

Prevalence of tinea pedis in psoriasis, compared to atopic dermatitis and normal controls – a prospective study

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Summary

There are discrepancies in the literature regarding the prevalence of tinea pedis in psoriasis. The aim of this investigation was to conduct a cross-sectional study of the prevalence of tinea pedis in psoriasis compared to atopic dermatitis patients and normal controls. We enrolled 232 psoriatic patients, 190 atopic dermatitis patients and 202 normal controls, between the years 2010 and 2013. The prevalence of tinea pedis was 13.8% in psoriasis patients, not significantly different from that in atopic dermatitis patients 8.4% ($P = 0.092$), but significantly higher than in normal controls 7.4% ($P = 0.043$). Both gender and age affected the prevalence of tinea pedis in psoriasis and normal controls, while only age affected the prevalence of tinea pedis in atopic dermatitis. Regarding gender, there was higher prevalence of tinea pedis in men: 19.1% ($P = 0.019$) in psoriasis and 12.1% ($P = 0.013$) in normal controls. Age affected the prevalence of tinea pedis in normal controls ($P < 0.001$), psoriasis patients ($P = 0.001$) and atopic dermatitis patients ($P = 0.001$), with higher prevalence with increasing age. *Trichophyton rubrum* was the most common species in psoriasis (71.9%), atopic dermatitis (75.0%) and normal controls (73.3%). Our study found a relatively high prevalence of tinea pedis among psoriasis patients.

Key words: Tinea pedis, psoriasis, atopic dermatitis.

Introduction

Reports in the literature on the prevalence of tinea pedis in adult population are variable, ranging from 2.9% in the general adult population of Madrid, Spain to 5.4% in the inhabitants of northeast Iran.^{1–3} There are discrepancies in the literature on the prevalence of tinea pedis in psoriasis. Altuany *et al.* [4] reported a prevalence of 1.6% in 60 psoriatic patients, i.e. lower than in normal controls, while Hamnerius *et al.* [5] found a prevalence of 8.8% of tinea pedis in 239

psoriatic patients, which was not significantly different from normal controls. In contrast to these two reports, Alteras *et al.* [6] reported a high prevalence of 55% in 34 psoriatic patients. Nevertheless, the differences in prevalence could be attributable to the heterogeneity of the above studies, regarding number of patients, population studied (inpatients vs. outpatients) and lack of control groups in some of the studies.

The prevalence of tinea pedis in adult atopic dermatitis patients is obscure, and we found no data in the English literature on this subject. In children with atopic dermatitis, one Korean study showed a prevalence of 14%.⁷

While the exact prevalence of tinea pedis in atopic dermatitis is as yet unknown, there are interesting data regarding the susceptibility of atopic dermatitis patients to chronic dermatophytosis.^{8,9} Jones *et al.* [8] assumed that atopic individuals are predisposed to chronic dermatophytosis due to impaired humoral immunity. However, it is assumed that if a patient with atopic

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dermatitis develops a chronic dermatophyte infection it is often more severe and more difficult to eradicate.¹⁰ Moreover, atopic dermatitis as well as asthma and rhinitis might be triggered by a fungal infection.¹¹

The aim of this cross-sectional, clinic-based study was to determine the prevalence of tinea pedis in patients with psoriasis, compared to patients with atopic dermatitis and normal controls. This relationship is important, since it has many potential clinical implications with respect to correct diagnosis, treatment and prevention of reinfection. Furthermore, there are only sparse data on the prevalence of tinea pedis in atopic dermatitis. Identifying patients at greater risk of fungal infection is essential for defining a prophylactic treatment approach in these groups of patients.

Patients and methods

Between the years 2010 and 2013, data were collected from 232 psoriatic patients (117 women and 115 men), 190 atopic dermatitis patients (117 women and 73 men), and 202 normal controls (103 women and 99 men). The psoriatic and atopic dermatitis patients were from the Dermatology Department and outpatient clinic at the Hadassah Hebrew University Medical Center in Jerusalem, Israel. The normal controls were recruited from parents and grandparents of children attending the outpatient clinic, who were not aware of any dermatological disease and had never consulted a general practitioner or dermatologist for skin problems related to the feet. The study was approved by the Helsinki Committee for clinical trials of the Hadassah Hebrew University Medical Center and written informed consent was obtained from all participants in the study.

Epidemiological and clinical data, including gender, age, type and duration of the disease and severity scores, Psoriasis Area and Severity Index (PASI) and Severity Scoring for Atopic Dermatitis (SCORAD), were recorded for both psoriasis and atopic dermatitis patients respectively. In case, the participants of the study presented with lesions on the soles or in the interdigital area of the toes, fungal scraping was performed. Exclusion criteria were patients under the age of 18 and any systemic treatment for psoriasis or atopic dermatitis.

Mycological examination

Scrapings were collected from soles and interdigital areas of the feet, examined by direct microscopy and

cultured on Sabouraud glucose agar (SDA; Hylabs, Rehovot, Israel) at 28 °C for 2–4 weeks.

