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DERMATOPHYTE INFECTIONS IN INDIA – A SYSTEMATIC REVIEW

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BY

MOHD AREEB

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"DERMATOPHYTE INFECTIONS IN INDIA – A SYSTEMATIC REVIEW"

A

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By

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I hereby declare that this dissertation entitled **"DERMATOPHYTE INFECTIONS IN INDIA – A SYSTEMATIC REVIEW"** is bonafide and genuine research work carried out by me under the guidance of **Dr. Mohd saquib** Assistant Professor, Department of Microbiology and Co-guide **Dr. Ausaf Ahmad** Statistician & Associate Professor, Department of Community Medicine, Integral Institute of Medical Sciences and Research, Lucknow.

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CONTENTS

DEDICATED TO

"TEACHERS"

FAMILY"

&

"FRIENDS

INTRODUCTION

INTRODUCTION

Dermatophytosis is a disease that causes infections of cornified tissues such as the skin, hair, and nails. Such condition is caused by dermatophytes, a collection of filamentous fungi that are closely related. Dermatophytes are categorised into three asexual species that cause infections in humans, according to Emmons morphological classification: Trichophyton (commonly affecting the skin), Epidermophyton (commonly affecting the skin and hair), and Microsporum (commonly affecting skin, hair, and nail). They secrete keratinases, which degrade keratin and allow them to enter the skin's outermost layer. Illness caused by those pathogens are typically dermal and limited to the skin's non-living, cornified layers. Dermatophytes, in general, loss the ability to penetrate deeper tissues or organs of the host.

Dermatophyte infections are frequently called "ring worm infections" due to their ring-like appearance. The location of the lesions on the body determines the name of these infections, which are also referred to as "Tinea infections." For instance, tinea capitis denotes a ring worm infection of the head.[1]

Dermatophytes are divided into three types: anthropophilic (derived from humans), zoophilic (derived from animals), and geophilic (derived from the environment) based on the mode of transmission.[2]

Dermatophytosis, a very common superficial fungus infection of the skin, is made more common by the warm and humid climate of India.[3]

The World Health Organization (WHO) reports that superficial mycotic infection is widespread throughout the world. is 20-25 percent.[4] Its prevalence varies by country. [5,6] It would be more

common in tropical and subtropical countries such as India, where temperatures and humidity are high for the majority of the year.[7]

It is estimated that between 31-71 percent of adults are asymptomatic dermatophyte carriers. Right now, we all are witnessing the unprecedented outbreak of recurrent and chronic dermatophytosis. These cases account for 6-12 percent of all new cases in India.[8]

Severe dermatophytosis is considered as a disease that lasts more than 6 months to 1 year with or without recurrence despite treatment. treatment. Dermatophytosis with a recurrence of the infection within six weeks is known as recurrent dermatophytosis. It occurs due to discontinuing of effective antifungal therapy, with the at least two such episodes in the previous six months.[9]

Chronicity is associated with several factors, including the area of infection, poor drug penetration in the nail keratin, and drug resistance. Immunocompromised patients, such as Diabetes mellitus, treatment failure/noncompliance, family members' shared illnesses and as well as poor personal hygiene all are responsible the for recurrence.[10]

Dermatophytes only infect the keratinized skin layers that are not alive. Multiple factors influence the severity of Dermatophyte infections, including the infected strain's or species' pathogenicity, the infection's anatomic location, environmental factors, and the host's reaction to fungal metabolic products. But the Dermatophytes and the types of Dermatophytosis vary regionally due to population lifestyle, climatic conditions, and population migration. As a result, some are widely distributed while others are geographically restricted.[11]

Dermatophytes have two critical properties: they are keratinophilic and keratinolytic.[12] A small skin break causes the primary infection. These breaks are caused by the production of

keratin-digesting enzymes. [13-15] This enzyme is known as keratinase.[16] The excreted enzyme is important in the infection process and is regarded as a primary virulent factor.[17]

That it has been been found that zoonotic dermatophytes, which are primarily found in pets and can spread to other animals, are responsible for 20 to 50 percent of human skin infections. [18-19]

Poor pet care could boost the number of contaminated pets [20], which can lead to illness in humans, where they establish colonies and produce noticeable sores in the skin's keratinized outer layer.[21]

Dogs and cats are the most susceptible to the disease and the primary source of human fungal infections among pets.[22]

Dermatophytes infection is easily spread through close contact with infected humans and animals or through inanimate object.[23]

Dermatophytosis cases are currently flooding dermatologists across India, with unusually Diagnosis is challenging due to massive lesions, ring within ring lesions, multiple site lesions (tinea cruris and corporis), and corticosteroid modified lesions.[24] Dermatophytosis has taken on a new face, causing dermatologists to panic. Furthermore, the disease's chronicity has afflicted patients more than any other skin condition in the nation.[24] Dermatophytosis is currently prevalent in 36.6-78.4 percent of Indians.[25]

DISEASE OF DERMATOPHYTES

T. capitis (scalp), t. faciei (face), t. barbae (beard), t. corporis (body), t. manuum (hand), t. cruris (groyne), t. pedis (foot), and t. unguium all are clinically classified by the site of

infections (nails). T. imbricata, pseudoimbricata, and Majocchi granuloma are clinical variants.[26]

Tinea Capitis (Infection of head region)

