Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/fd5qrg63

A GLOBAL PERSPECTIVE ON RINGWORM: EPIDEMIOLOGY, BURDEN OF DISEASE, PUBLIC HEALTH IMPLICATIONS AND TREATMENT CHALLENGES - REVIEW ARTICLE

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Abstract

Ringworm (dermatophytosis) has emerged as a significant global public health challenge, particularly in tropical regions like India. The disease manifests primarily as tinea corporis and tinea cruris, affecting skin, nails, and hair. An increasing trend of chronic and recurrent dermatophytosis has been observed, with more frequent reports in dermatology clinics. This has led to heightened interest in the condition at both national and international dermatology conferences. The World Health Organization (WHO) estimates that 20-25% of the global population is affected by superficial fungal infections, with nearly a billion individuals experiencing skin, nail, or hair fungal conditions.

Factors such as poor hygiene, overcrowding, and increased physical activity in hot and humid climates contribute to the high prevalence of ringworm. The rising incidence in children and the higher susceptibility of adults aged 21-50 years are linked to outdoor activities and lifestyle choices, including the use of tight-fitting clothing and synthetic fabrics, which trap moisture and create ideal conditions for fungal growth. Furthermore, the widespread and irrational use of topical steroid-antifungal combinations has worsened the situation, contributing to chronic and treatment-resistant infections.

Despite the escalating number of cases, management guidelines remain outdated. Physicians often rely on hit-and-miss treatment strategies, as current antifungal medications show diminished efficacy. Research on dermatophytosis and its treatment must be reinvigorated, emphasizing molecular mechanisms of antifungal resistance and the role of nonpharmacologic measures in preventing reinfection. The financial burden on families, where multiple members are affected, also calls for a more comprehensive public health approach to tackle this pervasive issue.

Key words: Dermatophytosis, Tinea corporis, Antifungal resistance, Chronic recurrent infections, Public health burden

Introduction

Numerous research projects and postgraduate thesis dissertations on chronic or recurring dermatophytosis are currently in progress at numerous Indian centers. Chronic recurring dermatophyte infections are the subject of a dedicated session at practically all significant regional and national conferences in India. We won't be shocked if, in the near future, a conference with a specific focus is held solely to go over the nuances of the persistent threat. Once thought to be simple skin disorders to treat, tinea corporis and tinea cruris are rapidly turning into a dermatologist's or general practitioner's worst nightmare. Patients with recurring or chronic dermatophytosis present treatment-related difficulties that are comparable to those seen with vitiligo, pemphigus, and other chronic dermatoses. Practitioners are treating these patients without agreement on treatment protocols; they are combining oral antifungals at increasing dosages[4.]

The World Health Organization (WHO) reports that 20–25% of people globally have a superficial mycotic infection. The frequency of occurrences differs among nations. The most frequent clinical manifestation was tinea corporis (78.1%), which was followed by tinea cruris (10.1%), tinea manuum (2.5%), tinea faciei (1.8%), and tinea pedis (0.7%) [3].

There are expected to be around a billion cases of fungal infections of the skin, nails, and hair, tens of millions of cases of mucosal candidiasis, and over 150 million cases of serious fungal diseases that either significantly impair or kill patients. On the other hand, the intensity varies from minor mucocutaneous infections that cause no symptoms to potentially fatal systemic infections [3.]

To date, estimates of the disease's burden have been made for 16 different nations. For just 16 nations, an estimated 21,073,423 instances are reported. High population densities, inadequate sanitation, and low socioeconomic position are a few of the elements contributing to the high incidence of tinea capitis [3].

According to estimates, between 10% and 15% of people will contract a dermatophyte infection at some point in their lives, making this class of diseases extremely important for public health [14]. The following factors enhance the risk of contracting ringworm infection: living in close quarters, working outside, having a low socioeconomic status, sweating excessively, and being overly crowded [13.]