Statistical examination

Association between categorical variables and the three groups was tested using *chi-square* and Fisher's exact tests. The Mann–Whitney test was used to compare the variables of age, PASI score and psoriasis duration among patient groups. Alpha levels for all tests were 0.05. We used Bonferroni's correction for multiple comparisons among the three groups. Prevalence with 95% confidence intervals based on the exact binomial calculation method was given for the various parameters of prevalence. Analyses were performed using SPSS software.¹²

Results

Mean age, gender, duration, severity index (PASI and SCORAD) for both psoriasis and atopic dermatitis, respectively, and type of psoriasis are presented in Table 1.

Fungal test was considered positive when both microscopical examination and mycological culture of skin flakes from the interdigital area and sole were positive. The fungal test was positive in 32 psoriatic patients (13.8%, 95% CI 9.6–18.9%). Only 16 atopic dermatitis patients (8.4%, 95% CI 4.9–13.3%) had tinea pedis, while the normal controls exhibited 15 cases of tinea pedis (7.4%, 95% CI 4.2–11.9%). Cross-tabulations among psoriasis, atopic dermatitis and normal controls showed that the prevalence of tinea pedis in psoriasis was not different from that in atopic dermatitis ($P = 0.092$), but was significantly higher than in normal controls ($P = 0.043$) (Table 2). The prevalence of atopic dermatitis was not significantly different from normal controls ($P = 0.715$).

Regarding the type of fungus, *Trichophyton rubrum* was the most common species in psoriasis (71.9%), atopic dermatitis (75.0%) and normal controls (73.3%). The distribution of other types of fungus in psoriasis and atopic dermatitis patients and normal controls can be seen in Table 2.

Both gender and age affected the prevalence of tinea pedis in psoriasis and normal controls, with higher prevalence in men: 19.1% (CI 12.4–27.5%, $P = 0.0019$) in psoriasis, and 12.1% (CI 6.45–20.2%, $P = 0.013$) in normal controls and older patients ($P = 0.001$ and $P < 0.001$ respectively) (Table 3).

In atopic dermatitis patients, only age affected the prevalence of tinea pedis ($P = 0.007$). No significant

Table 1 Age, gender, duration, onset, severity and type of disease by patient group.

Group	N	Age (years) ¹	Gender	Duration ¹	Onset ²	Type of disease	Severity ³
Psoriasis	232	53.0 (19–88)	F: 117 M: 115	10 years (4 months to 60 years)	Child: 26 (11.2%) Adult: 206 (88.8%)	Vulgaris: 192 (82.8) Palmoplantar: 22 (9.5%) Inverse: 8 (3.4%) Erythrodermia: 5 (3.4%) Pustular: 1 (0.4%) Guttate: 2 (0.9%)	Mild: 180 (77.6%) Moderate: 32 (13.8%) Severe: 20 (8.6%)
Atopic dermatitis	190	40.5 (18–87)	F: 117 M: 73	10 years (1 month to 60 years)	Infancy: 16 (8.4%) Child: 18 (9.5%) Adult: 156 (82.1%)	–	Mild: 128 (67.4%) Moderate: 52 (27.4%) Severe: 10 (5.3%)
Normal	202	41.5 (18–85)	F: 103 M: 99	–	–	–	–

¹Median (range).²In psoriasis: child onset if age ≤ 15 years old; adult if age ≥ 16 in atopic dermatitis: infancy onset if age ≤ 2; child onset if age 2–12; adult onset if age ≥ 12.³According to PASI (the Psoriasis Area and Severity Index) and SCORAD (Scoring for Atopic Dermatitis).**Table 2** Distribution of type of fungus among psoriatic, atopic dermatitis and normal controls.

Fungi	Group		
	Psoriasis	Atopic	Normal
<i>Candida albicans</i>			
N	2	1	2
% within group	6.3	6.3	13.3
<i>Scopulariopsis brevicaulis</i>			
N	1	0	0
% within group	3.1	0	0
<i>Trichophyton mentagrophytes</i>			
N	6	3	2
% within group	18.8	18.8	13.3
<i>Trichophyton rubrum</i>			
N	23	12	11
% within group	71.9	75.0	73.3
Total fungal prevalence			
N	32	16	15
% within group	100.0	100.0	100.0
Total tinea pedis positive ¹			
N/group size	32/232	16/190	15/202
% within group	13.8	8.4 ²	7.8

¹Positive cases of tinea pedis found in all groups of the study.²Psoriasis vs. atopic dermatitis ($P = 0.092$). Psoriasis vs. normal controls ($P = 0.043$).

difference in the prevalence of tinea pedis between men and women was found (Table 3). In addition, no significant differences in the prevalence of tinea pedis among PASI scores, disease duration and type of psoriasis were found among psoriasis patients (Tables 3 and 4). In atopic dermatitis patients, no significant differences in prevalence were found for disease duration ($P = 0.293$). However, a difference in prevalence based on SCORAD severity approached significance ($P = 0.055$).

