

Clinical, epidemiological, and therapeutic profile of dermatophytosis*

Carla Andréa Avelar Pires^{1,2}
Amanda Monteiro Lobato²
Francisca Regina Oliveira Carneiro²

Natasha Ferreira Santos da Cruz²
Priscila Oliveira de Sousa²
Alena Margareth Darwich Mendes²

DOI: <http://dx.doi.org/10.1590/abd1806-4841.20142569>

Abstract: BACKGROUND: The cutaneous mycoses, mainly caused by dermatophyte fungi, are among the most common fungal infections worldwide. It is estimated that 10% to 15% of the population will be infected by a dermatophyte at some point in their lives, thus making this a group of diseases with great public health importance. OBJECTIVE: To analyze the clinical, epidemiological, and therapeutic profile of dermatophytosis in patients enrolled at the Dermatology service of Universidade do Estado do Pará, Brazil, from July 2010 to September 2012. METHOD: A total of 145 medical records of patients diagnosed with dermatophytosis were surveyed. Data were collected and subsequently recorded according to a protocol developed by the researchers. This protocol consisted of information regarding epidemiological and clinical aspects of the disease and the therapy employed. RESULTS: The main clinical form of dermatophyte infection was onychomycosis, followed by tinea corporis, tinea pedis, and tinea capitis. Furthermore, the female population and the age group of 51 to 60 years were the most affected. Regarding therapy, there was a preference for treatments that combine topical and systemic drugs, and the most widely used drugs were fluconazole (systemic) and ciclopirox olamine (topical). CONCLUSION: This study showed the importance of recurrent analysis of the epidemiological profile of dermatophytosis to enable correct therapeutic and preventive management of these conditions, which have significant clinical consequences, with chronic, difficult-to-treat lesions that can decrease patient quality of life and cause disfigurement.

Keywords: Dermatomycoses; Fungi; Tinea

INTRODUCTION

The cutaneous mycoses, mainly caused by dermatophyte fungi, are among the most common fungal infections worldwide, affecting several age groups and adversely affecting the quality of life of infected patients.^{1,2}

It is estimated that superficial fungal infections affect roughly 20-25% of the world population.³ In Brazil, surveys by Siqueira et al (2006) and Brilhante et al (2000)⁵ showed that the prevalence of dermatophytoses among cutaneous lesions ranges from 18.2 to 23.2%.^{4,5}

In the Amazon region, the dermatophytoses have the highest incidence among the superficial mycotic infections.⁶ This is attributable to environmental factors characteristic of this region, such as the high temperature and relative humidity, which provide conditions favorable to fungal dispersion and development. Sociodemographic factors, such as pre-

carious socioeconomic status, promiscuity, prolonged contact with animals, and poor hygiene conditions, are also conducive to the incidence and propagation of mycotic infections in the area.⁷

The dermatophytoses are dermatomycoses caused by a specific group of fungi known as ringworms or tineas, comprising the genera *Microsporum*, *Trichophyton*, and *Epidermophyton*.⁸ Transmission of dermatophytes may occur by direct contact with infected humans or animals or indirectly, by contact with contaminated fomites.⁹

Clinical manifestations vary depending on the causal agent and on the host immune response; they may last months or years, and may be asymptomatic or manifest only as pruritus.¹⁰ In the majority of cases, however, infection manifests itself as blistering, fissures, scales, or spots.¹¹

Received on 24.02.2013.

Approved by the Advisory Board and accepted for publication on 25.04.2013.

* Work performed at the Dermatology service, Universidade do Estado do Pará (UEPA), and Centro de Ciências Biológicas e da Saúde (CCBS) - Belém (PA), Brazil.
Financial Support: None
Conflict of Interest: None

¹ Universidade Federal do Pará (UFPA) - Belém (PA), Brazil.

² Universidade do Estado do Pará (UEPA) - Belém (PA), Brazil.

