



## Non-complaining female patients with tinea pedis: A clinicomycological study

Dindar Sharif-Qurtas<sup>1</sup>, Sargul Maghdid-Asaad<sup>1</sup>, Niyan Sabah<sup>1</sup>

1 Dermatology Unit, College of Medicine, Hawler Medical University, Erbil, Iraq

### Original Article

#### Abstract

**BACKGROUND:** Tinea pedis (TP) is a common public problem that its prevalence is raising due to the change in the environment and reduction in immune reactivity of individuals. Fungal species apart from dermatophytes are isolated from cases of TP. In spite of the hidden cases or occult TP, the prevalence of this disease it is growing. In this study, we tried to identify hidden and non-complaining cases of TP among population attending for other complaints rather than foot problem.

**METHODS:** 46 female patients were included in this study, who attended outpatient department of Erbil Dermatology Teaching Center, Erbil, Iraq, for other dermatological problems. The anamneses were taken, clinical examination was done, and direct microscopy and culture of specimens taken from their foot were carried out.

**RESULTS:** 24 (52%) patients of the study sample showed positive culture growth. The most common symptoms among culture-positive patients were itching (84.6%) and bad odor of foot (63.6%). The most frequent affected areas among the sample patients were 4<sup>th</sup> interdigital web of foot (69.6%-76.1%) and heels (82.6%). The most common species identified were *Trichophyton rubrum* (n = 6, 23.1%) and *Trichophyton mentagrophyte* (n = 6, 23.1%). The next most frequent was *Trichosporon* spp (n = 5, 19.2%). Occult TP among culture positives was 16.6%.

**CONCLUSION:** Prevalence of TP is very high among women (52%). Non-complaining of these women about their conditions reflects lack of foot care awareness that needs improvement.

**KEYWORDS:** Tinea Pedis, Occult Tinea Pedis, Foot Care

**Date of submission:** 25 Sep. 2018, **Date of acceptance:** 11 Nov. 2018

**Citation:** Sharif-Qurtas D, Maghdid-Asaad S, Sabah N. Non-complaining female patients with tinea pedis: A clinicomycological study. *Chron Dis J* 2019; 7(2): 87-92.

### Introduction

Foot mycosis is a common disease that has a big impact on the public health all over the world.<sup>1</sup> It can interfere with quality of the life of patients because of its characteristic, chronic course, and relapses after treatment trials.<sup>2</sup> Foot mycosis may be either tinea pedis (TP) or tinea unguis. TP prevalence is 15%-25%;<sup>3</sup> it is traditionally thought to be caused solely by dermatophyte species.<sup>4</sup> But new reports proved that TP and similar clinical conditions can be caused by dermatophytes, yeast, and

non-dermatophyte molds.<sup>1,5,6</sup>

It is known that dermatophyte species and yeasts are never normal flora of the skin. When the skin, especially the foot, has contact with these microorganisms, they will remain on the skin up to 12 hours as transient normal floras. If they are not removed from the skin mechanically by the means of washing, pedicure, or any other method, they will penetrate the skin and cause TP.<sup>7</sup> Yeast species are known to be opportunistic pathogens that under certain circumstances like immune suppression can cause diseases.<sup>8</sup>

There are many risk factors and daily habits which can stand as facilitating means for the incidence of TP like diabetes mellitus (DM),

#### Corresponding Author:

Dindar Sharif Qurtas

Email: dindar.qurtas@med.hmu.edu.krd

suppressed cellular immunity, sex, age, occupation, climate, walking barefoot, lack of washing feet, ignorance of foot cleaning from debris, wearing slippers, etc.<sup>3,7,9</sup>

Recently, a new term has been emerged as occult TP or asymptomatic TP in some reports that is perceived variably. In some reports, this term stands for the TP in patients who have symptoms on foot subjectively but are objectively without signs or vice versa.<sup>4,10,11</sup> In another study, they regarded occult TP when the patient was without symptoms and there were no signs of this disease.<sup>3</sup>

In this study, we tried to search for cases of occult TP and non-complaining female patients who had TP and attended dermatology outpatient department for other problems rather than TP. To the best of our knowledge, there are no studies done in this direction neither in Kurdistan Region nor in Iraq.

## Materials and Methods

This prospective study was conducted on 46 patients. This sample was randomly selected from women attending dermatology clinic of "Erbil Dermatology Teaching Center" in Erbil, Kurdistan Region, Iraq, from January 2018 up to May 2018. The inclusion criteria were women who came to the dermatology center for other problems apart from TP. Patients were excluded from the study if they sought help for their foot problems and those who did not give consents to participate. All the patients were interviewed face to face to go through a developed questionnaire containing sociodemographic data and habits regarded as risk factors. Then the clinical examination was done which consisted of a detailed inspection of the toe web spaces and planter surfaces of the foot with a search for the presence of any sign or symptom of TP.

