

# Dermatophytosis: Clinical and therapeutic study in a reference center in the eastern Amazon

*Dermatofitoses: estudo clínico e terapêutico em centro de referência na Amazônia oriental*

Carla Andrea Avelar Pires<sup>1</sup>, Luiz Filipe Matos da Silva<sup>1</sup>, Thábata Chrystye Ribeiro Tenório Fonseca<sup>1</sup>, Amanda Gabay Moreira<sup>1,a,\*</sup>, Mioni Thieli Figueiredo Magalhães de Brito<sup>2</sup>, Guilherme Mestriner Colli<sup>1</sup>, Maria Amélia Lopes dos Santos<sup>1</sup>, and Francisca Regina Oliveira Carneiro<sup>1</sup>

<sup>1</sup>State University of Pará; <sup>2</sup>Federal University of Pará, Belém, PA, Brazil

<sup>a</sup>ORCID: 0000-0002-5542-4981

## Abstract

**Introduction:** Dermatophytosis is the most common fungal infection of the skin, hair, and nails in humans. It affects about 20% of the world's population in all age groups. **Objectives:** To analyze clinical, epidemiological, and therapeutic characteristics of patients diagnosed with dermatophytosis treated at a general and tropical dermatology reference service in the Brazilian Amazon region. **Methods:** We analyzed 75 medical records from January 2016 to January 2020, with a researchers' protocol to collect data on clinical forms, treatment, and recurrence. Statistical analysis used the chi-square test of adherence, and  $p < 0.05$  was considered statistically significant. **Results:** There was a female predominance, mean age of 49 years and 28% of patients had more than 10 lesions. The dominant type of dermatophytosis was onychomycosis in adults, followed by *Tinea capitis* (24%) in the pediatric group (mean 11.39 years). The elderly (37.33%) and children (26.67%) were the most affected. In most cases, treatment with combined topical and systemic medications was chosen. Griseofulvin and terbinafine were the most prescribed for systemic treatment and ciclopirox olamine was the main prescribed topic (36%). Although 77.3% of the patients attended a follow-up appointment, 25.33% relapsed in less than one year. **Conclusion:** The analyzed data emphasizes the importance of early diagnosis and treatment of dermatophytosis, especially in the extreme age group—pediatric and elderly age groups—besides the active importance of non-pharmacological measures to reduce recurrences and morbidity for patients.

**Keywords:** Dermatophytosis. *Tinea*. Treatment.

## Resumo

**Introdução:** Dermatofitoses constituem as infecções fúngicas da pele, cabelo e unha mais comuns em seres humanos, acometendo cerca de 20% da população mundial e todas as faixas etárias. **Objetivos:** Analisar características clínicas, epidemiológicas e terapêuticas de pacientes com dermatofitoses atendidos num serviço de referência em dermatologia geral e tropical na região da Amazônia Brasileira. **Métodos:** Foram analisados 75 prontuários do período de janeiro de 2016 a janeiro de 2020, cujos dados sobre formas clínicas, tratamento e recorrência foram coletados em protocolo próprio dos pesquisadores. Foi utilizado o teste Qui-quadrado de aderência na análise estatística e para a tomada de decisão adotou-se  $p < 0,05$ .

### Corresponding author:

\*Amanda Gabay Moreira

E-mail: gabayamanda@gmail.com

Received: 01-02-2022

Accepted: 22-05-2022

DOI: 10.24875/PJDV.M22000025

Available online: 02-08-2022

Port J Dermatol and Venereol. 2022;80(2):86-93

[www.portuguesejournalofdermatology.com](http://www.portuguesejournalofdermatology.com)

2797-5001 / © 2022 Portuguese Society of Dermatology and Venereology. Published by Permanyer. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

**Resultados:** Houve predomínio do sexo feminino, média de 49 anos de idade, e em 28% dos casos observaram-se mais de 10 lesões no mesmo indivíduo. O principal tipo de dermatofitose foi onicomicose em adultos, seguida por *Tinea capitis* (24%) na faixa etária pediátrica (média 11,39 anos). De *forma* geral, idosos (37,33%) e crianças (26,67%) foram os mais atingidos. Optou-se, na maioria dos casos, pelo tratamento com medicações tópicas e sistêmicas combinadas, sendo a griseofulvina e a terbinafina as mais prescritas para o tratamento sistêmico e a ciclopirox olamina o principal tópico prescrito (36%). Apesar de 77,3% dos pacientes terem comparecido em consulta subsequente, 25,33% recidivaram em menos de um ano.

