.

Results

A total of 8122 elementary school children, including 4032 (49.6%) boys and 4090 (50.4%) girls, with a mean age of 10.61 ± 2.41 (range 5-16) were examined (Table-1). The prevalence of tinea capitis and pedis were 31 (0.1%) and 41 (0.2%), respectively. There were 31 (0.38%) suspicious lesions on hair and 41 (0.50%) on foot. Of those, 9 (0.11%) were diagnosed as culture-positive tinea capitis and 22

Table-1: Socio-demographic features of children and risk factors affecting prevalence of tinea capitis and pedis in school children. # Poor income: having <300 USA dollar in a month; #fine income: having >600 USA dollar in a month.

Features		Total	Fungal culture (n) for tinea capitis				Fungal culture (n) for tinea pedis			
		(n)	Positive	Negative	Total	P-value	Positive	Negative	Total	P-value
Sex	Boys	4032	9	16	25	0.003	20	12	32	<0.001
	Girls	4090	0	6	6		2	7	9	
Age (year)	< 10	4187	5	9	14	0.81	1	8	9	<0.001
	≥10	3935	4	13	17		21	20	32	
Grade	Elementary or less	2336	6	15	21	0.96	4	10	14	0.96
	>Elementary	3018	3	7	10		18	9	27	
Number of Siblings	1-2	2376	2	6	8	0.64	3	5	8	0.10
	≥3	5720	7	16	23		19	14	33	
Mother's education level	Elementary or less	6937	7	17	24	0.20	18	17	35	0.63
	>Elementary	1185	2	5	7		4	2	6	
Father's education level	Elementary or less	6877	8	18	26	0.72	21	16	37	0.16
	>Elementary	1245	1	4	5		1	3	4	
Mother's occupation	Housewife	7915	9	21	30	0.15	21	19	40	0.55
	Employed	207	0	1	1		1	0	1	
Father's occupation	Unemployed	1717	5	14	19	0.003	11	17	28	0.003
	Employed	5339	4	8	12		11	2	13	
Family income	Poor#	2060	9	22	31	0.06	21	18	39	0.57
	Fine#	6062	0	0	0		1	1	2	
Frequency of having bath	>1 in a week	4342	4	14	18	0.12	13	10	23	0.59
	1< in a week	3780	5	8	13		9	9	18	
Animal husbandry	Yes	3400	8	13	21	0.003	14	2	16	0.03
	No	4722	1	9	10		8	17	25	
School settlement	Urban	5479	2	14	16	0.004	3	8	11	<0.001
	Rural	2643	7	8	15		19	11	30	

Table-2: Prevalence of causative agents in tinea capitis and tinea pedis in schoolchildren.

Causative agent	Culture positive	Prevalence (%)
Tinea capitis		
Trichophyton spp.	9	0.1
Trichophyton verrucosum	8	0.09
Trichophyton mentagrophytes	1	0.01
Tinea pedis		
Trichophyton spp.	9	0.1
Trichophyton rubrum	8	0.09
Trichophyton mentagrophytes	1	0.01
Candida spp.	3	0.03
Candida glabrata	2	0.02
Candida albicans	1	0.01
Trichosporon	2	0.02
Rhodotorula	8	0.09

(0.27%) were diagnosed as culture-positive tinea pedis. The etiologic agents for tinea capitis were Trichophyton verrucosum in 8 (88.8%) cases and 1 (11.1%) with Trichophyton mentagrophytes. There were 8 (36.3%) cases with Trichophyton rubrum, 1 (4.5%) with Trichophyton mentagrophytes, 8 (36.3%) with Rhodotorula, 2 (9.1%) with Trichosporon, 2 (9.1%) with Candida glabrata, and 1 (4.5%) with Candida albicans on foot (Table-2).