It's a mild fungal infection that mostly affects the skin and adjacent hair follicles. Treatment objective include symptom relief, clinical and mycological cure, and prevention of further transmission. To achieve mycological cure, systemic therapy is recommended. The FDA has approved griseofulvin for treatment. and has an efficacy range of 85-100 percent. Terbinafine is FDA-approved for use in children over the age of two; treatment is typically extended for 7-9 weeks. [27-28]

Tinea faciei (Infection of non-bearded area of face): -

Tinea faciei is more frequently seen as a membrane of the face that is smooth in the non-bearded region. [29-30] Tinea faciei is responsible for approximately 21% of all surface fungal infections.[31] Males are less likely to be affected than women.[32] They typically manifest as small patches, lifted bumps, the upper lip, and the chin are covered in red blisters on the face.[33] The warning signs are typically pruritic, accompanied by itchiness and burning when exposed to sunlight.[34] T. tonsurans, Tinea verrucosum, Tinea mentagrophytes, Microsporum canis, and T. rubrum are the most common T. faciei agents. [30,33]

Tinea barbae (Infection of beard region): -

Other names for tinea barbae include barber's itch, beard ringworm, and tinea sycosis."[35] This is a hair surface disease that affects men's beards and moustaches. [36,29] Tinea barbae begins in the neck and face. Shaving and the use of steroids are the main causes of tinea barbae. [37] In the neck and genital region, loose and broken hairs, kerion-like plaques, rash, itching, and pimples are all common symptoms of disease. [38-39] Barbeque causes reddening and swelling throughout the area. Infection is typically caused by T. mentagrophytes, T. verrucosum, T. megninii, T. rubrum, and T. violaceum are examples of zoophilic dermatophytes. M. canis and T. mentagrophytes Varerinacei are also known to cause tinea barbae, but these instances are uncommon. [36]

Tinea cruris (infection of groin area of the body): -

Gym itch, athlete's foot, jock rot, ringworm, groyne itch, groyne rot, eczema marginatum, are all names for Tinea cruris. Tinea cruris is a type of dermatophytosis that affects the proximal medial thighs and buttocks. It occurs most With the exception of auxiliaries infections, which are uncommon in men identified as a corresponding tiny pattern in women. The causative beings attack the affected areas' stratum corneum and lethal hair. Fungal spores are transmitted to the groyne area through scraping from trousers or underwear. Damaged skin appears red, tanned, darkening brown, to peel, or cracked. T. rubrum, E. floccosum, M. magnum, T. mentagrophytes, and T. raubitschekii are the universal pathogens.[40]

Tinea pedis or athlete's foot: -

Tinea pedis is a common infection that affects one out of every five adults, and its prevalence increases with age beginning in adolescence. Infections are caused by the scraping and scaling of the skin that contain realistic infectious agents such as fungus arthroconidia. Raw tissue, pain, and inflammation have also been exposed to swollen and cracked skin. This acute inflammation manifests itself as vesicles and pustules. Tinea pedis chronic agents are including T. rubrum, T. mentagrophytes var. Interdigitale, and E. floccosum. One hand, two feet syndrome is another name for tinea pedis." referring to the dermatophyte infection of both feet and one hand.[40]

Tinea unguium (infection of nails): -

Onychomycosis has been recognised as Tinea unguium which is caused by dermatophytes in nail. External white onychomycosis (pits on the nail's surface) and subungual dermatophytosis are two symptoms of onychomycosis (infection beneath the nail plate) Normal attachment of tinea unguium is to the toenail's tip, from which it slowly spreads to the nail matrix. It is typically seen in men, but it can also be seen in women as grooves and lines on their nails during pregnancy. The common dermatophyte affiliated with T. interdigitale, E. floccosum, T. violceum, M. gypseum, T. tonsurans, and T. Sudanese is Trichophyton rubrum. Typically, disease symptoms include weakness, altered nail shape, breaking of the nail's outer layer, lifting up of the nail, and loss of shine.[40]

SPECIAL SITUATIONS

Majocchi's granuloma: -

When a persistent superficial fungal infection spreads into the subcutaneous tissue, it is a form of severe dermatophytosis. The most frequent etiological agent is T. rubrum. [41] Automatic damage to the skin caused by trauma may allow fungi to penetrate the reticular dermis, and the resulting cellular destruction and decreased dermal pH makes the environment more conducive to their survival.[42] This is most common in immunosuppressant individuals.[43] Use of topical steroids results in majocchi granuloma growth and local immunocompromised. Terbinafine drug at a dose of 250 mg/day for 04-06 weeks and itraconazole at a dose of 200 mg twice regularly for 1.0 week/month for 2.0 months have been used properly. [44,45] Treatment regimens containing griseofulvin and itraconazole on a daily basis have been proposed.[46]

Tinea imbricate and pseudoimbricata: -

T. imbricata is a Trichophyton concentricum- caused severe superficial fungal infection of the smooth skin. Direct contact with T. concentricum filaments and spores causes disease, particularly between the mother and her child.[47]