**Conclusão:** Os dados analisados ressaltam a importância do diagnóstico e tratamento precoce das dermatofitoses, sobretudo em idades extremas —faixa etária pediátrica e idosos— além de destacar a importância *ativa* das medidas não farmacológicas na viabilização da redução de recidivas e morbidade aos pacientes.

**Palavras-chave:** Dermatofitoses. *Tinea*. Tratamento.

## Introduction

Superficial mycoses or *Tinea* are fungi infections preferentially affecting the epidermis and its annexes<sup>1</sup>, caused by dermatophytes, which include genera *Microsporum*, *Trichophyton*, and *Epidermophyton*<sup>2</sup>. All dermatophytes share morphological and physiological peculiarities in relation to the affected body region. These species have keratinophilic affinity and can cause pathology in humans and animals<sup>3</sup>.

Dermatophytosis affects approximately 20% of the world population, particularly in tropical and subtropical regions. Geographic location, weather, cultural factors (e.g., exposure to domestic animals), socioeconomic conditions, and personal hygiene practices contribute to epidemiological differences between distinct regions<sup>4,5</sup>.

Fungi can be found in humans, animals, and in the environment. Transmission can occur through direct contact with sick animals or humans or carriers, or even with contaminated objects or environments such as hairbrushes, bedding, carpets, or other contaminated surfaces. The diagnosis of dermatophytosis is clinical, based on anamnesis and physical examination. However, in cases of uncertain diagnosis or treatment failure, direct mycological exam and culture are useful tools to confirm the infection<sup>6</sup>.

The clinical picture varies on the affected body region and the previous use of topical medications. The relevant forms of infection are *Tinea capitis*, *Tinea corporis*, *Tinea cruris*, *Tinea unguium* and *Tinea pedis*. *Tinea capitis* affects children more frequently and is uncommon in adults. It can cause conditions that range from an isolated or a group of circular pseudoalopecia and scaly lesions (tonsurans) to an intense inflammatory form of high morbidity (kerion). Erythematous plaques associated with an annular border with desquamation and papules and central healing characterize *Tinea corporis* and *Tinea cruris*. *Tinea unguium* or onychomycosis occurs due to invasion of the nail plate and leads to

discoloration, hyperkeratosis and fragility of the nails. The appearance of grooves, roughness and fractures, with a yellowish appearance is typical for nail infection<sup>7</sup>.

Available topical therapies include agents such as azoles, allylamines, butenafine, ciclopirox, and tolnaftate. Oral treatments namely terbinafina, itraconazole, fluconazole, or griseofulvin are reserved for extensive or refractory skin infections and infections that extend to follicles or nails. It is noteworthy that oral ketoconazole increases the risk of severe liver damage, adrenal insufficiency and drug interactions<sup>8</sup>.

One of the primary concerns of patients is pruritus. In severe forms, it can affect patient's quality of life and the condition can extend and become chronic if treatment is not adequate. Another major impact is the aesthetic aspect, always present in dermatological diseases, because of the clear visibility of the lesions. This limits social interaction and contributes to the loss of quality of life. Considering the prolonged treatment in some forms of tinea, this can cause a financial burden and make it difficult to adhere to treatment<sup>9</sup>.

Due to the significant prevalence of dermatophytosis in Brazil, especially in the Amazon region, it is of great importance to know the main epidemiological, clinical, and therapeutic aspects in services of reference and excellence in dermatology. Early diagnosis and adequate treatment prevent quality of life reduction in the affected population.