Discussion

Our study revealed a prevalence of 13.8% of tinea pedis in psoriatic patients, which was in the same range as that of atopic dermatitis patients, but significantly higher than in normal controls. Our results differ from those of Altunay *et al.* [4] who found a very low prevalence of tinea pedis in psoriatic patients, and from those of Hammerius *et al.* [5] who detected no difference from normal controls. Our results are in accordance with the data reported by Alteras *et al.* [6] which showed a high prevalence of tinea pedis in psoriasis, although we did not see such high prevalence in our study. These studies differ in several methodological aspects, such as number of patients, and the population studied (inpatient vs. outpatient).

According to our findings, *T. rubrum* is the dermatophyte species that most often caused tinea pedis in psoriasis and atopic dermatitis patients and normal controls. This is in agreement with published data.^{4–6,13} We found *Scopulariopsis brevicaulis* in the interdigital space of the feet in one psoriatic patient. This result must be interpreted with precaution, since non-dermatophyte moulds can be due to contamination of the culture in the laboratory and no repeated sampling was made in our study to confirm this finding. Non-dermatophyte moulds were also reported to be isolated from nails of psoriatic patients.^{13–15}

In psoriasis and normal controls, a higher prevalence of tinea pedis was found in the elderly and in males. Similar findings in the normal population were reported by Kiraz *et al.* [2] and Pichardo-Geisinger *et al.* [16]. Interestingly, in atopic dermatitis patients, only age affected the prevalence of tinea pedis, while

Table 3 Association of tinea pedis with age, gender, duration and severity of disease in psoriasis, atopic dermatitis and normal controls.

Group	Median		N		P value	
	Fungi (no/yes)		Fungi (no/yes)		Mann–Whitney test	Chi square test
	No	Yes	No	Yes		
Psoriasis						
Age	50.00	62.00	200	32	0.001	0.019
PASI	15.150	17.000	200	32	0.956	
Duration	10.00	10.00	200	32	0.343	
Gender			107F : 93M	10F : 22M		
Atopic dermatitis						
Age	40.00	58.00	174	16	0.007	0.538
SCORAD	20.00	34.00	174	16	0.055	
Duration	10.500	5.000	174	16	0.293	
Gender			106F : 68M	11F : 5M		
Normal controls						
Age	40.00	66.00	187	15	<0.001	0.013
Gender			100F : 87M	3F : 12M		

PASI, Psoriasis Area and Severity Index; SCORAD, Scoring for Atopic Dermatitis.

Table 4 Type of psoriasis and tinea pedis.

Type of psoriasis	Tinea pedis, Y/N		Total
	No	Yes	
Inverse			
Count	8	0	8
% within psoriasis type	100.0	0	100.0
Pustular			
Count	0	1	1
% within psoriasis type	0	100.0	100.0
Guttate			
Count	1	1	2
% within psoriasis type	50.0	50.0	100.0
Erythroderma			
Count	5	0	5
% within psoriasis type	100.0	0	100.0
Palmoplantar			
Count	19	3	22
% within psoriasis type	86.4	13.6	100.0
Vulgaris			
Count	165	27	192
% within psoriasis type	85.9	14.1	100.0
Total			
Count	198	32	230
% within psoriasis type	86.1	13.9	100.0

There is no significant association between tinea pedis and type of psoriasis ($P = 0.063$).

men and women had the same prevalence of tinea pedis. Severity, duration and type of the disease had no impact on the prevalence of tinea pedis in both psoriasis and atopic dermatitis, although severity of the disease in atopic dermatitis, as revealed by the SCORAD score, approached significance ($P = 0.055$).

Most probably, this is due to the fact that chronic dermatophyte infection might exacerbate atopic dermatitis.^{8,17,18} Nissen *et al.* [19] have assumed that in selected patients, such an infection may trigger an IgE-mediated reaction that contribute to the exacerbation of eczema. Furthermore, our sample size of 117 atopic dermatitis patients is low, and it is plausible to assume that a larger sample size of atopic dermatitis patients can yield more accurate and significant results.

The hypothesis that the rapid turnover of the psoriatic skin decreases the ability of fungi to invade the skin is most probably not true. Arieli *et al.* [20] experimentally inoculated dermatophytes on psoriatic lesions in volunteers and found that psoriatic skin was infected in a higher percentage by *T. rubrum* than healthy skin of the same persons. In addition, Noah [21] found dermatophytes on the skin of psoriatic patients, and considered it one of the possible agents to cause exacerbation of psoriasis.

Our findings indicate that we should remain aware of the possibility of tinea pedis in psoriatic patients, treat it correctly with antifungal treatment, teach the patients how to prevent fungal reinfection and thus, sparing them from unnecessary further suffering.

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