

Review article


## Dermatophytosis in Ecuador *Dermatofitosis en Ecuador*

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Abstract

**Introduction:** Dermatophytosis is a frequent dermatological consultation in Ecuador; its prevalence cannot best tableside, or the cause 1 agent is determined, due to under-registration in medical consultation logs and poor application of laboratory diagnosis last decade; 91% were retrieved from thesis repositories. **Results:** Undergraduate and graduate projects and articles published in regional impact journals report tinea unguium and tinea corporis as the most frequent clinical entity, the most frequent agents belong to Complex T. rubrum 21% and Complex T. mentagrophytes 20%; The presence of M. ferrugineum isolated in the Interandina zone is striking. **Conclusions.:** In Ecuador, the circulation of three complexes and 11 species of dermatophytes is determined. Population studies with molecular methods should be developed to accurately determine the epidemiological status of these agents in this region of the Americas.

**Keywords:** Tinea, Dermatophytes, Dermatomycosis.

## Resumen

**Introducción:** Las dermatofitosis constituyen una consulta dermatológica frecuente en Ecuador; no se logra establecer su prevalencia, o determinar el agente causal, debido al subregistro en las bitácoras de consulta médica y la poca aplicación del diagnóstico de laboratorio. **Objetivo:** Estimar la situación de las dermatofitosis y sus agentes causales. Los tópicos hallados abarcan la relación de las tinea, en adultos, pacientes inmunocomprometidos, entre otros. Las bases consultadas en la Biblioteca Virtual en Salud de Cuba fueron Lilacs, IBECs, Medline, Scopus, PubMed/Medline y Scielo, así como repositorios de universidades ecuatorianas. **Métodología:** El documento se origina de una revisión documental con búsqueda, análisis y síntesis de fuentes secundarias, de 22 productos de investigación del último decenio; el 91% fueron recuperados de repositorios de tesis. **Resultados:** Los proyectos de grado, posgrado y artículos publicados en revistas de impacto regional reportan como entidad clínica más frecuente tinea unguium y tinea corporis, los agentes más frecuentes pertenecen al Complejo *T. rubrum* 21 % y Complejo *T. mentagrophytes* 20 %; llama la atención la presencia de *M. ferrugineum* aislado en la zona Interandina. **Conclusiones:** En Ecuador, se determina la circulación de tres complejos y 11 especies de dermatofitos. Deberán desarrollarse estudios poblacionales con métodos moleculares para determinar con exactitud el estado epidemiológico de estos agentes en esta región de las Américas.

**Palabras clave:** Tiña, Arthrodermataceae, Microsporum, Trichophyton, Epidermophyton.

## Development

The frequency of dermatophytes is variable throughout the world, it is subject to environmental factors and causal agents present in the ecosystems of each environment. In this way, it is postulated that infections by these microorganisms depend to a great extent on the host's resistance to the causative agent, the virulence of the fungus, and the environmental conditions in which they develop.<sup>1</sup>

Dermatophytosis is a mucous skin infection produced by dermatophyte fungi that affect more than half of the population. They cause damage to the keratinized surface of the skin, nails, scalp, glabrous skin, and mucous membranes, which in isolated cases manage to invade the subcutaneous cellular

tissue. At present, the lack of control in the sale of antifungal drugs must be considered, which facilitate the resistance of these pathogens that in some cases cause serious systemic infections on the individual due to ineffectiveness of the prescribed treatment.<sup>1</sup>

Ecuador is located on the tropical fringe and due to its Andean heights it has extensive temperate and cold zones; it has a great climatic and ecological diversity, a prominent feature of the geography of South America<sup>2</sup>. Agricultural activities condition workers to be exposed for extended periods to these variations in temperature and humidity that favor the growth of fungal microorganisms, particularly in tropical and subtropical areas, where about 25% of superficial mycoses occur.<sup>3</sup>

The records of dermatophytosis in Ecuador begin in 1936, when JA Falconí reports on a case of tinea favosa produced by *Achorion schoenleini*. Dr. José Daniel Rodríguez (1958) demonstrates for the first time *Nannizzia incurvata*, presentation of *Microsporum gypseum* and *Arthroderma tuberculatum* compatible with *Chrysosporium*. In 1968, JD Rodríguez and Ramon Lazo Salazar described *Keratinomyces jelloid* and *Microsporum cookie*. In 1979, L. Ajello and A. Padhye isolated "keratinophilic fungi in the Galapagos Islands" with a valuable report of *Arthroderma quadrifidum*<sup>4</sup>.