While dermatophytosis could affect patients of any age, the majority (64.9%) were between the ages of 21 and 50. The age range of 21 to 30 years old has been shown to have the highest incidence. The likelihood that this group has a higher frequency could stem from the fact that members of this group are typically the most active due to their participation in outside activities, including occupations and studies[2]

The variations in sebum production rates and immune system fluctuations associated with aging are reflected in the disparities in the occurrence of superficial infections among age groups and genders. There has also been evidence of ethnic predisposition, particularly with tinea capitis. Low socioeconomic groups had higher rates of recurrent dermatophytosis, with tinea corporis and cruris being the most prevalent clinical manifestations linked to chronicity[4] .

Prolonged sun exposure and strenuous physical labor that causes excessive perspiration can result in tinea problems. Furthermore, men's synthetic clothing and tight fittings, in particular, contribute to heated, sweaty, and wet skin conditions. The growth of dermatophytes is favored by all of these circumstances. Wearing socks and shoes for extended periods of time can cause wet conditions and the development of tinea pedis and tinea unguium, particularly in inter-digital regions[2.]

Research

Research in this field has frequently been disregarded, despite the fact that cutaneous dermatophytosis is becoming more commonplace worldwide, particularly in tropical regions. In fact, the American Academy of Dermatology's recommendations for the treatment of tinea corporis and cruris must be

found nearly two decades ago, and even then, they don't seem to be sufficient for the modern environment.
With little mention of tinea corporis/cruris, the more recent guidelines—which were released by the British Association of Dermatology and the British Medical Journal—have mostly concentrated on tinea capitis and tinea unguium [16].

India
It is more common in tropical and subtropical countries like India, where year-round high temperatures and humidity are experienced.
Unquestionably, within the previous 4-5 years, dermatophytosis has become more common throughout India. An growing tendency of dermatophytosis has been found by comparing studies conducted on superficial fungal infections in cities like Chennai, Ahmedabad, and Kolkata throughout different time periods [19].
Not only in India but in many other countries as well, there has been a recent surge in the number of patients presenting with dermatophytic infections and an increase in the failure of therapy[18].

Difficult to treat
In India, cases of chronic dermatophytosis, which is hard to cure, have increased within the last seven to eight years. Numerous reports have indicated that dermatophytosis is common in many regions of India[13] .
In India, 80% of children with tinea capitis were male.Females were more likely to contract Tinea corporis and T. unguium. Males between the ages of 21 and 30 were more likely to contract T. cruris. In this study, mixed infections with Tinea corporis and Tinea cruris were also common. The most frequent species is T. rubrum, which is followed by T. mentagrophytes. The most frequent etiological agent of T. corporis was T. rubrum[13]

Cell mediated immunity
The pathophysiology of dermatophytosis has been better understood recently, and this has underlined the critical role that cell-mediated immunity plays in fighting these diseases. Therefore, the existence of a positive immediate hypersensitivity (IH) response to trichophyton antigen coupled with the absence of a delayed hypersensitivity reaction suggests a chronic condition [16].

Identification
Physical assessment
A comprehensive history and physical examination is frequently adequate to diagnose tinea. An erythematous, elevated, scaly ring with middle clearing is the characteristic lesion. There could be more than one lesion. The infection can range in intensity from scaly, minor lesions to erythematous, exudative lesions that are typical of bacterial infections that have been overlaid.
Since potassium hydroxide (KOH) staining is low cost, simple to use, and highly sensitive, it is frequently used to diagnose tinea. Under a microscope, scrapings from the lesion(s) are positioned in a drop of KOH and checked for the presence of fungal hyphae.

Culture
If the results of a KOH stain are not definitive, a fungal culture might be carried out as a confirmatory test. On Sabouraud's medium, hair and/or scrapings taken from the afflicted areas are placed. Although it can take up to three weeks to turn positive, fungus cultures are more specific than KOH stains.

Therapeutic difficulties
It is crucial to emphasize once more that systemic antifungal therapy is frequently insufficient in the current situation, and we need new management guidelines. Topical antifungals alone, without the use of antibiotics or steroids, shall be used to address dermatophytosis [17].