The specimens were collected for microbiological analysis. For all subjects, a sample from the toe web, sole, and heels skin was collected by scraping with a sterile scalpel.

The procedure was performed after cleansing the selected area of the skin with alcohol and allowing it to dry, then scraping of skin surface was done by a sterile scalpel No. 15 blade or glass slide.

Specimens collected were sent for direct microscopy and culture. Microscopic examination of the skin scale material was carried out after preparation with potassium hydroxide solution (20%); then, the slide was treated by a special stain (lactophenol red stain for fungi). If the result of direct microscopy was positive then the remaining specimen was sent for culturing in Petri dishes containing Sabouraud Dextrose Agar (SDA). These Petri dishes then were kept in the incubator at 25 °C and examined every 3 days for fungal growth up to 3 weeks. The sample obtained from growth in the culture media was treated by lactophenol red stain for fungi on a slide for good visualization. Both morphology of colonies on the culture media and microscopy were taken into consideration to identify the species of the fungi. For the non-dermatophyte growth, we used Analytical Profile Index (API) 20E, a biochemical test to identify the genus and species of the fungal growth.

All the data obtained were analyzed using SPSS software (version 22, IBM Corporation, Armonk, NY, USA).

## Results

A total of 46 female patients were enrolled in the study. Their age ranged between 15-80 years, with the mean age of  $39.9 \pm 15.3$  years. Majority of the patients were housewives consisting of 38 (82.6%) patients and the rest were students (17.4%). Residents of Erbil City were 32 (69.6%) patients and subjects from Erbil peripheries were 14 (30.4%) (Table 1).

Asking about subjective feeling of the patients, 19 (41.3%) of them were asymptomatic. Itching was the only symptom in 14 (30.4%) cases.

**Table 1. General characteristics of the patients**

Characteristics	Mean ± SD
Age (year)	39.9 ± 15.3
	<b>n (%)</b>
Occupation	
Student	8 (17.4)
Housewife	38 (82.6)
Address	
Inside Erbil	32 (69.6)
Peripheries of Erbil	14 (30.4)

SD: Standard deviation

Burning sensation of the foot was positive in only 3 (6.5%) patients. 10 (21.7%) had both itching and burning sensation at their foot. Regarding family history of TP or other fungal skin infections, it was positive in 10 (21.7%) subjects. 7 patients (15.7%) had contact with animals. DM was present in 9 (19.6%) patients (Table 2).

**Table 2. History elements of the patients**

History		n (%)
Associated symptoms	No symptoms	19 (41.3)
	Itching	13 (28.3)
	Burning sensation	3 (6.5)
	Bad odor	11 (23.9)
Family history of TP or fungal skin infections	Yes	10 (21.7)
	No	36 (78.3)
History of contact with animals	Yes	7 (15.2)
	No	39 (84.8)
History of DM	Yes	9 (19.6)
	No	37 (80.4)

TP: Tinea pedis; DM: Diabetes mellitus

All patients were asked through a questionnaire about number of activities related to the foot care and hygiene. Wearing only slippers as footwear was observed in 37 (80.4%) patients and the others were using slippers only at home (n = 9, 19.6%). Majority of the subjects in our study sample were never wearing socks (n = 37, 90.4%). Only 9 (19.4%) patients were wearing socks half a day time. No one was using socks all the day. Never drying foot after washing them was a

dominant behavior which was consistent in 34 (73.9%) patients. 7 (15.2%) patients were drying their foot sometimes after washing. Walking barefoot in the house was another behavior interrogated which was done never in 9 (19.6%), sometimes in 21 (45.7%), often in 11 (23.9%), and always in 5 (10.9%) patients. Removing excessive skin of the foot (pedicure) by the patients was another question considered, but the majority were not practicing it (n = 30, 65.2%). 12 (26.1%) patients were doing pedicure sometimes. Only 3 (6.5%) patients were doing it always (Table 3).