Certain clinical signs predominate depending on the affected site. These manifestations include: scalp lesions, caused by tinea capitis (scalp ringworm); widespread lesions, caused by tinea corporis; lesions in the interdigital spaces and plantar regions of the foot, caused by tinea pedis (athlete's foot); and nail lesions, caused by tinea unguium (Figures 1-3).^{1,11,12,13}



FIGURE 1:
Tinea corporis



FIGURE 2: Tinea capitis



FIGURE 3: Onychomycosis

The diagnosis of dermatomycoses is primarily established by observation of clinical manifestations and by the characteristic distribution of lesions. When necessary, direct examination is performed for diagnostic confirmation.¹⁴

The choice of adequate treatment is determined by the site and extent of lesions, the fungal species involved, and the efficacy, safety profile, and pharmacokinetics of the available antifungal agents.¹⁵

First-line therapy is based on the use of topical agents, typically imidazole antifungals.¹⁵ When such therapy is ineffective, oral therapy with antifungal agents such as terbinafine, itraconazole, ketoconazole, and fluconazole usually follows.¹⁶ Combined therapy with topical and oral antifungals and anti-inflammatory agents has been employed in an attempt to increase the cure rate.⁸

Although these dermatoses are not serious in terms of mortality or psychological morbidity, they have substantial clinical consequences, producing chronic, difficult-to-treat cutaneous lesions.¹⁷ Furthermore, they lead to a decline in patient quality of life and cause disfigurement, with impacts on self-esteem and vanity, and can even result in social discrimination.¹⁸

Therefore, taking into account the high prevalence and great relevance of dermatophytoses, not only for the infection itself but also for its complications, the present study sought to determine the clinical, epidemiological, and therapeutic profile of dermatophyte infections in patients enrolled at the Dermatology service of Universidade do Estado do Pará, Brazil, from July 2010 to September 2012.

METHODS

This descriptive, retrospective, cross-sectional, observational study was carried out in Belém, state of Pará, Brazil, and consisted of a chart review of 145 patients seen at the Dermatology service of Centro de Ciências Biológicas e da Saúde da Universidade Estadual do Pará, a regional secondary referral center for cutaneous diseases.

The study sample comprised all patients treated at the service between July 2010 and September 2012 with a clinical diagnosis of dermatophytosis, regardless of causative species, site of infection, age, sex, or prior therapy. Cases with inconclusive clinical diagnosis were confirmed by fungal direct examination performed at the service's reference laboratory. Patients with incomplete or missing data in their charts and those with a clinical and/or mycological diagnosis inconsistent with dermatophytosis were excluded.

Data were collected by means of a chart review, and the parameters of interest were recorded in a protocol developed by the investigators. The questionnaire was designed to collect information on epidemi-

ological data, clinical aspects, and therapy prescribed.

Microsoft Word 2010 and Microsoft Excel 2007 were used to process the manuscript, charts, and tables. Statistical analyses were carried out in the Bioestat 5.0 software environment. The chi-squared test of independence and Williams' corrected G-test were used for analysis.

This study was approved by the Universidade do Estado do Pará Research Ethics Committee with judgment number 180.297/2012.

RESULTS

Data analysis showed that, of the 145 patients included, 89 were female (61.4%) and 56 were male (38.6%). The most prevalent age group was 51-60 years.

The main clinical form of dermatophytosis in the sample was onychomycosis (38.6%), followed by tinea corporis (24.1%), tinea capitis (22.1%), and tinea pedis (15.2%).

There was a significant proportion of patients with onychomycosis and tinea pedis in the adult age range ($P < 0.001$), whereas tinea capitis was more common among children and adolescents ($P = 0.010$). There were no significant differences in the age distribution of the other dermatophytoses.

Regarding treatment, there was a predominance of combination therapy with topical and systemic agents (62.8%), with fluconazole (33.1%) and ciclopirox olamine (49%) as the most commonly prescribed systemic and topical agents respectively.

Finally, we found that 31% of patients did not attend their follow-up visits.

DISCUSSION

Analysis of the characteristics of the research sample showed that the female population affected by dermatophytosis was approximately 1.5 times larger than the male population with these conditions (Table 1). Likewise, other studies have reported a higher prevalence in women; this difference may be explained by the fact that women are more likely to seek medical attention.^{6,19,20}

The average age of patients with a diagnosis of dermatophytosis varies widely by study and region. In a 2010 study, Araújo et al. found that patients aged 0-20 years accounted for nearly half of all cases of dermatophytosis in the Brazilian state of Paraíba.²¹ In Natal, state of Rio Grande do Norte, Calado et al. (2006) found an average age of 47 years.²² Corroborating these findings, the highest prevalence of dermatophytosis in our sample was among the 51-60 age range (Table 1).