## Methods

### *Ethical aspects and type of study*

This is an observational, descriptive, cross-sectional, unicentric study carried out at the dermatology service of the Center for Biological Sciences and Health of the Universidade do Estado do Pará, in Belém, Pará, one of the reference centers for general and tropical dermatological diseases in Amazon region. University's

**Table 1.** Sociodemographic characteristics of patients with dermatophytosis treated at a reference service, 2016–2020

Sociodemographic characteristics	n	%	p-value
<b>Gender</b>			
Male	25	33.33	Chi-square
Female	50	66.67	0.0056*
<b>Age group</b>			
Under 18	20	26.67	Chi-square
19-29 years	3	4.00	< 0.0001*
30-39 years	6	8.00	
40-49 years	9	12.00	
50-59 years	9	12.00	
60 years or older	28	37.33	
Mean ± standard deviation		49 ± 26.41	
<b>Occupation</b>			
Retired	9	12.00	Chi-square
Domestic worker	9	12.00	0.0092*
Dressmaker	3	4.00	
Domestic	2	2.67	
Student	15	20.00	
Others	12	16.00	
No information	25	33.33	

As resources for the statistical analysis, the Chi-square test of adherence was used and for decision making, a *p*-value < 0.05 or 5% was adopted, signaling with an asterisk (\*) the significant values.

Research Ethics Committee (opinion No. 3,853,185) approved and authorized this research.

### Casuistry

The study sample consisted of all patients evaluated at the dermatology outpatient clinic between January 2016 and January 2020, who had a clinical diagnosis of dermatophytosis, regardless of the causative species, location, age and sex, or previous medication use. 75 medical records were analyzed. We performed direct mycological examination and culture only in cases in which the clinical diagnosis was insufficient and there was a need for complementary semiology. Patients with incomplete medical records, as well as those whose diagnosis of dermatophytosis was ruled out after direct mycology and/or culture, were excluded from the study.

### Data collection

The authors used a standardized protocol to collect and analyze medical data. The variables collected were

epidemiological data and occupation, clinical aspects, type of treatment, recurrence, and presence of comorbidities.

### Data analysis

Regarding statistical analysis, Chi-square test of adherence was used. *p*-value < 0.05 or 5% was considered statistically significant. Significant values were indicated with an asterisk (\*). We used Microsoft Word 2016 and Microsoft Excel 2016 software to process the manuscript, graphs, and tables.

### Results

The sample comprised 75 patients during the years 2016–2020. Data analysis showed a predominance of females (66.67%) and a mean age of 49 years (Table 1).

The dominant type of dermatophytosis diagnosed was onychomycosis (49.33%), followed by *Tinea capitis* (24.0%) (Table 2). Most patients were treated with

**Table 2.** Clinical characteristics of patients with dermatophytosis treated at a referral service, Belém–Pará, 2016–2020

Clinical features	n	%	p-value
<b>Type of dermatophytosis/agent*</b>			
Onychomycosis	37	49.33	Chi-square
<i>Tinea capitis</i>	18	24.00	< 0.0001*
<i>Tinea corporis</i>	15	20.00	
<i>Tinea cruris</i>	5	6.67	
<i>Tinea pedis</i>	9	12.00	
<b>Number of lesions</b>			
1	21	28.00	Chi-square
2-5	19	25.33	0.0059*
6-10	4	5.33	
More than 10	21	28.00	
No information	10	13.33	
<b>Return inquiry</b>			
Yes	58	77.33	Chi-square
No	17	22.67	< 0.0001*
<b>Previous clinical condition</b>			
Yes	5	6.67	Chi-square
No	13	17.33	0.0990
No information	57	76.00	
<b>Recurrence in less than 1 year</b>			
Yes	19	25.33	Chi-square
No	23	30.67	0.6434
No information	33	44.00	

\*The same patient may have been affected by more than one dermatophytosis/agent.

topical and systemic medications in combination (75%). Griseofulvin (28%) and terbinafine (25.33%) were the most prescribed for systemic treatment and, as preferred topical medication, Ciclopirox olamine was chosen in 36% of cases (Table 3). As for patient follow-up, after starting treatment, 77.33% attended follow-up appointments, 75% of them for 10 months or less, while approximately 10% for over 20 months (Fig. 1).

