

## Superficial fungal infections in children

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### Abstract

**Objective:** This study was performed to determine the prevalence and the demographic characteristics of patients, who were diagnosed with superficial fungal infection at the dermatology department of two centers, and compare their epidemiologic data to those reported in the literature.

**Material and Method:** Files of 20716 children, between 0 and 16 years of age, who presented to the Dermatology Outpatient Clinic between 2011 and 2015, were investigated retrospectively. Of these, 518 children, diagnosed with superficial fungal infection, were assessed with respect to age, gender, presence of systemic disease and demographics. The diagnosis and the laboratory investigations performed were recorded

**Results:** There were 251 girls (48%) and 267 boys (52%), diagnosed with superficial fungal infection. Eight types of superficial fungal infection were detected in 518 patients (2.5%). Assessment by age group revealed the following: 8.4% of the infection were observed between 0 and 2 years of age (n=44), 16.9% were observed (n=88) between 3 and 5 years of age, 34.9% were observed (n=181) between 6 and 11 years of age and 39.5% were observed between 11 and 16 years of age (n=205). *Tinea corporis* (26%, n=136) and *Pityriasis Versicolor* (19%, n=99), *Candidiasis* (17%, n=86) and *Tinea Pedis* (14%, n=72) were the most commonly detected ones.

**Conclusion:** Superficial fungal infections occur less in children, promptness is important in the diagnosis and treatment due to potentially permanent complications. In addition, with respect to preventive medicine, being aware of the factors that would reduce transmission would prevent occurrence of complications.

**Keywords:** superficial fungal infection, children, prevalence

### Introduction

Superficial fungal infections (SFI) are common among children's skin disorders. 7-15% of the pediatric clinical manifestations result from SFI. The factors frequently include the *Trichophyton*, *Microsporum* and *Epidermophyton* species and they are transmitted via skin contact from humans, animals and the soil. The clinical course is determined by the host's immune response, localization and the type of the fungus (1). The distribution of the factors may vary depending on the country, geographic region, the climate and the living conditions. To avoid complications such as cicatricial alopecia and nail dystrophy, early diagnosis and onset of treatment is important. Factors that would reduce or prevent transmission should be known; and this is significant for preventive medicine (2). There is limited number of studies on pediatric SFI. In this study, we retrospectively investigated the incidence and distribution of pediatric cases, diagnosed with SFI.

### Material and Methods

Files of 20716 children, between 0 and 16 years of age, who presented to the Dermatology Outpatient Clinics of Ankara Pediatric Health and Diseases Hematology Oncology Training and Research Hospital and Ankara Atatürk Training and Research Hospital between 2011 and 2015, were investigated retrospectively. Of these, 518 children, diagnosed with SFI, were evaluated with respect to age, gender, presence of systemic disease and demographics. The diagnosis and the laboratory investigations performed were recorded. Patients were grouped by demographic data and diagnosis.

It was approved by the local ethics committee before start of the study. All patients were diagnosed by examination findings and fungal screening using a direct microscope with 10% KOH, to assist in diagnosis. Culture could not be conducted due to the difficulty of the procedure.

Received 16-06-2016 Accepted 01-07-2016 Available Online 15-07-2016

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Patients were investigated under 4 categories to compare distribution by demographic data and diagnosis: between 0 and 2 years (infantile), between 3 and 5 years (pre-school), 6 and 11 years (school) and between 12 and 16 years (adolescence).

Statistical analyses were performed with SPSS Version-20; comparison of the categorical variables was done with Fisher Cross Table statistics and for determining statistical significance, Chi-square test was used.  $P < 0.05$  was considered significant. % was used for summarizing data

## Results

Among patients, diagnosed with SFI, 251 were females (48%) and 267 were males (52%). The male to female ratio was 1.08.

Eight types of SFIs were detected in 518 patients (2.5%). Among SFIs, *Tinea Corporis* (26%, n=136) and *Pityriasis Versicolor* (19%, n=99), *Candidiasis* (17%, n=86) and *Tinea Pedis* (14%, n=72) were the most commonly detected ones.