Of the several clinical forms of dermatophytosis, onychomycosis predominated in the present study, followed by tinea corporis, tinea capitis, and tinea pedis (Table 2). Previous studies in Italy and Croatia reported this exact same order of prevalence of clinical forms.^{23,24}

TABLE 1: Sociodemographic profile of the study sample

Sociodemographic variables	n	%
Sex		
Male	56	38.6
Female	89	61.4
Total	145	100.0
Age range		
0-10 years	27	18.6
11-20 years	15	10.3
21-30 years	14	9.7
31-40 years	9	6.2
41-50 years	22	15.2
51-60 years	35	24.1
61-80 years	23	15.9
Total	145	100.0
Occupation		
Homemaker	39	26.9
Student	34	23.4
Not reported	17	11.7
Retired	14	9.7
Salesperson	4	2.8
Domestic servant	3	2.1
Driver	3	2.1
Builder	3	2.1
Other	28	19.3
Total	145	100.0

TABLE 2: Clinical profile of the study sample

Clinical variables	n	%
Type of dermatophytosis diagnoses*		
Onychomycosis	56	38.6
Tinea corporis	35	24.1
Tinea capitis	32	22.1
Tinea pedis	22	15.2
Tinea cruris	6	4.1
Tinea interdigitalis	2	1.4
Tinea manuum	2	1.4
Body area affected*		
Unknown	36	24.8
Head	33	22.8
Lower limbs	26	17.9
Fingernails	20	13.8
Toenails	18	12.4
Genitalia	10	6.9
Upper limbs	10	6.9
Trunk	10	6.9

Note: * The sum of the variables exceeds 100.0 due to cases of comorbid occurrence of more than one form of dermatophytosis in the same patient, as well as to extension of dermatophytosis to more than one body area.

Other epidemiological studies confirm the high frequency of onychomycosis in relation to other forms of ringworm.^{25,26} This may be explained by increasing use of swimming pools, growing involvement in sports, wearing of occlusive footwear both in professional settings and during leisure time, and increasing incidence of diabetes and vascular disease.^{8,27,28}

We found a relatively low incidence of onychomycosis in children, which may be attributable to faster nail growth, smaller nail surface area for invasion by infectious spores, and lower likelihood of trauma. Conversely, 98.2% of patients with onychomycosis were adult or elderly, which may be a result of the reduction in nail growth rate and the increased likelihood of trauma in these age ranges (Table 3).²⁹

Providing further evidence of the close relationship between age and topographic distribution of lesions, we found that the scalp was the predominant site of dermatophytosis in children (Table 3). Binder et al. (2011) and Cortez et al. (2012) reached the same conclusion, reporting that the highest prevalence of tinea capitis was found in the pediatric population.^{30,31}

Tinea capitis is considered a disease of childhood; as seen in this study, adults are rarely affected. This prevalence is due to the absence of sebum secretion and colonization by *Malassezia* spp. characteristic of childhood, which reduce the ability of the scalp to protect itself from infection by these dermatophytes.³² Furthermore, children are more exposed to other risk factors, such as poor hygiene, crowded enclosed places (daycare facilities and schools), direct contact with household pets, and playing with sand.⁶

Treatment of dermatophytosis is generally a long and onerous process, typically involving the use of antifungal agents of the allylamine class (such as terbinafine) and the azoles (ketoconazole, miconazole, oxiconazole). Most infections can be managed with topical therapy alone; however, in an attempt to

increase the cure rate, topical and systemic (oral) medications are often combined. In the present sample, 62.8% of patients received combination topical and systemic therapy (Table 4).³³

Topical therapy with the fungicidal allylamine antifungals is associated with slightly higher cure rates and shorter courses of treatment than therapy with the fungistatic azoles.^{34,35,36} However, this therapeutic advantage is offset by their significantly higher cost.³⁷ Therefore, as the present study was conducted in a public health system setting, we may infer that therapeutic options had to be adapted to meet the patients' economic status. This may explain why there were no prescriptions of topical terbinafine therapy.

Followed by topical terbinafine, ciclopirox olamine is the most effective agent against dermatophytosis.³⁸ This helps explain the findings of the present study, in which ciclopirox olamine accounted for 49% of topical prescriptions (Table 4).