In 57.33% ( $n = 43$ ) of the patients, a direct mycological examination was performed and 40 patients (93.02%) confirmed the clinical suspicion (Table 4).

Some characteristics correlated with dermatophytoses, such as domestic animals and family members affected by a similar condition. However, most medical records did not report this information. There were only descriptive results of comorbidities, because many categories had a very low number of patients (Table 5).

## Discussion

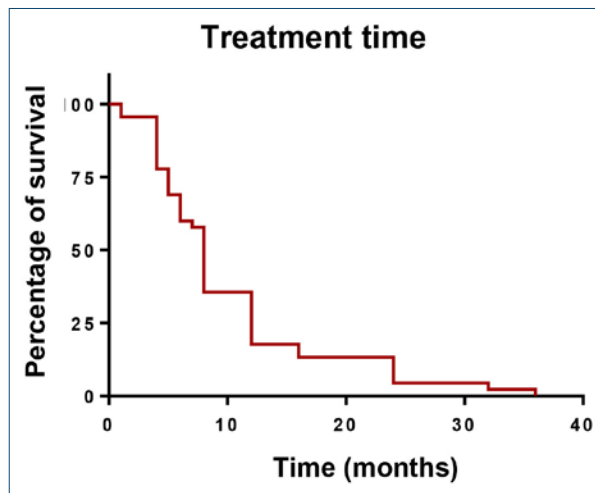
Data showed a female predominance. This association is often correlated with women's greater demand for assistance in health services and self-care compared to the male population<sup>4,5,10,11</sup>.

The mean age of the patients was 49 years ( $\pm 26.41$ ), similar to studies carried out in another Brazilian state and in Valparaíso<sup>2</sup>. According to literature data, the most affected age group varies in relation to the type of dermatophytosis. For example, *Tinea capitis* is more common in children, especially in prepubertal children<sup>12</sup>, and onychomycosis, the most prevalent dermatophytosis in this study, is more prevalent in adults<sup>13</sup>. Hormonal changes during puberty that perpetuate during adulthood, such as the greater secretion of acids by the sebaceous glands and their type prevent the

**Table 3.** Treatments for dermatophytosis in patients treated at a reference service, 2016–2020

Treatment	n	%	p-value
<b>Carrying out treatment</b>			
Yes	72	96.00	Chi-square
No (other diagnosis)	3	4.00	< 0.0001
<b>Type of treatment</b>			
Systemic	7	9.72	Chi-square
Topic	11	15.28	< 0.0001
Combined	54	75.00	
<b>Type of systemic treatment*</b>			
Fluconazole	17	22.67	Chi-square
Griseofulvin	21	28.00	0.0040
Itraconazole	3	4.00	
<b>Topical treatment*</b>			
Amorolfine	11	14.67	Chi-square
Butenafine	12	16.00	< 0.0001
Ketoconazole	9	12.00	
Ciclopirox olamine	27	36.00	
Clotrimazole	1	1.33	
Fenticonazole	2	2.67	
Piroctone olamine	2	2.67	
Selenium sulfide	1	1.33	

\*The same patient may have used more than one type of systemic/topical treatment.



**Figure 1.** Treatment duration of dermatophytoses in the 75 patients studied.

growth of species that cause tinea in the scalp, explaining the lower occurrence of *Tinea capitis* in adult and elderly patients<sup>14</sup>.

The expressive number of onychomycosis in this series is due to several reasons. The major factors associated are the age group, characteristically more affected by this location; presence of comorbidities, local components (trauma, inadequate nail care, use of closed shoes), sports activities and dermatological changes<sup>15,16</sup>. In a recent Brazilian systematic review involving 24 studies, Bodman and Krishnamurthy<sup>13</sup> also observed that onychomycosis was the most prevalent dermatophytosis.

