Epidemiological and mycological data of onychomycosis in Goiania, Brazil

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Summary
Onychomycosis defined as fungal infection of the nail represents more than 50% of all onychopathies. Epidemiological studies have shown that this mycosis is worldwide in occurrence, but with geographical variation in distribution. The direct microscopy and culture of the nail samples were performed to identify the causative agent. Out of 2273 patients with nail infection examined between January 2000 and December 2004 in Goiania, state of Goias, Brazil, diagnosis of onychomycosis was confirmed in 1282 cases, with dermatophytes and Candida species being the most common aetiological agents isolated. Dermatophyte onychomycosis was more common in toenails than in fingernails, while onychomycosis caused by yeast had a similar frequency in both toenails and fingernails. Among the species identified, Candida albicans was responsible for 492 cases (38.4%) of onychomycosis, Trichophyton rubrum was found in 327 cases (25.6%) and Trichophyton mentagrophytes in 258 cases (20.1%). Other fungi isolated from nail infections included Aspergillus sp., Trichosporon sp., Geotrichum sp. and Fusarium sp. In our study, yeast of the genus Candida were the dominant cause of onychomycosis in women and dermatophytes were the principal cause of this condition in men.

Key words: Onychomycosis, dermatophytes, Candida spp.

Introduction
Onychomycosis defined as fungal infection of the nail represents more than 50% of all onychopathies.1 The agents of onychomycosis belong to three groups of fungi: dermatophytes, responsible for most of the infections followed by yeast and non-dermatophyte filamentous fungi.2,3 The majority of nail infections are caused by Trichophyton rubrum, Trichophyton mentagrophytes and Candida albicans. Moulds of the genera Aspergillus, Fusarium, Scopulariopsis, Acremonium and Scytalidium can also be implied in the pathogenesis of onychomycosis.4 The causative agent of onychomycosis may show geographical variation in distribution. Few reports exist on the prevalence of the pathogens and the true frequency of onychomycosis in Goiania, state of Goias, a region located in the Midwest of Brazil, where this infection is also a common clinical presentation. The aim of this present study was to investigate the aetiological agents of onychomycosis in Goiania, over a period of 5 years.

Methods
This study was carried out from January 2000 to December 2004, and included 2273 patients (1748 women and 525 men) with clinical suspicion of fungal infection of the nails. Samples of nails were collected by vigorously scraping the distal portion of the nail, the underneath area, as well as the nail bed. Nail samples were digested in 20% potassium hydroxide directly on a microscopic slide and cultured in Sabouraud glucose agar medium with 0.05% chloramphenicol, and in Sabouraud glucose agar medium with 0.05% chloramphenicol and cycloheximide. The cultures were incubated at 27 °C for 4 weeks and examined twice a week during the incubation period. Positive samples on direct...
microscopy and negative cultures were recultured. The dermatophytes were identified by the methodology of Rebell and Taplin [5], the identification of yeast was performed according to Kurtzman and Fell methodology [6], while the non-dermatophyte moulds were identified by macroscopic characteristics and microscopic arrangement, size and shapes of the hyphae and organs of proliferation. Three mycological evaluations were performed in cases of isolation of non-dermatophyte moulds and non-\textit{Candida} yeast. Chi-squared test ($\chi^2$) was utilised for a statistical analysis. A $P < 0.01$ was considered to be significant.

**Results**

Of all the 2273 samples examined from patients with nail disorders, 1282 (56.4%) cases of onychomycosis were confirmed through a mycological analysis by microscopy and fungal culture. Dermatophytes were isolated in 591 cases (46.1%), yeast in 689 (53.7%) and non-dermatophyte moulds were identified in two cases (0.1%) of these infections. From the 1282 investigated persons, 926 were women (72.2%) and 356 were men (27.8%). The infection was more frequent in people over 20 years of age, with a maximum between 40 and 49 years of age (24.3%) and was less frequent in people over 70 years of age (Fig. 1). Seven hundred and ninety-four patients (67.7% women and 32.3% men) had lesions in their toenails and 362 (80.0% women and 20.0% men) in their fingernails. Considering all nail infections (Table 1), we verified that dermatophytes were more prevalent in men and yeast in women. Dermatophytes were present in 71.6% of men (255/356) and 36.3% (336/924) of women ($P < 0.01$) while the yeast were present in 28.3% (101/356) men and 63.3% (588/924) women ($P < 0.01$).