Assessment by gender revealed the following: 8.4% of the infection were observed between 0 and 2 years of age (n=44), 16.9% were observed (n=88) between 3 and 5 years of age, 34.9% were observed (n=181) between 6 and 11 years of age and 39.5% were observed between 11 and 16 years of age (n=205). Distribution by age group is shown in Table 2.

Investigation of the presence of the concomitant disease in children with SFI revealed different skin diseases at a rate of 2.3% (n=12) and non-skin diseases at a rate of 4.4% (n=23) (Table 3).

**Table 1:** The most common superficial fungal infection by gender in children. \* Percentage indicates the rate of the diseases by gender

The Diseases	Girl	%*	Boy	%*	Total
<i>T. Corporis</i>	54	40	82	60	136
<i>P. Versicolor</i>	52	53	47	47	99
<i>Candidiasis</i>	54	63	32	37	86
<i>T. Pedis</i>	27	38	45	62	72
<i>T. Capitis</i>	25	43	33	57	58
<i>Onychomycosis</i>	29	62	18	38	47
<i>T. Ingunalis</i>	10	53	9	47	19
<i>T. Manum</i>	-	-	1	100	1
<b>Total</b>	251	48	267	52	518

**Table 2:** Distribution by age group

Diseases	Number of Patients	Overall %	In the Group	0-2 y		3-5y		6-11y		12-16y	
				N	%	N	%	N	%	N	%
<i>T.corporis</i>	136	0,66	26	4	9	20	23	65	36	47	23
<i>P.versicolor</i>	99	0,48	19	3	7	5	6	17	9	74	36
<i>Candidiasis</i>	86	0,42	17	20	45	26	29	25	14	15	7
<i>T.pedis</i>	72	0,35	14	2	5	6	7	28	16	36	18
<i>T.capitis</i>	58	0,28	11	6	13	21	24	26	14	5	2
<i>Onychomycosis</i>	47	0,23	9	7	16	7	8	8	19	19	8
<i>T.ingunalis</i>	19	0,09	4	2	5	3	3	6	3	8	4
<i>T.manum</i>	1	0,005	-	-	-	-	-	-	-	1	1
<b>Total</b>	518	2,5	100	44	10	88	100	181	100	205	100

**Table 3:** Presence of concomitant disease in children with superficial fungal infection

Diseases	Concomitant Disease	Number of Patients
<i>Onychomycosis</i>	Obesity	1
	Down Syndrom	1
	Paronychia	1
	<i>T. Pedis</i>	1
	Hyperhidrosis	1
<i>T. Pedis</i>	Acne	3
	Elevated Liver Enzymes	1
	Asthma	2
	Cerebral Infact	1
	Kidney Abnormality	1
	Hypothyroidism	1
<i>T. Capitis</i>	Seborheic Dermatitis	2
	Acne	1
<i>T. Corporis</i>	Hypothyroidism	1
	Osteoporosis	1
<i>T. Faciei</i>	Milk Allergy	1
<i>T. Manum</i>	Epilepsy	1
<i>P. Versicolor</i>	Anemia	1
	FMF	1
	Osteoporosis	1
	Allergic Rhinitis	1
	Diabetes Mellitus	1
	Growth Retardation	1
<i>Candidiasis</i>	Congenital Cardiac Disease	2
	Frequent Urinary Infection	1
	Hyperactivity	1
	Degenerative Cerebral Disease	1
	Dermatitis	2
	Pyoderma	1

## Discussion

In children, SFI is not observed as commonly as in adults; but it has been gradually increasing and becoming remarkable over time due to its complications. Its pediatric incidence varies depending on the populations, geographic regions and different climatic conditions (3,4,5,6).

The rates were as follows: 13.4% in Ethiopia (7), 16.3% in Egypt (3) 2.3% in Switzerland (8), 35% in Nigeria (9), 4.65% in India (6), 6.7% in Kuwait (4). In our country, the rates vary between 3.8 and 6% in studies on SFI (10-12). In this retrospective study we performed in 20716 pediatric patients, we detected the incidence of SFI as 2.5%. These differences may result from environmental, geographic, hygienic differences and the number of patients. Karaca et al. detected that SFI was most common between the age of 5 and 12 (50%) (13).