PREDISPOSING FACTORS: -

Dermatophytosis pathogenesis is influenced by the complex interaction between agent, host, and environment. Immunosuppressant conditions such as diabetes mellitus, lymphoma, and chronic infection can all lead to extensive, recurring, or recalcitrant dermatophytosis in the host. Because of excessive sweating, rubbing, and alkaline pH, intertriginous areas such as the

groyne, axilla, and inter-web spaces between toe are more susceptible to infection. High moisture, high heat, increased urbanisation, and the use of tight-fitting clothes and occlusive footwear are all climatic factors that predispose people to infection. Trichophyton interdigitale and trichophyton mentagrophytes structures are replacing anthropophilic T. rubrum as the most prevalent isolate in some areas, but this is not the case in most of the world. [48,49,50] T. interdigitale causes both mild and chronic infections.[51] Dermatophytic infections are frequently passed down through families, particularly t. capitis and t. pedis. Under favourable conditions, epidermal adhesion occurs within an hour of inoculation into the host skin, facilitated by adhesins found on the fungal cell wall. [52,53] This is followed by keratin digestion facilitated by proteases, serine subtilisin, and fungalysin, that also acts as a potent immunogenic stimulus.[52] In response to antigenic stimulation, The keratinocytes generate a variety of cytokines, including IL-8, 16, 22, 1beta, TNF alpha, IFN gamma, and others, in order to annihilate the dermatophytes.[54] Furthermore, Lymphocytes are inhibited by the mannans made by T. rubrum.[53]

PATHOGENESIS OF DERMATOPHYTOSIS

Genetics of dermatophytosis: -

Not all of us are equally susceptible to a fungal infection, even when they share similar risk factors. There is proof of genetic or familial predispositions, which may be influenced by particular innate and adaptive immunity flaws. Tinea imbricata was among the first fungal diseases to be linked to a genetic predisposition. [55]

Dermatophytes infection pathogenesis include a complex interaction between the host, agent, and environment. lymphocytes. overarching illnesses like diabetes mellitus, lymphomas, immunocompromised status, or Cushing's syndrome, as well as advanced age, can all lead to

acute, extensive, or persistent dermatophytosis. Some parts of the body are more prone to dermatophyte infection, such as intertriginous areas (web spaces and groynes), where sweating, maceration, and an alkaline pH promote fungus growth. Following inoculation into the host skin, favourable conditions favour infection progression via adherence followed by penetration mediated by proteases, fungolysin, which causes keratin network digestion into oligopeptide or aminoacid and also acts as a potent immunogenic stimulus. Furthermore, the mannans produced by T. rubrum inhibit lymphocytes. Infection persists due to impaired Th17 cell function, which results in low production of interleukin-17 (IL-17), IL-22 (key cytokine in clearing mucocutaneous fungal infection).[56]

Immunology of dermatophytosis: -

The immune response to dermatophyte infection ranges from innate immunity to humoral and cell-mediated immunity. The currently accepted theory is that dermatophytosis is controlled by a cell-mediated immune response.[57]

Dermatophytosis are increased by a decrease among the number of epidermal dendritic cells, particularly Langerhan cells, in the epidermis.[58] Neutrophils, like keratinocytes and dendritic cells, explore an important role in innate immunity against dermatophytes.[59]

Overall, dermatophytosis elimination is facilitate by Th1 cell-mediated immunity, whereas Th2 response either predisposes to infection or causes an allergic reaction. Th1 cells produce cytokines like IFN and enhance phagocytosis. [60,61]

REVIEW OF LITERATURE

REVIEW OF LITERATURE

There has been a recent rise in predominance, recurrence and resistance could be attributed to the changing epidemiology. In developing nations, particularly in tropical and subtropical nations like India where the ambient temperature and relative humidity are high, dermatophytes are the most frequent causes of superficial fungal infections. Increased urbanisation, as well as the wearing of restrictive clothing and shoes, has been associated to a higher incidence.[62] Recent research on the epidemiology of dermatophytic infections from various regions of India have revealed an increase in the prevalence of cutaneous dermatophytosis along with changes in the infection spectrum and the isolation of several unusual species. [63-66] *In quite extensive investigations from Chennai and Rajasthan, Trichophyton rubrum continues to be the most prevalent isolate, with tinea corporis and cruris being the most typical clinical presentations. But Trichophyton mentagrophytes in research from Lucknow and New Delhi*.[66] The most typical isolates were and Microsporum audouinii·[64] Several studies have also demonstrated the isolation of rare species, such as Microsporum gypsum, in nonendemic regions of the world.[64]

Dermatophytosis prevalence in India currently ranges from 36.75% to 78.45%. Studies carried out across India have revealed modest geographic variations in the isolation of the dermatophyte species.[25]

Epidemiology of dermatophytosis in India

Author Year	Area	Sample Size	Clinical Subtype	Predominant Dermatophyte Isolate	M: F	Common Age Group Affected
Bhatia et al (2014) [67]	North, India	202	T. corporis (39.01percent)	T. mentagrophyte (63.5%) T. rubrum (31%)	5.7:1	21-50 years
Kucheria et al (2015) [68]	North, India	100	T. corporis (31.0percent)	T. rubrum (46.4%) T. mentagrophyte (30.35%)	1.3:1	20-30 years
Naglot et al (2015) [69]	North-east, India	632	T. Corporis (34.082percent)	T. rubrum (50.015percent) T. mentagrophyte (30.34percent)	4.04:1	20-40 years
Putta et al (2016) [70]	West, India	80	Tinea Corporis (41.26%)	T. mentagrophyte (37.74%) T. tonsurans (28.03%)	1.5:11	20-40 years
Ramaraj et al (2016) [71]	South India	210	Tinea Corporis (63.28%)	T. Rubrum (48.95%)	4:03	20-40 years

				T. mentagrophyte (44.76%)		
Gupta et al (2014) [72]	Central, India	100	Tinea Unguium (52.06%)	T. Rubrum (41%)	3.7:1	>60 years

The work presented in this paper focuses recognising the causing fungus species in diverse diagnostic presentations, as well as on the clinical profile of dermophyte infections.