Dermatophyte onychomycosis was more common in toenails than in fingernails. Of all the 591 patients analysed with dermatophytosis, 496 (83.9%) had infections in toenails, 55 (9.3%) in fingernails and 40 (6.8%) in toenails and fingernails. Onychomycosis caused by yeast had a similar frequency in toenails and fingernails. The lesions were present in 296 (42.9%) toenails, in 307 (44.5%) fingernails, and in 86 (12.5%) toenails and fingernails (Table 1).

The identification of the aetiological agent showed that \textit{C. albicans} was responsible for 71.4% of the cases of infection by yeast, while \textit{T. rubrum} (55.3%) and \textit{T. mentagrophytes} (43.7%) were the most common aetiological agents of dermatophytosis. \textit{Fusarium} spp. and \textit{Aspergillus} spp. were the only non-dermatophyte moulds isolated (Table 2).

**Discussion**

Onychomycosis is a cutaneous fungal infection highly prevalent in the population but its importance is often underestimated. This infection can cause pain and discomfort and can generate many physical, psychosocial and occupational problems, considerably impairing patients’ quality of life.1,7,8

In our study, onychomycosis incidence rates were the highest between 30 and 59 years and decreased in patients over the age of 70 years (Fig. 1). The increased prevalence of nail lesions by fungi in adults can be explained as a consequence of nail trauma and slow nail growth.1 The low prevalence found in older people, in our study, should have been determined by other factors. According to Ogasarawa \textit{et al.} [9], the life style is determinative for onychomycosis. The disease, for example is more often in people who wet their feet and hands frequently and is rarely seen in the feet of people who do not wear shoes. Lopes \textit{et al.} [10] in a study performed in Rio Grande do Sul, Brazil verified a decreasing occurrence of tinea unguium in the elderly patients over the age of 60 years.

![Figure 1](image-url)  
**Figure 1** Distribution of onychomycosis according to age.
In this study, we found more female patients affected by onychomycosis compared to male patients. Some investigators have reported differences among fungal infection of fingernail and toenail between men and women. Sayed et al. [11] demonstrated that fingernail involvement was predominant in females (76.2%) whereas toenail onychomycosis was predominant in males (53.6%). Our results showed that toenail onychomycosis was more frequent in men (257/329) than in women (537/827), while fingernail involvement was more frequent in women (290/827) than in men (72/329). The increased prevalence of onychomycosis in the toenails in men could be the result of more traumas in the nails because of occlusive footwear, which favours the appearance of disease.12 The reason for the higher frequency of fungal infection of fingernails among women is probably because of the frequent immersion of the hands in water (associated with working in wet environment as housewives) or exposure to chemicals and trauma.8,13

Although previous reports have indicated that dermatophytes are responsible for most of the nail infections,3 we found that onychomycosis caused by yeast was the most common clinical form with C. albicans isolated in 71.4% of cases. This species has been frequently found in onychia and paronychia by yeast.14,15 Among the dermatophytes, T. rubrum and T. mentagrophytes were the most common aetiologic agents of tinea unguium found in our casuistic. According to some researchers,16,17 these fungi are responsible for the high prevalence of dermatophytosis in our population.

The role of non-dermatophyte moulds and non-
Candida yeast in onychomycosis remains controversial. Nowadays, they have been described as pathogens of the nails.9,18,19 In our study, we isolated Trichosporon, Geotrichum, Aspergillus and Fusarium at a low rate. These results suggest that these organisms are relatively uncommon pathogens of onychomycosis in our region, or that other relevant diagnostic criteria for nail infection are necessary.

Table 2 Aetiological agent responsible for onychomycosis in 1282 patients

<table>
<thead>
<tr>
<th>Dermatophytes</th>
<th>n</th>
<th>%</th>
<th>Yeast</th>
<th>n</th>
<th>%</th>
<th>Moulds</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichophyton rubrum</td>
<td>327</td>
<td>55.3</td>
<td>Candida albicans</td>
<td>482</td>
<td>71.4</td>
<td>Aspergillus sp.</td>
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<td>50</td>
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<tr>
<td>Trichophyton mentagrophytes</td>
<td>258</td>
<td>43.7</td>
<td>Candida tropicalis</td>
<td>105</td>
<td>15.2</td>
<td>Fusarium sp.</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Epidermophyton floccosum</td>
<td>6</td>
<td>1.0</td>
<td>Candida guilliermondii</td>
<td>52</td>
<td>7.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Candida parapsilosis</td>
<td>31</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Trichosporon sp.</td>
<td>8</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Geotrichum sp.</td>
<td>1</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>591</td>
<td>100</td>
<td></td>
<td>689</td>
<td>100</td>
<td></td>
<td>2</td>
<td>100</td>
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References