**Table 3. Behaviors of the patients related to the foot hygiene**

Behavior		n (%)
Wearing slippers	Always	37 (80.4)
	At home	9 (19.6)
Wearing socks	All the day time	0 (0)
	Half a day time	9 (19.6)
	Never	37 (90.4)
Drying foot after washing	Never	34 (73.9)
	Sometimes	7 (15.2)
	Often	2 (4.3)
Walking barefoot indoor	Always	3 (6.5)
	Never	9 (19.6)
	Sometimes	21 (45.7)
	Often	11 (23.9)
Foot dead skin removing (pedicure)	Always	5 (10.9)
	Never	30 (65.2)
	Sometimes	12 (26.1)
	Often	1 (2.2)
	Always	3 (6.5)

On physical examination of the foot for TP, the foot was divided into interdigital webs, planter surface, and heels. Majority of the patients had no clinical signs in the first and second interdigital spaces (73.9%-78.3%). In the third interdigital web on both right and left sides, about half of the patients had no clinical signs (50%-52.2%). While majority of the subjects were observed to have a sign or more of TP in the fourth interdigital web (69.6%-76.1%). Soles of the patients also predominated to be without any clinical signs of TP (84.8%). Again heels of these women dominantly had signs suspecting of TP (82.6% of patients) (Table 4).

**Table 4. Clinical signs on examination of foot of the study patients**

Site of examination		No clinical findings [n (%)]	Cracks [n (%)]	Macerations [n (%)]	Flour-like scales [n (%)]	Fine scales [n (%)]	Redness [n (%)]	Ulcerations [n (%)]	Vesicles [n (%)]
First interdigital web	Rt	35 (76.1)	1 (2.2)	0 (0)	1 (2.2)	9 (19.6)	0 (0)	0 (0)	0 (0)
	Lt	35 (76.1)	2 (4.3)	0 (0)	1 (2.2)	8 (17.4)	0 (0)	0 (0)	0 (0)
Second interdigital web	Rt	34 (73.9)	0 (0)	7 (15.2)	0 (0)	5 (10.9)	0 (0)	0 (0)	0 (0)
	Lt	36 (78.3)	0 (0)	5 (10.9)	0 (0)	5 (10.9)	0 (0)	0 (0)	0 (0)
Third interdigital web	Rt	23 (50.0)	0 (0)	17 (37.0)	0 (0)	3 (6.5)	1 (2.2)	2 (4.3)	0 (0)
	Lt	24 (52.2)	0 (0)	13 (28.3)	0 (0)	4 (8.7)	3 (6.5)	2 (4.3)	0 (0)
Fourth interdigital web	Rt	14 (30.4)	0 (0)	18 (39.1)	0 (0)	2 (4.3)	6 (13.0)	5 (10.9)	1 (2.2)
	Lt	11 (23.9)	0 (0)	24 (52.2)	0 (0)	2 (4.3)	7 (15.2)	1 (2.2)	1 (2.2)
Planter surface of foot	Rt	39 (84.8)	1 (2.2)	0 (0)	1 (2.2)	1 (2.2)	0 (0)	0 (0)	0 (0)
	Lt	39 (84.8)	1 (2.2)	0 (0)	1 (2.2)	5 (10.9)	0 (0)	0 (0)	0 (0)
Heels	Rt	8 (17.4)	22 (47.8)	0 (0)	1 (2.2)	15 (32.6)	0 (0)	0 (0)	0 (0)
	Lt	8 (17.4)	20 (43.5)	0 (0)	1 (2.2)	17 (37.0)	0 (0)	0 (0)	0 (0)

Rt: Right foot; Lt: Left foot

**Results of the cultures:** Generally, 22 (48%) patients had no growth of fungi and 24 (52%) patients showed positive growth of the fungi in the culture media. 2 patients had combined 2 fungal growth. Totally, 9 genus of fungi had been identified, 6 genus of yeast and 3 genus of dermatophytes. *Trichophyton rubrum* and *Trichophyton mentagrophyte* were the most common isolated fungi, their frequencies were 6 (23.1%) and 6 (23.1%) of the patients, respectively. Other genus identified were *Trichosporon*, *Cryptococcus neoformans*, *Candida albicans*, *Candida tropicalis*, *Candida albida*, and *Trichophyton verrucosum*, and their frequencies were 5 (19.2%), 3 (11.5%), 2 (7.6%), 1 (3.8%), 1 (3.8%), and 1 (3.8%), respectively (Tables 5-7).

**Table 5. Culture results**

Fungal genus isolated	n (%)
<i>Candida albicans</i>	2 (7.6)
<i>Candida tropicalis</i>	1 (3.8)
<i>Cryptococcus albida</i>	1 (3.8)
<i>Cryptococcus neoformans</i>	3 (11.5)
<i>Rhodotorula mucilaginosa</i>	1 (3.8)
<i>Trichosporon</i>	5 (19.2)
<i>Trichophyton rubrum</i>	6 (23.1)
<i>Trichophyton mentagrophyte</i>	6 (23.1)
<i>Trichophyton verrucosum</i>	1 (3.8)

**Table 6. Age group of patients in relation to the results of culture**

Age group (year)	Culture results for TP		Total [n (%)]
	Negative [n (%)]	Positive [n (%)]	
15-25	8 (72.7)	3 (27.3)	11 (100)
26-35	3 (37.5)	5 (62.5)	8 (100)
36-45	4 (36.4)	7 (63.6)	11 (100)
46-55	4 (40.0)	6 (60.0)	10 (100)
56 and older	3 (50.0)	3 (50.0)	6 (100)

TP: Tinea pedis

## Discussion

In this study, our subjects' age was ranging from 15-80 years. The youngest age group (15-25 years) had least percentage of TP (27.3%), while the 36-45 years age group had the highest (63.6%) prevalence, which is higher than prevalence in a study done by Priya and Janaki<sup>12</sup> (38.46%).