Topical and systemic drugs are treatment options for dermatophytosis. Most dermatophyte infections require only topical agents, whereas oral systemic treatment is recommended in extensive, refractory and/or relapsing cases and in infections with extension to follicles (e.g., *Tinea capitis*) and nails, as in onychomycosis<sup>1,17</sup>. In our study, 75% of the patients underwent topical and systemic treatment in combination, possibly because onychomycosis and *Tinea capitis* were the most prevalent, in agreement with the literature<sup>17</sup>.

Approximately 25% of the patients received treatment with terbinafine, which along with itraconazole, are

**Table 4.** Laboratory characteristics of patients with dermatophytosis treated at a reference service, 2016–2020

Laboratory characteristics	<i>n</i>	%	<i>p</i> -value
<b>Mycological examination</b>			
Yes	43	57.33	Chi-square 0.2010
No	31	41.33	
No information	1	1.33	
<b>Direct mycological test result</b>			
Yes	40	93.02	Chi-square < 0.0001
Negative/inconclusive	3	6.98	
<b>Culture performed</b>			
Yes	2	2.67	Chi-square < 0.0001
No	72	96.00	
No information	1	1.33	

**Table 5.** Characteristics associated with the development of dermatophytosis in patients treated at a reference service, 2016–2020

Associated features	<i>n</i>	%	<i>p</i> -value
<b>Animals at home</b>			
Yes	3	2.67	Not applicable
No	2	1.33	
No information	70	96.00	
<b>Affected family members</b>			
Yes	5	4.00	Chi-square < 0.0001
No	3	2.67	
No information	67	93.33	
<b>Comorbidities</b>			
Yes	20	26.67	Chi-square 0.7423
No	17	22.67	
No information	38	50.67	
<b>Type of comorbidity*</b>			
Asthma	2	2.67	Not applicable
Diabetes mellitus	10	13.33	
Dyslipidemia	1	1.33	
Viral hepatitis	2	2.67	
<b>Arterial hypertension</b>	11	14.67	
Heart disease	1	1.33	
Lymphoma	1	1.33	
Vitiligo	1	1.33	
Immune thrombocytopenic purpura	1	1.33	

\*The same patient may have had more than one comorbidity.

drugs approved by the Food and Drug Association in the treatment of onychomycosis. Systemic drugs are a feasible treatment of onychomycosis because of their accessibility, lower cost and high efficacy<sup>18</sup>. A recent Cochrane review of oral antifungal agents in the treatment of onychomycosis showed terbinafine was more effective than azoles in achieving clinical cure with no difference in adverse effects or recurrence rates<sup>19</sup>.

The most frequently prescribed topical treatment in our study was ciclopirox olamine (36%), which is widely used in nail varnish preparations for onychomycosis, in combination with systemic treatment. Recurrence rate is higher in monotherapy. However, it is also possible to use monotherapy in cases of minimal (distal and lateral) subungual onychomycosis (less than 50% of the total nail area involved) and/or when the patient is not a suitable candidate for oral antifungal therapy<sup>20</sup>.

The second most prevalent dermatophytosis in the series was *Tinea capitis*. In these cases, oral antifungal agents such as terbinafine and griseofulvin are the first line of treatment. The duration of treatment ranges from 4 to 6 weeks or even 12 weeks for griseofulvin<sup>21</sup>. In our casuistic, 83.33% ( $n = 15$ ) of the patients diagnosed with *Tinea capitis* underwent treatment with griseofulvin and all cases had clinical cure confirmed by direct mycological examination. Besides systemic treatment, in many medical records, ketoconazole or topical selenium sulfide shampoo, was prescribed to prevent the spread of the fungus<sup>22</sup>.