The high efficacy of ciclopirox notwithstanding, this finding is also attributable to the fact that onychomycosis was the most prevalent clinical form of dermatophytosis in the sample; ciclopirox enamel is the first-line drug of choice for this condition, as it can even be used in patients who are unable or unwilling to undergo systemic therapy.³⁹

Butenafine, an allylamine-like antifungal, was the second most commonly prescribed topical agent in the sample. This corroborates the findings of previous studies, which have shown butenafine to be an excellent option, particularly for tinea corporis, pedis, and cruris, due to its anti-inflammatory action and prolonged skin retention after topical application (Table 4).^{40,41}

Systemic therapy is indicated when lesions are generalized, recurrent, chronic, or unresponsive to topical therapy. Conventional oral treatment regimens are associated with long treatment duration and poor adherence.⁴²

TABLE 3: Association between type of dermatophytosis and age range

Dermatophytosis	Age range						Total		P
	Child/Adolescent		Adult		Elderly		n	(%)	
	n	(%)	n	(%)	n	(%)			
Onychomycosis	1	(1.8)	37	(66.1)	18	(32.1)	56	(100.0)	<0.001*
Tinea corporis	12	(34.3)	19	(54.3)	4	(11.4)	35	(100.0)	0.352*
Tinea capitis	29	(90.6)	2	(6.3)	1	(3.1)	32	(100.0)	<0.001*
Tinea pedis	1	(4.5)	14	(63.6)	7	(31.8)	22	(100.0)	0.010#
Tinea cruris	1	(16.7)	5	(83.3)	0		6	(100.0)	0.204#
Tinea interdigitalis	0		2	(100.0)	0		2	(100.0)	0.402#
Tinea manuum	0		2	(100.0)	0		2	(100.0)	0.402#

Note: *Chi-squared test of independence; #Williams' corrected G-test.

TABLE 4: Treatment profile of the study sample

Treatment variables	n	%
Treatment modality		
Topical	25	17.2
Systemic	25	17.2
Combined (topical + systemic)	91	62.8
Not reported	4	2.8
Total	145	100.0
Topical antifungals*		
Ciclopirox olamine	71	49.0
Butenafine	34	23.4
Ketoconazole	8	5.5
Oxiconazole	7	4.8
Miconazole	6	4.1
Amorolfine	3	2.1
Clotrimazole	2	1.4
Fenticonazole	2	1.4
Betalfatrus®	1	0.7
Systemic antifungals*		
Fluconazole	48	33.1
Griseofulvin	45	31.0
Terbinafine	18	12.4
Itraconazole	9	6.2
Ketoconazole	1	0.7

Note: *The sum of the variables exceeds 100.0 due to combined prescriptions of more than one agent or pharmaceutical form.

The most widely used systemic antifungals for this purpose are terbinafine, itraconazole, ketoconazole, and fluconazole. The last three, however, require elevated concentrations to achieve a fungistatic effect, which is consistent with the mechanism of action of azole antifungals.⁴³

Several comparative studies found that fluconazole was the least active of the antifungal agents assessed, with its effect varying depending on the causative species.^{38,44} Nevertheless, in the present sample, it was the most widely used agent for systemic treatment of dermatophytosis (Table 4).

Griseofulvin was the second leading systemic antifungal in our sample. This agent is considered the standard of care, particularly for tinea capitis (Table 4).³⁵ As compared with ketoconazole, griseofulvin produces excellent outcomes, with a faster onset of action and no side effects.^{32,45}

Due to the difference in cost between the azole and allylamine antifungals, the incorporation of economic outcomes (such as cost-effectiveness analyses) to existing systematic reviews should help define which therapeutic option produces the best clinical outcomes per currency unit invested, and is thus the most efficient alternative for each condition.

Finally, we found that 31% of patients did not attend follow-up appointments. This high rate may be explained by improvement of lesions before the date scheduled for follow-up, as the average course of treatment of dermatophytosis (excluding onychomycosis) lasts 20 to 45 days, which corresponds to the average time elapsed between the initial visit and first follow-up visit at the facility where the study was conducted.¹

CONCLUSION

This study provides evidence of the importance of recurrent analysis of the epidemiological profile of dermatophytoses to enable correct therapeutic and preventive management of these conditions, which have significant clinical consequences, producing chronic, difficult-to-treat lesions that can decrease patient quality of life and cause disfigurement. □

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MAILING ADDRESS:

Carla Andréa Avelar Pires

Rua Perebebuí nº 2623

Bairro do Marco

66087-480 - Belém - PA

Brazil

E-mail: carlaavelarpirez@gmail.com

How to cite this article: Pires CAA, Cruz NFS, Lobato AM, Sousa PO, Carneiro FRO, Mendes AMD. Clinical, epidemiological, and therapeutic profile of dermatophytosis. *An Bras Dermatol*. 2013;88(2):259-64.