Tinea capitis in children having unemployed fathers (5/1717) was higher than for those whose fathers were employed (4/5339) (p=0.003). Tinea capitis in male gender (9/4032) was higher than for those in female gender (0/4090) (p=0.003). Tinea capitis in students having animal husbandry (8/3400) was higher than for those having no animal husbandry (1/4722) (p<0.003). Children getting education in rural areas were more likely to present with tinea capitis (8/2643) than children in urban areas (2/5479) (p<0.004).

Tinea pedis in male gender (20/4032) was higher than for those in female gender (2/4090) (p<0.001). Children ≥10 years old were more likely to present with onychomycosis (21/3935), compared with the <10 years old group (1/4187) (p<0.001). Tinea pedis in children having unemployed fathers (11/1717) was higher than for those whose fathers were employed (11/5339) (p=0.003). Tinea pedis in children having animal husbandry (14/3400) was higher than for those having no animal husbandry (8/4722) (p=0.003). Children in rural areas were more likely to present with tinea capitis (19/2643), compared with children in urban areas (3/5479) (p<0.001).

In multivariate logistic regression analysis, school settlement was identified as a risk factor for both tinea capitis and pedis. Tinea capitis was observed 7.27-folds (CI 95% 1.51-35.03) and tinea pedis was 13.19-folds (CI 95% 3.89-44.70) higher in school children in rural areas. Age and gender were effective risk factors for tinea pedis. Tinea pedis was 22.18-folds (CI 95% 2.98-165.23) higher in children above 10 years old and 5,17-folds (CI 95% 1.742-15.34) higher in male gender (Table-3).

Discussion

This was a population-based cross-sectional study aimed at investigating the prevalence and effective risk factors of tinea capitis and pedis in school children in rural and urban schools of Kayseri, Turkey. In this study, the prevalence of tinea capitis and pedis was 0.1% and 0.2%, respectively. The most isolated agent for tinea capitis was T. verrucosum. The most isolated agent for tinea pedis was T. rubrum as dermatophyte, and Rhodotorula as yeast. Additionally, we detected school settlement as a risk factor for both tinea capitis and pedis. However, age and gender were risk factors for only tinea pedis. As

Table-3: Results of multivariable logistic regression analysis on the relation among tinea pedis, tinea capitis and the potential prognostic factors. Factors which were not statistically significant (p >0.05) were not shown in the table. CI, confidence interval; OR, odds ratio.

		Number of culture positive cases /negative cases	OR	95% CI	P- value
Tinea pedis					
Age (year)	<10	1/4186	1	2.98-165.23	0.002
	≥10	21/3914	22.18		
Gender	Boy	18/4014	5.170	1.742-15.34	0.003
	Girl	4/4086	1		
School Settlement	Urban	3/5476	1	3.89-44.70	<0.001
	Rural	19/2624	13.19		
Tinea capitis					
School settlement	Urban	2/5477	1	1.51-35.03	0.013
	Rural	7/2636	7.27		
Constant			<0.001		<0.001

dermatophyte infections are not notifiable diseases, knowledge about the prevalence of these infections can only be achieved from healthcare facilities. Therefore, true prevalence can be obtained from population-based field studies like the current study. The factors affecting epidemiological features and spreading of dermatophyte infections can be better understood by such studies.[6]

The prevalence of tinea capitis and pedis varies by geographic region.[7] Pérez-González M et al. reported the prevalence of tinea capitis as 0.23% in Barcelona, Spain.[1] The prevalence of tinea capitis in different geographic regions was also reported as 2.5% in London,[8] 0.1% in Germany,[9] 0.3% in Italy,[10] 1% in Palestine,[11] 7.1% in Tanzania,[1] 13% in Cleveland,[12] 14% in Philadelphia (USA),[13] and 31.2% in Nigeria.[1] In our country, tinea capitis prevalence was reported as 0.3% in rural areas of Eskisehir,[6] 0.2% in Adana,[14] 0.4% in Afyon,[15] and 0.07% in Erzincan.[16] The prevalence of tinea pedis in school children was reported as 2.5% in Barcelona,[1] 6.9% in Israel,[17] 5.2% in Australia,[18] 2.6% in Tanzania,[19] and 7.89% in Peru.[20] The prevalence of tinea pedis from Turkey was reported as 2% in Eskisehir, and 0.15% in Istanbul. Our data indicated a low prevalence of tinea pedis and similar prevalence of tinea capitis in our country than other studies. The reason of this difference between studies may be due to geographical differences, poor hygiene and sanitary conditions as the distribution of dermatophytes vary with geographic location since some species are widely distributed in the world whereas others are geographically restricted.[6]