Regarding treatment of *Tinea capitis*, it is essential to identify potential sources of infection at home or in pets. Transmission between members of the same family is the most common route, mainly through contaminated fomites. In addition, zoophilic species such as *Microsporum canis* can cause infection after contact with infected domestic dogs and cats. Zoophilic species are more often associated with more severe and difficult-to-treat forms, such as *kerion celsi*<sup>21,23</sup>. In the analyzed sample, 96% ( $n = 70$ ) and 93.3% ( $n = 67$ ) of the medical records did not present information on the presence of affected domestic animals or family members, respectively.

Regarding follow-up, 77.33% of the patients attended successive consultations, which is essential for an effective treatment, especially in cases of onychomycosis, whose therapy is long, occasionally needs monitoring with laboratory tests and permanent cure may be difficult, as highlighted by Bentine<sup>24</sup>. Treatment duration varies according to the clinical response, type, location and extent of dermatophytosis. Another factor is the appropriate use of the drug, which can last from

two weeks to several months, as in the case of onychomycosis (generally, 12 months in toenails)<sup>16</sup>. In the present study, more than half of the patients completed treatment and follow-up in less than 10 months.

The correct identification of the etiological agent by culture may be an important step as it can influence the prognosis<sup>15</sup>; however, in the present study, only 2 patients (2.67%) had fungi cultures.

Several predisposing factors facilitate the infection and spreading rate by dermatophytes, such as gender, local trauma, peripheral circulation changes, immunosuppression, occupation, hormonal changes, and even local weather<sup>25</sup>. A classic example is type 2 diabetes mellitus, because of microangiopathy, poor healing, and sensory neuropathy<sup>19,24</sup>. We identified only 26.67% ( $n = 20$ ) of the patients with comorbidities, half of them ( $n = 10$ ) had type 2 diabetes mellitus.

## Conclusion

The present study provided demographic data, characterization of clinical aspects, and treatment regimens used in medical practice at a reference center in northern Brazil. Analyzed data emphasize the importance of early diagnosis and treatment of dermatophytosis, especially in the most fragile age groups (pediatric and elderly) and reflects how onychomycosis is most frequent in adults and *Tinea capitis* in children.

## Funding

None.

## Conflicts of interest

None.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** Right to privacy and informed consent. The authors have obtained approval from the Ethics Committee for

analysis and publication of routinely acquired clinical data and informed consent was not required for this retrospective observational study.