The method used in this paper includes collecting specimen from 150 clinically suspected cases of dermatophytosis. The large number of the 150 patients studied were between the ages of 21 and 30 years old, with a male to female ratio of 1.63:1. Tinea corporis is the most common clinical type, accounting for 36 cases (24.6 percent), followed by tinea capitis (34 cases, 23.03%), and tinea unguium (16 cases) (10.7 percent). Trichophyton mentagrophytes were the highly common isolate with 29 cases (48.3 percent), followed by Trichophyton rubrum with 23 cases (38.3 percent), T. verrucosum with 6 cases (8.03 percent), and Trichophyton verrucosum with 6 cases (8.03 percent).

So, the current study reveals the changing trend in the prevalence of dermatophytes in that study.[73]

This paper's work focuses on to investigate the efficacy of Peels containing salicylic acid are used to treat dermatophytosis. This paper's method includes the The study included twenty-six patients (20 males and 6 females) with dermatophytosis and positive potassium hydroxide

(KOH) mounts. After applying 30% salicylic acid to the lesions on a weekly basis for four and half weeks, patients were followed up on a weekly basis for four and half weeks.

22 (88%) of the 25 patients showed clinical and microbiological cure one week after the last salicylic acid implementation, while the remaining three patients were nonresponders. Nine (41%) out of the 22 respondents experienced recurrences, showing that a longer course of therapy may be necessary in some patients for the fungus to be completely eliminated.

Peeling with salicylic acid is a cheap and efficient way to treat dermatophytic infection. [74]

In such paper, we review the literature on the management of dermatophytoses in order to bridge the therapeutic recommendation gap. Because of varying epidemiological factors and the emergence of drug-resistant organisms, successful dermatophytosis management has become increasingly difficult. Appropriate drug dosage and duration in a compliant patient aid in successful mycological cure. Aside from pharmacological therapy, general measures and lifestyle changes are also important in preventing recurrences. Advances in disease management are predicted by enhanced diagnostic tests and novel immunomodulatory therapy.[75]

This paper's work focuses on evaluating numerous epidemiological and clinical factors, including the presence of tinea unguium as a risk factor for CRD. According to the (cases), a total of 81 consecutive clinically diagnosed patients with CRD were chosen. Another 81 patients with dermatophytosis other than CRD were chosen as controls. There were 44 (55%) cases of chronic dermatophytosis and 36 (45%) cases of recurrent dermatophytosis among the total of 80 cases. Chronic dermatophytes was pretty uncommon in patients under the age of 20. Sharing linen, family history, and topical corticosteroid use were also common among CRD

patients. Tinea unguium was found in seven cases (7.05percent) and two controls (2.05percent), but the presence was not statistically significant (P = 0.270). The present CRD epidemic may be caused primarily by a pathogen with specific epidemiological and clinical determinants. It could be primarily a skin pathogen with little or no affinity for hair and nails.[76]

The work in this paper focuses on the potential risk factors associated with familial dermatophytosis. Dermatophytosis affected slightly more than half (55.4 percent) of the 673 subjects from the 113 families that were polled. In 103 families, the first member to become infected had the exact same initial site of infection as the second member. Every family admitted to having previously used irritant soap and over-the-counter medications. A common factor was cleaning the family's clothing collectively. Every family shared a bathroom and bathed with the same soap and stool.

Trying to share toilets, soaps and towels, cleaning clothes in the same machine, abusing topical steroids and over-the-counter topicals, and using antiseptic soaps that eradicate healthy flora are all examples of sharing. were identified as possible risk factors in our survey.[77]

This study offers a thorough upgrade on antifungal drug sensitivity testing and its use in the management of dermatophytosis.

following extended exposure to sub-inhibitory levels of azoles, amorolfine, and terbinafine, T. rubrum could resist to these drugs, resulting in Failures in treatment are causing the infections to persist and become chronic.

Antifungal Susceptibility Testing is one of the methods used in this paper. Several methods are available for testing dermatophyte antifungal susceptibility, but only the broth microdilution method is presently accepted for determining dermatophyte sensitivity in a lab setting. In light of increasing dermatophyte resistance, antifungal drug sensitivity tests should be performed at least in cases of chronic/recurrent dermatophytosis or treatment failure/relapse. Because no CBP has been defined as of yet, there is an urgent need to establish ECV for dermatophytes, and this value may guide the clinician while managing recalcitrant/resistant dermatophytosis.[78]

The word done in this paper is focussed on the current agreement sought to offer a strategy to the management and therapy of tinea corporis, cruris, and pedis that is gained through experience.

A point-of-care test recommended was KOH mount microscopy. In cases of persistent, recurrent, relapse, recalcitrant, and multisite tinea, fungus culture was advised. For localised cases of naive tinea cruris and corporis, dermatologic combination therapy was advised; however, for recalcitrant tinea pedis, extensive corporis lesions, and recalcitrant cruris and corporis cases, a combination of systemic and topical antifungals was advised. Due to their anti-inflammatory, antibacterial, and broad-spectrum activity, topical azoles are recommended. Itraconazole and terbinafine should be the first-line systemic medications. Treatment should last at least 2-5 weeks in naive cases and at least 5 weeks in recalcitrant cases. The use of topical corticosteroids in the clinical management of tinea was strongly discouraged.