More than half of all daily patients who visit our dermatology department have dermatophytosis, indicating a recent rise in both the number of patients and the chronicity of this superficial illness.(18) Treatment failure rates appear to be influenced by familial dermatophytosis; if one family member is left untreated or undiagnosed, it may cause recurrences in other family members. Patients with chronic or recurring dermatophytosis typically have multiple family members affected, according to observations. The whole family is financially impacted by this [18].

The clinical pattern of dermatologophytosis has drastically changed in the last several years. The conventional therapeutic guidelines that we have been using, derived from both Western and Indian literature, are no longer appropriate or practical [19].

The prevalence of Trichophyton mentagrophytes infections, which cause inflammatory lesions, the erratic use of topical and oral antifungal agents, and likely growing resistance to antifungal agents are all potential contributing factors. However, one of the most formidable enemies we have faced recently is the irrational fixed drug combination creams[19].

Women with active tinea corporis, tinea cruris, and tinea corporis are becoming more common. These women frequently appear as a secondary concern to the index case, which is typically a man.

Trends in fashion are shifting, with younger people choosing figure-hugging denim, leggings, and jeggings over more sensible options like air conditioning or clothing that isn't appropriate for our hot, muggy weather. This may account for the higher incidence of tinea corporis and cruris in young, thin, generally hygienic women without any additional risk factors, as well as in overweight individuals. Many women arrive with an infection that is located submammary, affecting the inframammary fold rather than the breast surface. This emphasizes the part that friction and maceration from sweat's moisture play [20].

Additionally, dermatophytosis in youngsters is becoming more common. Tinea capitis was once thought to be the most typical fungal illness that affects kids. When mothers and grandmothers caring for newborns and toddlers with lesions on their trunks from tinea corporis, they infrequently observed tinea cruris and a few minor lesions of the disease [19].
On the other hand, youngsters presenting with big lesions involving numerous sites is not unusual these days. This may be explained by an enhanced virulence and infectivity of the organism, or by the higher spore load in the families as a result of several family members being afflicted. It also serves as a sign of the dermatophyte's ease of transmission. Children share mattresses, clothes, and linens far too frequently, which seems to emphasize the role of fomites in their lives. The author has observed that youngsters who are obese are more affected.

In India, there is a growing recognition of the significance of an untreated and unreported infected family member serving as a continual source of reinfection, which is sometimes misinterpreted as treatment failure. It is normal practice to share a family member's medication with others in an attempt to relieve their symptoms, but doing so might also result in clinical resistance[20].

Males appear to be more susceptible to genital dermatophytosis, which usually affects the penis rather than the scrotum. It is nearly invariably accompanied by illogical FDC-treated tinea cruris or tinea corporis. It typically affects the labia majora and mons pubis in females[19].
The financial toll that superficial dermatophytosis takes on the sufferer and family is a fact that is not often mentioned. Several family members are frequently afflicted, and in order to receive an appropriate course of therapy, each member must pay for their own medication visits and dermatologist visits. This frequently serves as a deterrent to many people who, for budgetary reasons,

purchase medications solely for one person then experiment with them on other members by taking short-term self-treatment doses, which exacerbates the issue[20].
All of these factors should be understood by the doctors treating the infections, who should then use pharmaceutical therapy and counseling to treat the illnesses completely[17].

Resistance
The inappropriate use of antifungal medications in cutaneous mycoses has led to the emergence of antifungal resistance in recent years. Research conducted globally is observing a growing trend of resistance to commonly prescribed antifungal medications used to treat dermatophytic infections. Some fungi naturally develop primary resistance in the absence of previous exposure. After being exposed to the antifungal treatment, previously susceptible strains develop secondary resistance, which is typically reliant on changed gene expression[4].

Bio film
The dermatophytes' formation of biofilms has been linked to another resistance mechanism. It has been shown that T. rubrum and T. mentagrophytes may both form biofilms. It is well recognized that biofilms provide host immunity as well as resistance to antimicrobial agents[4].
The pathogenic organism's susceptibility is not the sole factor that determines a successful clinical response to antimicrobial therapy; other factors include the host immune system, medication penetration and distribution, patient compliance, and the lack of a protected or persistent focus of infection. A few other risk factors in the Indian context are overcrowding, sharing of shoes and clothing, poor cleanliness, wearing tight clothing, and migration. Predisposing factors that are especially pertinent to India include the widespread availability of over-the-counter (OTC) medications and the widespread usage of topical steroid and antifungal combinations by patients. Increasing our knowledge of the molecular mechanisms underlying antifungal medication resistance and the host and genetic variables that predispose us to recurrent dermatophytosis is an urgent necessity[4] .