In Ecuador there are no population studies that allow determining the incidence or prevalence of dermatophytosis, which is not a notifiable disease. With In order to present a vision of the current state of this entity, a review and analysis of the publications of Ecuador during the last decade is carried out. As a result of the search, 22 sources were detected, of which 91% were retrieved from thesis repositories (Table 1).

## Clinical-epidemiological aspects

The frequency of dermatophytoses is variable, as are the etiological agents recovered from them. The risk factors that were most identified were exposure to activities that involve spending a large part of the working time wearing closed shoes<sup>5</sup> and socks without accessing proper hygiene of their feet<sup>6</sup>, sports activities (swimming), use of community or public toilets, trauma, advanced age, presence of comorbidities such as diabetes<sup>7</sup>, immunodeficiency and genetic predisposition, among others, which predisposes to infection and the development of these pathologies<sup>8</sup>. It is shown that the female

sex is the most affected <sup>3, 9</sup>. The age group that frequently attends the consultation is between 18 to 65 years old <sup>(10)</sup>, both in rural and urban areas <sup>11, 12</sup>.

Laboratory diagnosis is made by conventional methods, using clinical samples from scrapings of skin scales, nails and hair fibers, which are treated with 20% potassium hydroxide (KOH). <sup>3, 13</sup> or inoculated on Sabouraud Dextrose Agar with Chloramphenicol and Mycosel Agar media <sup>14</sup>. Microscopic preparations with lactophenol blue, microculture and urease test are basic elements for the subsequent identification of the genus and species. (fifteen). These are the simplest and fastest method of detecting a fungal infection, but they provide late results, which is why it is necessary to develop other identification techniques that shorten the response time of the results. <sup>16, 17</sup>.

Dermatophytes comprise three genera: Trichophyton, Microsporum and Epidermophyton, they are classified into geophiles, zoophiles or anthropophiles depending on their habitat. <sup>5</sup>. Its clinical presentations generally correspond to the area of the skin where the lesion is located. <sup>17</sup>.

Tinea capitis or head dermatophytosis: affects the scalp and hairs. It presents as single or multiple pseudoalopecic plaques with or without inflammatory desquamation. It affects children, older adults, and exceptionally young adults with immunodeficiency. The most frequent etiological agents are *M. canis*, *T. rubrum* and *T. violaceum*, which can affect the outer or inner layer of hairs <sup>16</sup>.

Tinea corporis or circinate herpes: it can be located on the skin of any part of the body, especially the shoulders and extremities, while it is less frequent on the face. Lesions can be single or multiple, erythematous, the center is usually dry, the active borders are reddish in appearance <sup>18, 19</sup>. Growth and healing are centrifugal <sup>(16)</sup>. The presence of *T. rubrum*, *T. violaceum*, *T. schoenleini*, *T. mentagrophytes*, *T. verrucosum*, *T. rubrum*, *M. canis* is associated <sup>5, 16, 20</sup>.

Tinea cruris or intertrigo: the lesions present with active, erythematous borders and a dry center with signs of healing. They are in the groin, the perianal and perineal area, as well as the upper and inner part of the thighs, closely associated with the presence of humidity in these areas. They can be single or multiple, bilateral, and asymmetric, with extension in the centrifugal direction. It is more common in adult males <sup>15, 21</sup>.

Tinea pedis, Ringworm of the foot or athlete's foot: it is the most frequent (it affects 79% of the population at some point in their life). Mycosis of worldwide distribution, but predominates in areas with hot and humid climates. Among the predisposing factors are age and male sex. There is no predilection for racial group. Its main etiological agent is *Epidermophyton floccosum* <sup>13, 17, 22</sup>.