The above consensus recommendation will aid in the standardisation of care, management guidance, and diagnostic judgement for healthcare practitioners.[79]

We will be reviewing contemporary topical therapy formulations as well as drugs/interventions in the experimental phase in this article.

Due to their high effectiveness and low risk of having negative systemic effectsTopical antifungals are typically regarded as the first line of treatment for superficial, non-complicated dermatomycoses. The three key categories of topical antifungal medications are polyenes, azoles, and allylamine/benzylamines.

Newer versions of older medications have also drawn attention. just a while ago topical amphotericin B in lipid-based gel formulation has been found to be effective and safe in the treatment of numerous mucocutaneous fungal infections, including dermatophytosis.

Several more recent agents are still in experimental trials and will needed additional research before they are commercially available. Newer topical agents, PDT, and lasers have all been tried, particularly for onychomycosis, which presents unique management challenges. The prudent application of newer antifungals, emphasis on patient compliance, and prescribing without combining with oral/topical corticosteroids are all necessary adjunctive steps to provide cure to patients with hard-to-treat dermatophytosis.[80]

The emphasis of such article is on the treatment schedule presented in common textbooks as well as the most recent changes made to treat dermatophytosis of the glabrous skin. Several systemic AFAs, including griseofulvin, terbinafine, ketoconazole, fluconazole, and itraconazole, have been shown to be effective against dermatophytes, with terbinafine being the only fungicidal agent.

Among the most critical issues that requires instant awareness in a war situation is the abuse of over-the-counter topical steroid antifungal creams. We must raise health awareness about

dermatophytosis and topical steroid abuse among practitioners, pharmacists, and the general public through meetings, social media campaigns, posters, and pamphlets. Counseling is, indeed, the cornerstone of therapy in the treatment of dermatophytosis.

widespread therapy delivered in a disciplined method, based on clinical response in patients, will undoubtedly produce a positive therapeutic outcome. Treatment duration is best individualised, with diagnostic recovery as the objective.[81]

The work in this paper is focusing to ascertain epidemiology of dermatophytes and isolate the most common dermatophytic species by using LPCB in SDA medium.

The method in this paper includes collection of samples i.e., total number of sample 230 skin scrapping, nail, and hair root specimen were collected. Out of 230 isolates there is 108 males and 65 females were positive for skin fungal infection, 114 isolates were identified as dermatophytes while 60 performed to be non-dermatophytes.

Among them are dermatophytes isolated from different clinical samples, *T. verrucosum* (43/114, 38.01percent) was the most common species, and *T. corporis* was the most common infection (36.02parcent). These isolates were examined by microscopic examination by using KOH mount.[82]

The purpose of this review is to return to this vital subject and highlight recent developments in the pathophysiology and management of tinea corporis, tinea cruris, and tinea pedis, as well as the lack of clarity in specific management issues.

Recent advances in dermatophytosis pathophysiology have verified the critical role of cell-mediated immunity in combating those infections. As a result, the absence of a delayed

hypersensitivity reaction in the presence of a positive immediate hypersensitivity (IH) response to trichophytin antigen suggests that the disease is chronic.

various new techniques, including polymerase chain reaction (PCR) and mass spectroscopy, could aid in the identification of various dermatophyte strains. In limited disease, topical antifungals are used, and oral therapy is commonly reserved for more severe cases. This review also identifies substantial research anomalies in the management of cutaneous dermatophytosis that must be filled in order to provide patients with better and more effective care.

More restrictive RCTs comparing the several oral antifungal therapies are required to provide a clear picture of the appropriate dosage and regimen of therapy.[83]

The purpose of this study was to find out how common dermatophytosis is in dogs, cats, and pet owners.

The method in this paper includes sample collection, of a total of 363 samples taken from clinically suspected cases of dermatophytosis from dogs (23 in number), cats (202 in number), and humans (37 in number) collected and studied to identify the presence of significant dermatophytes. Cats (158, 55.5 percent) had the most significant dermatophytic fungal infections out of these (n=285), followed by dogs (108, 37.8 percent) and humans (19, 6.7 percent).[84]

The current study was conducted to determine the diagnostic model of dermatophytes and non-dermatophytes, as well as to determine the most common infectious agent.

Among the 15,950 patients screened for that study, 298 cases of suspected superficial fungal infection were identified. To identify the fungal species, the specimen collection (skin, nail, and hair) was subjected to direct microscopy with potassium hydroxide and cultured on SDA. The preponderance of dermatophytosis was 75.06 percent (63/83), non-dermatophytosis was 24.41 percent (21/83), and superficial fungal infection was 27.06 percent (83/298). The most prevalent dermatophytic species was Trichophyton rubrum (79%), and the most prevalent non-dermatophytic species was Candida (60%). First most typical clinical manifestation (78%) was tinea corporis, which was followed by tinea cruris (29%) and tinea manuum (2.5%) and tinea faciei (1.0%) and tinea pedis (0.7%) and onychomycosis (6.07%) and piedra (0.6%).[85]

The work in this paper focuses on the recent trend of dermatophytosis to determine the change in the patterns of disease distribution as well as the prevalence of dermatophytosis and its etiological agents.