Do not use steroid creams to treat rashes that may be ringworm.
People who have ringworm don’t always know what’s causing their rash. Because of this, people may treat their rash with over-the-counter creams or ointments that include drugs known as corticosteroids, or simply "steroids." Steroid creams don't destroy the fungus that causes ringworm, but they can be useful for treating some skin conditions and even temporarily lessening the itching and redness associated with ringworm.
Steroid creams can exacerbate ringworm by weakening the skin's protective barrier. Rarely, the use of steroid creams might lead to a more serious condition by allowing the ringworm-causing fungus to penetrate deeper into the skin and making it more difficult for medical professionals to identify[22].
The majority of these presentations are related to the use of over-the-counter lotions that contain steroids. These creams have the potential to provide immediate symptom alleviation, but they may also cause an unusual presentation, persistence, and widespread infection over time.
The current outbreak has been greatly exacerbated by the widespread usage of these creams[17]. This implies Antibiotics and antifungal medications might exacerbate ringworm and lead to additional health issues.

Nonpharmacologic measures
One significant potential contributing factor to take into account is the fact that all affected households reported using the same stool and soap for bathing; this could possibly be the reason why tinea cruris is the most common site of infection. In addition, every impacted family (100%) reported washing every article of clothes in one pot. There were 52 households (46%) with a Western-style restroom in their homes, which could potentially accelerate the spread of infection. On a towel, Trichophyton rubrum was discovered to live for approximately 12 weeks, while Trichophyton mentagrophytes lived

for more than 25 weeks. When trichophyton locate a temperature that is suitable for infection, they can live off the host body as spores [18].

Encourage patients to wash and store any infected clothing separately, as well as to disinfect their clothing. The best natural method of disinfecting clothing is to wash it in hot water (60°C) and let it air dry. All of the families who were included did not iron their garments, which may have also contributed to the infection's persistence[18].

Even after ironing, sun-drying, applying warm salt water, etc., the fungi will still exist. Lemons contain citric acid, which has been shown to be more effective than other ways at killing fungus, thus we recommend washing with lemon juice water in the morning and evening.

Changes in lifestyle also play a significant part. The popularity of more occlusive, synthetic clothing—like jeans and lycra—has increased perspiration and discomfort, which raises the risk of infection. It is commonly known that perspiring raises the chance of developing dermatophytosis. The several eponyms for dermatophytosis, including athlete's foot, Dhobi's itch, and jock's itch, have brought this to light. Sweating may raise the risk of dermatophytosis when combined with other variables like poor cleanliness. According to a research by Ranganathan et al., individuals who worked in jobs that involved increased sweating (58.9%), like labor, had higher incidence rates of dermatophytosis than those who did not work in such jobs. Low-income and extremely low-income groups are most likely to have widespread and chronic dermatophytosis[18].

It is recommended that patients wear loose-fitting cotton or synthetic clothing that wicks moisture away from the skin. Socks ought to possess comparable qualities. After fully drying, areas that are susceptible to infection should not be covered with clothing. Additionally, patients should be counseled against sharing clothes and being barefoot[16].

It is believed that the Indian custom of hand-washing clothing in a single vessel, as opposed to the Western habit of using high-temperature washing machines, significantly reduces the spread of infection. Showering in the West is not as common as it is in India, where sharing a bathing seat is the norm. India has always been vulnerable to the advent of dermatophytosis due to its tropical climate, but in recent years, there has been an increase in the frequency and prevalence of familial dermatophytosis. Even while hereditary predisposition is known, genetic changes happen gradually throughout time, in contrast to the abrupt shift in appearance [18].

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