Tinea unguium or onychomycosis: infection of the nail plate that can be acquired from ringworm of the feet. Nails are dull, thickened, with yellowish-white, grayish-brown, or black longitudinal or transverse striations, are friable, and are eroded. It is cosmopolitan and the most common causative agents are: *T. rubrum*, *T. mentagrophytes*, *T. tonsurans* <sup>12</sup>.

Treatment: requires an analysis of the compromise of the nail plate, the damage of the matrix and the number of affected nails. If this results in fewer than four compromised structures, treatment can be topical. If the involvement includes more structures and there is a suspicion of recurrence, the indicated treatment is orally with terbinafine or itraconazole. <sup>3, 10, 23, 24</sup>.

Dermatophyte lesions are the cause of dermatological consultation all over the world. It is estimated that they affect 1.5 million people, which is equivalent to 25% of the world's population <sup>25</sup>. The regions with high prevalence are found in the tropical and subtropical strip of the American continent. <sup>26</sup>. In the present review, 22 research products were found corresponding to the last 10 years regarding dermatophytosis in Ecuador. Those that reveal that its etiology not only depends on the geographical location, but also on the age, the socioeconomic level, the possession of domestic animals and the type of dermatophyte present in each region.

Countries that share climatic floors like Ecuador present controversial indicators. Tuesta A. records that in Piura, Peru, the highest incidence of this pathology is found in females with 58.82% <sup>27</sup>, which agrees with Pires, et al. in Brazil <sup>(28)</sup>; Dike-Ndudim et al. report that in Nigeria the most affected population is children <sup>29</sup>; meanwhile, Gavilán et al. in Peru they did not find an association regarding sex <sup>30</sup>. Generally, A 36% incidence of dermatophytosis is observed in females, 18% in males and 52% who do not value this variable, which does not allow generating a criterion regarding this issue.

Moya states that in Manabí, Ecuador, dermatophytoses do not have a defined age group, they are observed from infancy 2.6%, they increase in adolescence to 20.5% and in geriatric age 40%<sup>18</sup>. Campozano and Heras argue that age is a predisposing factor for fungal infections according to the geographic area of analysis, the type of mycosis and the causative agent (twenty). In the present analysis it is possible to establish that age is not a predisposing factor, it is considered as a variable to determine the prevalence of tinea at certain ends of life.

Rafat et al., in Iran and Otašević et al., in Serbia, agree that sports activities such as swimming, the use of public places such as beaches, trauma to the skin and attachments, poor disinfection of hairdressing instruments, diseases that compromise the immune system, living with infected pets, wearing tight shoes, peripheral vascular compromise and prolonged use of immunosuppressants and metabolic diseases that compromise the immune system such as HIV, type II diabetes mellitus are predisposing factors for acquiring and developing dermatophytoses<sup>31</sup>. Coincidentally, in Machala, Gomezcoello et al. associate agricultural activities, raising poultry animals, the use of closed boots or moccasins made of synthetic material and frequent contact with humidity during the working day, with the development of the disease<sup>14</sup>.

Tangarife-Chestnut and table ensure that the success in isolating the etiological agents of mycoses derives from several factors: the correct collection of the sample, its transport and processing in the shortest possible time, as well as the correct selection of the culture media and the temperature of incubation<sup>32</sup>. In this sense, Martin-Mazuelos et al. state that the best results come from the processing of samples of skin scales with discolored or dystrophic areas, nail plate scales, lateral edges of the nail or pieces of hair from the site of the injury that contain the root<sup>33</sup>.

It is generally recognized that Diagnostic with laboratory Wood's lamp, microscopy and culture give good results<sup>3, 4</sup>. Observation with KOH at different concentrations (10-25%) alone or mixed with Parker® blue black ink, dimethyl sulfoxide or calcofluor white of arthroconidia and hyphae in parasitized tissues continues to be a fast and effective method<sup>35</sup>. The diagnosis must be confirmed by the identification of the fungi by means of various techniques, histomycological studies with periodic acid Schiff (PAS), cultures on Sabouraud

agar, mycobiotic agar or DTM (Dermatophyte test medium) and with molecular methods.<sup>36</sup>