The method used in this paper includes specimen collection, as a total of 633 samples were collected from patients, with 438 males and 196 females ranging in age from 2 year to 81 years included in this study. 377 (59.66%) of the 632 patients had tinea, in which T. corporis (34.082%), tinea unguium (27.085%), tinea cruris (21.048%), tinea pedis (11.014%), tinea faciei (3.071%), and tinea capitis (1.032 percent). Trichophyton rubrum (50.015 percent) was the most common causative agent, followed by Trichophyton mentagrophytes and Epidermophyton floccosum.[86]

The current study was carried out to Analyze the dermatophytic infection trend in patients with fungal infections. This study includes all confirmed Dermatophytosis cases. There were 298 dermatophytosis cases in the study group.

220 (73.83 percent) of the 299 clinical specimens from confirmed cases were skin scrapings, 35 (11.411 percent) were nail clippings, and 45 (14.077 percent) were hair plucking with a hair stub. Tinea corporis was the most common clinical type of dermatophytosis, accounting for 97/299 (32.021 percent), followed by Tinea cruris 84/299 (27.085 percent), Tinea pedis 42/299 (13.076 percent), Tinea unguinum 35/299 (11.041 percent), Tinea capitis 19/299 (6.41%), Tinea faciae 15/299 (4.71 percent), and Tinea barba (4.03 percent). 140 of 299 Dermatophytosis cases tested positive for culture. Trichophyton rubrum is the most common isolate, accounting for 97/140. (69.29 percent). For the purpose of identifying dermatophytic infections, the KOH wet mount examination can be used as a screening method.[87]

This review article incorporates understanding of important dermatophytes and the illnesses they cause, as well as molecular identification and treatment strategies.

Among birds, animals, and humans, dermatophytes are fungi that lead to infection by utilising keratin. Dermatophytes cause a variety of diseases, including athletes' foot, ringworm, and jock itch, and they typically colonise humans through their skin, hair, and nails. Microscopy, culture techniques, PCR, and other techniques are commonly used to diagnose these diseases. According to the latest research, treatment includes the use of various antifungal drugs, certain essential oils, and so on. The most important factor in tinea infection control, however, is maintaining circumstances that are clean and hygienic, as it is true that "an ounce of prevention is worth a pound of cure".[88]

This paper focuses on isolating and identifying species of dermatophytes from superficial mycoses in patients. The methods in this paper include the collection of samples, with a total of 203 samples collected in the form of skin and nail scrapings, as well as hair follicles from various ringworm/ tinea conditions. 75 specimen (36.61 percent) tested positive for

dermatophyte species after culture. Trichophyton species was the most common (98.66% of cases), followed by Microsporum gypseum (1.36 percent cases). The male to female ratio of positive cases was found to be 63:11. The age group most affected was 20 to 50 years. This paper's method also includes dermatophyte isolation and identification via microscopy, followed by a urease test.[89]

The above study's objectives are to identify the most prevalent etiological agent of dermatophytoses and isolate different fungal agents from clinical samples of patients with different mycoses. Potassium hydroxide (KOH) analysis and culture were performed on clinical specimen from 261 patients. isolates were performed; causative agents were identified macroscopically and microscopically. KOH examination revealed that 183 (62.7 percent) were positive, although 133 (50.81 percent) were culture positive. Dermatophytes were isolated from 91/141 (64.31 percent) of the sample tested. Trichophyton rubrum (75.51 percent) is the most common isolate among dermatophytosis patients.[90]

In that research, we compared a nested PCR targeting the chitin synthase1 (CHS1) gene in skin and hair samples from patients clinically suspected of having dermatophytosis to a conventional test.

The study included 155 patients who were medically improbable of having dermatophytosis. There were 105 skin scrapings and 50 hair samples. On clinical specimens, KOH microscopy, fungal culture, and first round and nested PCR were performed, and the results were compared. The nested PCR for dermatophytes was positive in 83.81 percent of the sample, followed by KOH microscopy (71 percent), first round PCR (50.81 percent), and fungal culture. In ability

to detect dermatophytes, it was found that nested PCR was more delicate than culture isolation, KOH microscopy, and single round PCR for both skin and hair dermatophytosis.[91]

The purpose of this research was to investigate the Diagnostic and therapeutic and cultural traits of people with a dermatophyte infection that is severe.

75 adult participants with tinea corporis for more than a year were included in this study. Skin was scraped and stained with a 10% potassium hydroxide solution (KOH). Sabouraud's Dextrose Agar (SDA) medium was used for culture, which was incubated at 26-28°C for three weeks. Fungal colonies were discovered. Onychomycosis was found to be a major cause of chronicity in 28 percent of patients, a statistically significant finding (P value 0.01). An earlier study proposed that onychomycosis could cause chronic dermatophytosis anywhere.

As a result, the factors discovered to be responsible for chronicity were onychomycosis, body surface area of involvement, prolonged sun exposure and diabetes mellitus.[92]

AIM

AND

OBJECTIVE

AIM & OBJECTIVE

AIM: The aim of this study to analyze the epidemiology of dermatophytes and itsassociated risk factor among patients during last ten-year interval.