## References

1. Azulay RD, Azulay DR, Azulay-Abulafia L. *Dermatologia*, 7th ed. Rio de Janeiro: Guanabara Koogan; 2017.
2. Bouer FJ, Logullo L, Heins EM, Dinato SLM. Epidemiology and evaluation of diagnostic methods in superficial mycoses in the dermatology service of a Public Hospital in Santos, Brazil. *J Port Soc Dermatol Venereol*. 2021;79(4):345–50.
3. Barroso LC. *Dermatofitoses em pessoas atendidas em um serviço público de micologia de Manaus/AM: Epidemiologia e possíveis fontes de infecção* [Dissertação]. Manaus/AM: Fundação Oswaldo Cruz; 2017.
4. Sanguino TC, Jarros IC, Negri M. Occurrence of dermatophytoses in patients from the Sistema Único de Saúde. *An Bras Dermatol*. 2019;94(3):293–7.
5. Pires CA, Cruz NF, Lobato AM, Sousa PO, Carneiro FR, Mendes AM. Clinical, epidemiological, and therapeutic profile of dermatophytosis. *An Bras Dermatol*. 2014;89(2):259–64.
6. Universidade Federal do Rio Grande do SUL. *Telecondutas - Dermatofitoses* [internet]; 2017. Acesso em 12 de agosto de 2021. Disponível em [https://www.ufrgs.br/telessaunders/documentos/telecondutas/tc\\_tinea.pdf](https://www.ufrgs.br/telessaunders/documentos/telecondutas/tc_tinea.pdf).
7. Lana DFD, Batista BG, Alves SH, Fuentesfria AM. Dermatofitoses: agentes etiológicos, formas clínicas, terapêutica e novas perspectivas de tratamento. *Clin Biomed Res*. 2017;36(4):230–41.
8. Goldstein AO, Goldstein BG, Dellavalle RP, Levy ML, Rosen T, Ofori AO. Dermatophyte (tinea) infections. In: Lee S (Ed). UpToDate. Retrieved September 15, 2019, from <https://www.uptodate.com/contents/dermatophyte-tinea-infections>.
9. Verma S, Vasani R, Reszke R, Matusiak Ł, Szepletowski JC. Prevalence and clinical characteristics of itch in epidemic-like scenario of dermatophytoses in India: a cross-sectional study. *J Eur Acad Dermatol Venereol*. 2020;34(1):180–3.
10. Pereira FO, Gomes SM, Silva SL, Teixeira APC, Lima IO. The prevalence of dermatophytoses in Brazil: a systematic review. *J Med Microbiol*. 2021;70(3).
11. Rocha J, Duarte ML, Oliveira P, Brito C. Dermatofitias no distrito de Braga - estudo retrospectivo dos últimos 11 anos (1999–2009). *J Port Soc Dermatol Venereol*. 2011;69(1):69–78.
12. Al Aboud AM, Crane JS. *Tinea Capitis*. [Updated 2022 May 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK536909/>
13. Bodman MA, Krishnamurthy K. *Onychomycosis*. [Updated 2022 May 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK441853/>
14. Petrucelli MF, Abreu MH, Cantelli BAM, Segura GG, Nishimura FG, Bitencourt TA, et al. Epidemiology and diagnostic perspectives of dermatophytoses. *J Fungi (Basel)*. 2020;6(4):310.
15. Pereira, HS, Silva PMF, Araújo JSM, Pereira IF. Caracterização das dermatofitoses de pacientes atendidos em um laboratório de análises clínicas na cidade de Campina Grande-PB. In: *Anais do VII Congresso Internacional de Envelhecimento Humano*, 2021; Editora realize: 2021. p. 1401-17.
16. Kovitwanichkanont T, Chong AH. Superficial fungal infections. *Aust J Gen Pract*. 2019;48(10):706–11.
17. Rato M, Costin A, Furtado C, Sousa C, Toscano C, Veríssimo C, et al. Epidemiologia das infecções fúngicas superficiais em Portugal: revisão de 3 anos (2014–2016). *J Port Soc Dermatol Venereol*. 2016;76(3):269–78.
18. Lipner SR, Scher RK. Onychomycosis: treatment and prevention of recurrence. *J Am Acad Dermatol*. 2019;80(4):853–67.
19. Kreijkamp-Kaspers S, Hawke K, Guo L, Kerin G, Bell-Syer SE, Magin P, et al. Oral antifungal medication for toenail onychomycosis *Cochrane Database Syst Rev*. 2017;7(7):CD010031.
20. Dalla Lana DF. *Desenvolvimento de Novas Entidades Químicas e Formulações Para o Tratamento de Dermatomicoses*. (Tese de Doutorado). Porto Alegre/RS: Universidade Federal do Rio Grande do Sul; 2019.
21. Leung AKC, Hon KL, Leong KF, Barankin B, Lam JM. Tinea capitis: an updated review. *Recent Pat Inflamm Allergy Drug Discov*. 2020;14(1):58–68.
22. Hay RJ. Tinea capitis: current status. *Mycopathologia*. 2017;182(1-2):87–93.
23. John AM, Schwartz RA, Janniger CK. The kerion: an angry Tinea capitis. *Int J Dermatol*. 2018;57(1):3–9.
24. Bentine LLM. *Dermatófitos Como Agentes de Onicomicoses em População Adulta de Serviço Ambulatorial do Hospital de Aeronáutica de São Paulo, na Cidade de São Paulo, Brasil* [Dissertação]. São Paulo: Secretaria de Saúde do estado de São Paulo; 2017.
25. Gupta AK, Versteeg SG, Shear NH. Onychomycosis in the 21st century: an update on diagnosis, epidemiology, and treatment. *J Cut Med Surg*. 2017;21(6):525–39.