In this review we did not find works from Ecuador based on molecular techniques; 91% used the KOH bleaching technique, of these 95% used it at a 20% concentration and 10% KOH with Parker® blue ink. The ADS medium, incubated at 28C for 10-15 days, was used by 86% of the investigations, in 14% the authors added a bacterial inhibitor to the formula; in 18% other additional conventional techniques were used to achieve identification by species of dermatophytes. There is no standardized application of these methods; A situation that could be because the infrastructure and equipment of the laboratories of the hospitals that are categorized by the Ministry of Public

Health by complexity of health care do not have the supplies. In this review, during the period from 2011 to May 2020, 22 papers on dermatophytosis in Ecuador were compiled. 67.6% of them show the registry of their etiological agents. In order of frequency appear the *T. rubrum* complex (21%), the *T. mentagrophytes* complex (20%), *Trichophyton* sp (15%), *Microsporum* sp (15%), *E. floccosum* (10%), *T. violaceum* (8.5%), *T. tonsurans* (8.5%), *T. verrucosum* (7.10%), *T. schoenleinii* (7.10%), *M. canis* (3%), *M. audouinii* (3 %) and *T. concentricum* (1.5%). Additionally, four studies (6% of the total) refer lesions caused by dermatophytes without specifying the causative agent. The recovery by Quisupangui (2017) of an isolate of *M.*

In general, this casuistry coincides with studies carried out in the region of the Americas, in which *T. rubrum* seems to be the most frequent etiological agent. For 50 years, a growing increase in its frequency has been observed and today it is estimated that it is responsible for 60% to 80% of dermatophytoses, followed by *T. mentagrophytes* (23.7%) and *M. canis* (7, 1 %)(19). Due to increasing population migration, some geographically restricted species (eg *M. ferrugineum*, *T. soudanense*, *T. concentricum* and *T. gourvilli*, usually confined to Africa and the East) have been recovered in atypical geographic locations. Sylla identifies the presence of *T. soudanense* in nail lesions in Dakar<sup>37</sup>. In the United States of America and in some European countries, a change in etiological agents is also noted, especially tinea capitis, in which *T. tonsurans* has replaced *M. audouinii*<sup>19</sup>.

Dermatophytoses represent 25% of skin lesions and its annexes, in fact they acquire their name

according to the area of the body where it is located<sup>3, 4</sup>. In the case of Ecuador, 90% of the studies are related to tinea unguium, followed by tinea corporis (32%), tinea capitis (27.3%), tinea pedis (22.8%), tinea manuum (9%) and tinea cruris (5%)<sup>3, 4</sup> (graph 3). We found no record of tinea incognita. The dermatological manifestations of lesions caused by dermatophytes in immunocompromised patients are atypical and present as papules, plaques, and nodules, which is why they are often misdiagnosed<sup>23</sup>.

In Peru, Tuesta's study in children registers tinea capitis (50%) as the most frequent diagnosis, followed by tinea pedis, tinea corporis and tinea cruris<sup>27</sup>. However, Torres et al. found in residents of the Yanomami area in Venezuela as the main diagnosis of dermatophytosis tinea corporis regardless of the age and sex of the patient<sup>38</sup>.

During the present review, no population studies were found that allow us to determine the clinical-epidemiological and microbiological aspects of this pathology with precision. When contrasting the results of the present analysis with those reported by authors from countries geographically and climatologically similar to Ecuador, it is not possible to be conclusive, since the results depend on the type of sample that each researcher applied in their studies.

### Conclusions.

Dermatophytoses are an entity that groups lesions that affect the keratin of the skin and mucous membranes, they are caused by filamentous fungi of anamorphic genera that have an affinity for the stratum corneum of the skin. This type of mycosis causes that in most cases the patient needs to go to medical consultations several times due to the lack of etiological diagnosis of the agent

that causes his condition. In Ecuador, scientific reports on the matter are scarce; In general, atypical cases and those that denote interest in the field of medicine are presented in clinical sessions or conferences, which causes insufficient written information. It is recognized that dermatophyte infections depend directly on the environmental conditions of each region, the type of population and the predisposing risk factors.

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