In our study, we most commonly observed *T. Corporis*. *T. Corporis* involves the dermatophyte infection of the regions other than the groins, palms, and soles. In children, it is transmitted via pets and in the rural area, it is transmitted via bovine or ovine animals.

When it manifests on the face, it is called tinea facialis (14, 15).

In Nigeria, the ratio was reported to be 0.06% and in the trial by Ertas et al involving 51 cases, the ratio was reported to be 7.8% (9,16). In this study, we found *t. corporis* at a ratio of 26% in 136 children in total with 5 occurring on the face.

*Pityriasis Versicolor* is a yeast infection of the stratum corneum in the regions where sebaceous glands are located on the epidermis, which is caused by *Malassezia furfur*. It occurs as hypo- or hyperpigmented macula on different parts of the body in varying size in hot and humid climate. It involves the face uncommonly (15,17). While Nanda et al (4) reported a ratio of 0.62% and Oke et al (9) reported a ratio of 4.4%, in our country Seraslan et al (10) detected a ratio of 5.4%, Tamer et al (12) detected a ratio of 0.09% and Kavak et al reported a ratio of 2.5% (18) and they all declared that the disease increased with age. In similarity to the trial by Ertas et al, we detected an overall ratio of 0.48% and 19% in 518 children (16). The increase observed with the increasing age was statistically significant.

The higher incidence during adolescence may be attributed to hormonal causes.

*Candidiasis* is a fungal infection that is caused by *Candida Albicans*. In our study, its incidence ranked third among others. *Candida*, detected in 2-5% of the healthful babies, is present at a high ratio in oral flora and folds of the skin. The disease occurs as a result of physical irritation such as moisture, heat, friction, alkaline pH and diabetes, collagen tissue disorder, malignancy, severe infections, immunocompromising diseases, and presence of systemic predisposition such as AIDS (14,17,19). The prevalence of oral candidiasis varies between 0.1 and 37 (4, 14,20,21). In our country, Yilmaz et al reported the ratio as 10% below 2 years of age and Kose et al detected the ratio as 7.7% (22, 23). In our study, only 4 among 86 patients had oral Candidiasis and 6 had vaginal Candidiasis. While oral Candidiasis is not observed commonly in children, the low rate we detected in our study may be associated with the fact that this disease was solved by the parents, primary care physicians and pediatricians. In the study by Koksall et al. performed in children between 2 and 15 years of age, Candidiasis was reported at a ratio of 1% while Ertas et al detected a ratio of 15.8% (16,24). In our study, among all other diseases, Candidiasis was reported at a ratio of 0.42% and among fungal diseases, it was detected at a ratio of 17%. More than half were between 0 and 5 years of age.

*T. pedis* is reported between 1.3% and 2.3% and at a higher rate during adolescence. It was detected at a rate of 2.5% in a Spanish study (25); in a screening, performed in 7158 children between 6 and 14 years of age in Istanbul, the rate was detected to be 0.15 for *T.Pedis* (26); Balci et al reported a rate of 0.05 for *T.Pedis* in a screening of 8122 children (27). Inanir et al detected *T. Pedis* in 0.5 of 785 children (28). In our country, the rates in other studies range between 4.6 and 2.6% (11,18). In our study, we detected an overall rate of 0.35% in 72 children and a rate of 14% in the group for *T. Pedis*, similar to Tekin et al (29). These different ratios in the studies may be related to the fact that the studies were performed for the purpose of screening or to the examination of the patients, who presented to the clinic due to complaints.

In children, *T. Capitis* is a common dermatophyte infection (11,12). It is common in children between 2 and 10 years of age before puberty. In kerion forms, scar tissue may develop and lead to alopecia and represent a cosmetic issue for the individual (2,11). Contact with animals, poor hygiene conditions facilitate the occurrence of the disease. Based on the reports by the WHO, *t. capitis* has a rate of 7-13% and differs by the geographic region (30). In children, it occurs at a rate of 1% (30). The rate ranges between 0.07 and 0.8% in Turkish studies (3,12,14,24). In the foreign literature, the rates were as follows: 0.23% in

Spain, 26.9-62.5% in Nigeria, 68% in India and 78% in Egypt (3, 6, 9, 29). These results show that it is correlated with the level of development of countries. Ertas et al reported the *t. capitis* ratio to be 35.4 (16). Balci et al detected a *t. capitis* ratio of 0.03 in their screening involving 8122 students (27). In our trial, we detected an overall ratio of 0.28%, 11% among the SFIs, 24% between 3 and 5 years and at a higher ratio in males. Koksall et al reported a ratio of 54% between 2 and 15 years and at a higher ratio among males, similar to us (24).