The distribution of causative agents of tinea capitis and tinea pedis differ from region to region in Turkey. The most encountered tinea capitis agent was reported as M. canis in the rural area of central Turkey, as M. Canis and T. mentagrophytes in the south of Turkey, T. violaceum and M. canis in the southeast of Turkey, and as T.verrucosum in the middle and east of Turkey.[6,14,21] In this study, the most detected agent of tinea capitis was Trichophyton verrucosum which was similar with results detected in the east of Turkey. The other obtained agent Trichophyton mentagrophytes was also the most encountered agent in Italy, Poland and Spain. It can be interpreted that flora of tinea capitis in Kayseri is similar with those found in the east of Turkey region. Migration of people from east to west may also have contributed to the fungal flora of Kayseri.

Trichophyton rubrum is known as the most common cause of tinea pedis all over the world. A study reported Trichophyton rubrum, Candida albicans and Candida glabrata as the most common agent of tinea pedis in Istanbul,[22] a city located in the northwest of Turkey, whereas others reported Trichophyton rubrum and Trichophyton mentagrophytes as the common etiologic agents in rural areas of Eskisehir, a city located in the centre of Turkey.[6] Although Trichophyton rubrum was the common agent for tinea pedis, Rhodotorula and Candida were not very rare yeast infestations in our study. These differences may be due to having different fungal flora at the same geographic region at the same time.

Ilkit et al. reported that zoophilic dermatophytes were responsible for 80% of cases of tinea capitis in Adana.[14] In the present study, because all tinea capitis agents were zoophilic, it can be interpreted that tinea capitis may probably be transmitted from infected animals to the students. It is known that tinea capitis was more common in children living in home with animals. Similarly, Flores et al. reported high frequency of dermatophyte infection in school children living with pets in Peru.[20] In another study, tinea infestation was more common among school children in contact with pets.[1] However, there are also reports showing high frequency of antrophilic species for tinea capitis.[23] These etiological differences may be due to the study population, geographical regions and research techniques applied.

In this study, tinea capitis was observed 5.6-folds and tinea pedis 1.3-folds higher in school children attending schools in rural areas. It can be explained that rural schools in Turkey have undeveloped infrastructure, low health conditions, poor socioeconomic status, and poor hygiene and sanitation conditions when it is compared with those in urban schools. In literature, it was shown that inadequate hygiene conditions may be the reason of high number of dermatophyte infections.[6]

In this study, tinea pedis was 2.8-folds higher in children above 10 years age and 13.5-folds in children attending schools in the rural area. Tinea pedis is common in adolescents and young children.[24] A study also reported high prevalence of tinea pedis in 13-15 age groups.[1] It can be explained by that children at this age may be prone to close personal contact with friends and have inadequate knowledge about fungal infections.

Although we could not explain the high frequency of infection in the male gender, but it can be concluded that male gender increases sensitivity to infection due to some reason that we do not know yet.

Conclusion

Despite the low prevalence of tinea capitis and pedis in Kayseri, it is still an important public health problem in our region as well as all over the world. Care in the

paediatric age group should be taken to prevent dermatophyte infections because children in the community can generate a source for infection. It should be kept in mind that causative agents of tinea capitis and pedis vary for each geographic region. For this purpose, epidemiological field studies should be done for each region; local and national educational programmes, including information about dermatophyte infections, should be given to doctors, teachers, families and children. Factors facilitating dermatophyte infections such as poor hygiene and sanitation conditions should be improved in school children living in the rural district of Kayseri, Turkey.

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