OBJECTIVE: To perform a systematic review of English language articles foundvia Pub med, Google Scholar taking into consideration of following questions:

a) Which dermatophytic species are more frequently isolated (its distribution pattern)?
b) What are the risk factors which contribute significantly in dermatophytosis?
c) What are the preventive measures to decrease the incidence ofdermatophytosis?

MATERIALS

AND

METHODS

METHODOLOGY

AREA OF STUDY: - Mycology

TYPE OF STUDY: - Systematic- Review

RESEARCH OF DESIGN: - Qualitative and Quantitative.

DATA TYPE: - Data for this meta-analysis were collected from following sources.

a) Data from various publications in indexed journals.

b) Data from recent editions of textbooks.

c) Online data from various literature reviews.

d) Data from websites of CDC, NCDC, WHO.

TIME FRAME: - All the studies in indexed journal from year 2005 to 2021.

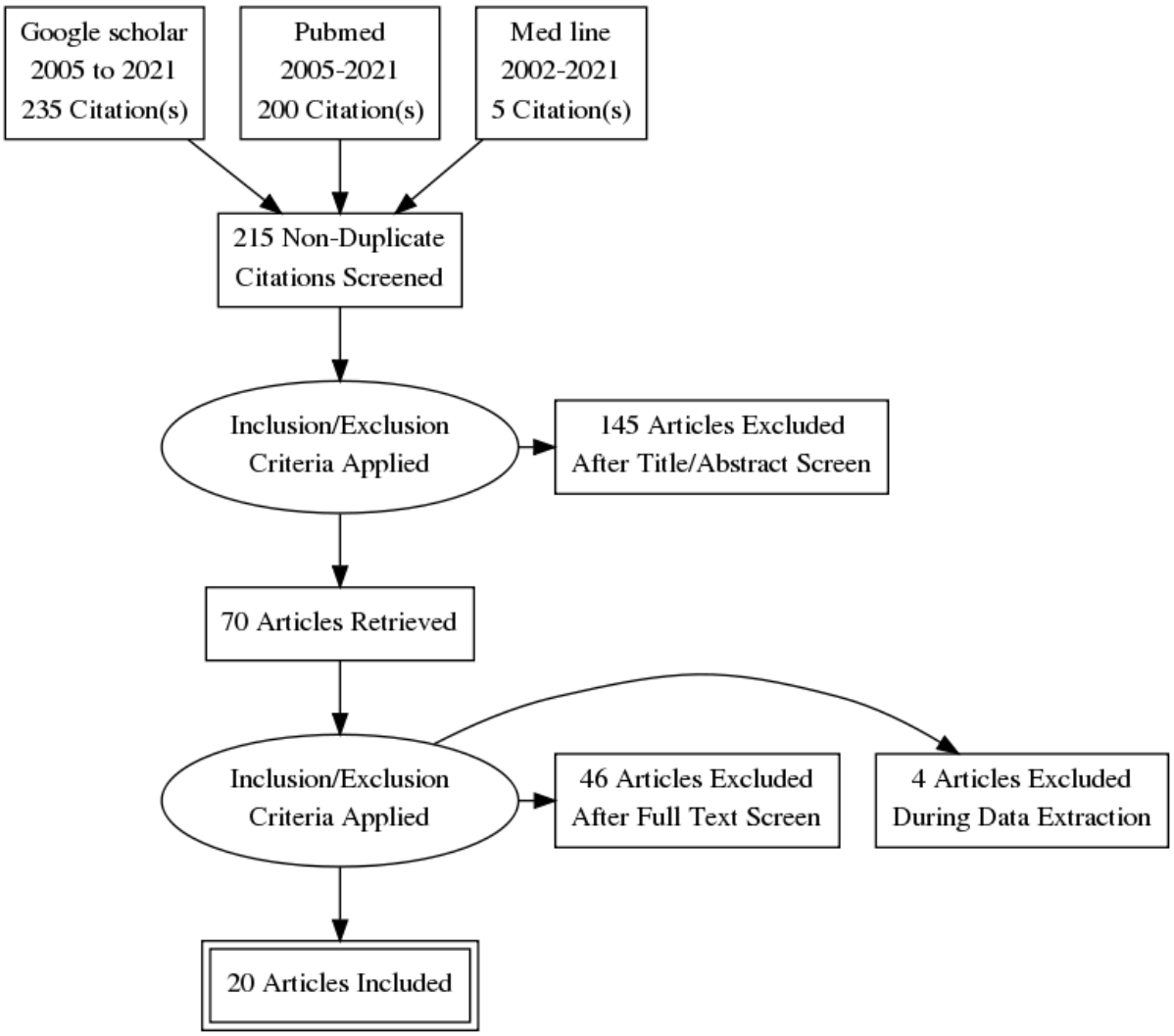
SEARCH STRATEGY: - This systematic-review followed the PRISMA guidelines. Articles were searched on PubMed, Google scholar, Web of Science, Science Direct, and Scopus using terms related to Dermatophytes, Dermatophytosis, tinea infections were used. Boolean AND, OR and NOT were used.

INCLUSION CRITERIA: - Article titles and abstracts were screened to include relevant articles. Dermatophyte infections in India, species of dermatophytes, risk factor of dermatophytosis, Epidemiology of dermatophytes, treatment and prevention of dermatophytes.

EXCLUSION CRITERIA: - Article titles and abstracts were screened by researchers independently to exclude irrelevant articles.