*Onychomycosis* is the fungal infection of the nails and represents 20% of all nail diseases. It was reported at a rate of 0.2-2.6% (14). In children, the structural differences of the nail plaque or excessive exposure to recurrent traumas may represent an effective barrier for colonization of the fungal agents and this may explain why it is reported at a lower rate relative to adults (15,17,31). However thumb sucking habits, irritation caused by the saliva, and use of pools create a quite appropriate environment for fungus growth. Down syndrome, HIV infection, long term use of cortisone, presence of previous tinea pedis and tinea capitis are among the other risk factors (17). In our study, one of our patients had Down syndrome. The disease is caused by dermatophytes, yeast or mold. Mostly hands are involved in pre-school children and feet are involved at older ages (14,32). Early diagnosis and treatment is important in eliminating the source of the infection and avoiding nail dystrophy (2). Gupta et al found the ratio of onychomycosis was 0.44% (35) below 18 years and the ratio was 0.02% in the study reported by Philpot et al (33). Oke et al reported a ratio of 0.8% for onychomycosis while Sobjanek et al detected a ratio of 9.7 in a screening performed in 1588 children below 16 years in Poland (9, 34). Hapcioglu et al reported onychomycosis at the highest ratio (3.3%) (26). In this study in 23235 children between 7 and 14 years, the ratio was detected to be 0.01% (26). The ratios were between 0.10 and 3% in the other studies in Turkey (12,13,26,28,31). Balci et al detected onychomycosis in a pediatric screening involving 8122 children between 5 and 16 years of age (0.018) (35). Ertas et al told a ratio of 17.8% (16). In this study, we detected an overall ratio of onychomycosis of 0.23%; the ratio was 9% among the fungal infections and the condition was most common between 12 and 16 years and occurred more among girls.

*Tinea Inguinalis (Tinea cruris)*: It is more common in males. It manifests as an itchy plaque with a sharp edge, located laterally or bilaterally in the genito-crurale region (inner part of the femurs), which expands slowly (19). While Ertas et al reported only one case, we had 19 cases in our study (16).

*Tinea Manum* was present in only one case.

Atopic system predisposes the individual to transmission of the infection. While hypersensitivity to

the factors aggravates the infection, suppressed or deficient cellular immunity leads to chronic diffuse and refractory clinical courses (1). In our trial, we detected the systemic diseases such as asthma, allergy history, chronic infections, liver dysfunction, renal disease and epilepsy at a rate of 4.4% in 23 cases. In addition, history of drug use in relation to these diseases may have facilitated occurrence of SFI and complicated recovery.

As can be seen in Table 3, the presence of systemic diseases including congenital cardiac disease, frequent urinary infection, chronic dermatitis, degenerative brain disease facilitate the development fungal infections. Socio-economic status, malnutrition, poor hygiene also affect the pattern of the skin diseases.

## Conclusion:

Fungal diseases of childhood differ from those in adults with respect to type, distribution and incidence. While there are many studies in this age group, the results are not very satisfactory. If left untreated, some fungal infections can lead to permanent hair loss and nail dystrophies and impair quality of life. Different from the other studies in our country, this study involved a large series, which could provide a more accurate view on the incidence of the diseases. We believe that our study could initiate future studies and be helpful in preventive medicine.

**Conflict of Interest:** The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Ethical issues:** All Authors declare that originality of research/article etc... and ethical approval of research, and responsibilities of research against local ethics commission are under the authors responsibilities. The study was completed due to defined rules by the Local Ethics Commission guidelines and audits.

**Acknowledgement:** None

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