**Table 7. Culture result in cases having itching and bad odor in their foot**

Fungal species	Itching (n = 13)	Bad odor (n = 11)
No growth [n (%)]	2 (15.4)	4 (36.4)
Positive growth [n (%)]	11 (84.6)	7 (63.6)
<i>Candida albicans</i>	1	1
<i>Cryptococcus albida</i>	1	0
<i>Cryptococcus neoformans</i>	0	1
<i>Trichosporon spp</i>	2	3
<i>Trichophyton mentagrophyte</i>	4	2
<i>Trichophyton rubrum</i>	3	0



This increasing in the prevalence in this specific age group may be due to reduced immune status and less foot care behaviors at those ages. In our study, the most common symptoms were itching and bad odor of foot. It was found that majority of subjects (84.6%) with itching had positive culture and the most common fungal growth in these patients belonged to dermatophytes. Regarding bad odor, 63.6% had positive culture results and the majority of cultures were yeast genus. These two results suggest for the fungal species-specific symptoms, where itching is a characteristic of dermatophytes and bad odor is from yeasts infections.

The study searched for the correlation of the foot care behavior to the prevalence of TP, but statistically no significant association was found within study sample of positive and negative culture results. However, the prevalence of TP in our study sample is higher than the study done in Canada, where the prevalence was 15%;<sup>10</sup> this may be related to foot care habits, especially using slippers always as footwear compared with other communities. On the other hand, nearly such a high prevalence (40%) was found in a report done in western countries.<sup>12</sup> The most common clinical signs observed by us were fourth interdigital web lesions (69.6% on right side and 76.1% on the left side) and cracked heels (82.6% on both sides). These results emphasize that mentioned clinical signs must be taken seriously in clinical search for TP, also these two locations may be a favorite site for specimen taking for culturing. TP is a fungal infection caused by dermatophytes or yeasts. Its prevalence is suspected to change dynamically because of the change in the environments and risk factors.<sup>1</sup> The prevalence of TP in our study was 52% of the sample which is much higher than the ordinary registered TP (14%-20%).<sup>3</sup> This high rate of TP in our locality is most probably due to poor foot care and too much use of open slippers among women that

increases the incidence of contact with soil and environment containing fungi.

Among 24 culture-positive patients, the incidence of occult TP, i.e., asymptomatic cases without any lesions, was seen in 4 (16.6%) cases (Trichophyton rubrum: 1 case, Trichophyton mentagrophyte: 1 case, Trichophyton verrucosum: 1 case, Trichosporon spp: 1 case). This percentage is similar to a study done in Israel.<sup>3</sup> Increased prevalence of occult TP among our patients may be due to reduced immune reactivity locally and also may be due to overuse of water procedure in the local culture.

In our study sample, dermatophytes isolated were half (50%) of all other growth. The rest (50%) was yeast genus. It is shown that the frequency of human infections with non-candida yeast species is increasing recently.<sup>13</sup> In addition, it is worthy to mention that in this study, among 13 cases of yeast-positive TP, 11 (84.6%) were non-candida yeast. Increased percentage of species of yeasts indicates that TP or TP-like conditions can be due to other fungi apart from TP. This may be due to changes in the environment and the habits of the human, in spite of the use of too much antibiotics by women for intercurrent genitourinary infections, which can lead to change in the normal flora of the skin and mucous membranes and finally to reduced immunity.

Limitations of this study were small study sample and lack of some materials needed for more precise identification of the fungi species. In terms of community health in the skin profile, we recommend further studies with larger study sample to identify reliably the causes of the high prevalence of TP among our population.

## Conclusion

The prevalence of TP and foot mycosis is very high in our locality among women. Cases of non-candida TP are escalating in the frequency. Awareness of the society, especially women, should be raised for the prevention

and treatment of foot fungal infections. We recommend further study with larger sample size for determination of risk factors increasing the incidence of this disease.

### Conflict of Interests

Authors have no conflict of interests.

### Acknowledgments

The authors thank Hawler Medical University, Erbil, Iraq.

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