Study Selection Process:

At the first stage of the search, 440 articles were found, and after reviewing the titles of articles, 225 duplicate and overlapping articles were deleted and 215 articles remained. In total, 145 articles were removed due to noncompliance with the criteria, the extract of 70 potentially related articles were reviewed, and 46 articles were excluded due to lack of access to the full text of the article 4 article excluded during data extraction. Finally, 20 appropriate papers were selected to enter the meta-analysis stage.



OBSERVATION

AND

RESULTS

OBSERVATION AND RESULTS

S.NO.	AUTHOR	YEAR	COUNTRY	STUDY FINDING
1.	Tonita M Noronha et.al.	2021	Karnataka, India	Out of the 150 cases studied, 94 (62percent) were males and 58 (38percent) were females. The male-female ratio was 1.63:1.1. The vast majority of the patients (22.7 percent) is between the ages of 21 and 30. Tinea corporis is the most common clinical type observed (24.7 percent). The overall positivity by culture was 41%, and the overall positivity by direct microscopy was 59.03 percent. T. mentagrophytes is the most common species found (48.03 percent).
2.	Vikrant Saoji et. al.	2021	Maharashtra, India	One week after the last salicylic acid application, 22 (88 %) of the twenty five patients showed clinical and microbiological cure, whereas the remaining three patients were non responders. Nine (41percent) of the 22

				responders had recurrences, indicating that 4 weeks of treatment is insufficient in some patients to eradicate the fungus and that longer treatment may be required. Salicylic acid had no major (systemic) side effects on any of the patients while undergoing treatment.
3.	Faizan M. KAlekhan et. al	2020	Mangalore, Karnataka, India	In study included a total of 80 cases and 80 controls. There were 44 patients (54percent) with CRD and 36 patients (44percent) with recurrent dermatophytosis among the total of 80 cases. In patients, CRD was comparatively rare. under the age of 20. Various variables such as hygiene, linen sharing, ancestor's history, and topical corticosteroid abuse have also common among CRD patients. T. unguium was found in six cases (7.5%) and two controls (2.5%), but the presence was not statistically significant (P = 0.27). In terms of the frequency of T. unguium, recurrent dermatophytosis (four cases) outnumbered chronic dermatophytosis (two cases). Both cases of tinea unguium among the controls

				involved fingernails. KOH positivity was found in all tinea unguium patients.
4.	Ankita Tuknayat et. al.	2020	Chandigarh, India	Dermatophytosis affected slightly more than half (55.4 %) of the 112 families surveyed, which included 672 subjects. The primary site of infection in the subsequent family member affected was the same site as that affected in the first member in 103 families. All families reported using an irritant soap and over-the-counter drugs in the past. A common factor was washing all of the family's clothing together.
5.	Murlidhar Raja Gopalan et. al.	2018	India, chennai	The KOH mount microscopy was suggested as a point-of-care test. Fungal culture was advised in cases of chronic, recurrent, relapse, recalcitrant, and multisite tinea. Topical monotherapy was recommended for naive tinea cruris and corporis (localised) cases, while a combination of systemic and topical antifungals was recommended for recalcitrant tinea pedis, extensive corporis lesions, and recalcitrant cruris and corporis

				cases. Topical azoles are suggested due to their anti-inflammatory, antibacterial, and broad-spectrum activity. Terbinafine and itraconazole should be the first-line systemic medications. Treatment should last at least 3-5 weeks in naive cases and at least 5 weeks in recalcitrant cases. The use of topical corticosteroids in the clinical management of tinea was strongly discouraged.
6.	Kanika sahani et. al.	2018	New Delhi, India	In this research the increasing prevalence of recurrent/chronic dermatophytosis has necessitated the development of newer antifungal agents and/or preparations. In the last ten years, more recent formulations or derivatives of existing drug classes, as well as a only few more recent drug classes , have been described, providing hope for combating this threat. Recent topical agents, PDT, and lasers have all been tried, particularly for onychomycosis, which presents unique management challenges. Even though there is little risk of systemic side effects , topical therapy has an added advantage.

7.	Vandana Upadhyay et. al.	2019	Gorakhpur, India	Out of 220 isolates, 173 samples (108 males and 65 females) tested positive for skin fungal infections via KOH mount or culture. In addition, 114 isolates were identified as dermatophytes, while 58 samples were identified as non-dermatophytes. Trichophyton verrucosum (43/114, 38 %) was the most common species isolated from clinical samples, and T. corporis was the most common infection (36.02 %).

8.	S. Murmu et. al.	2016	Kolkata, India	Cats (158, 55.5 %) had the most specimen (n=285) with significant dermatophytic fungal infections, followed by dogs (109, 37.81 %) and humans (18, 6.6 %). Microsporum canis (60.0 %) had the highest incidence among dogs, cats, and humans, followed by Microsporum gypseum (22.05 %), Trichophyton mentagrophytes (15.8 %), and Trichophyton rubrum (15.08 %) (1.07 %). T. rubrum was only found in human cases in this study, whereas the presence of the other three was slightly higher in cats than in dogs and humans. Its occurrences were higher in young animals and humans aged 20-30 years during the rainy season (April to August), as well as in in-contact humans.
9.	A Lakshmanan et. al.	2015	Tamil Nadu, India	Tropical and subtropical countries have the highest prevalence of superficial fungal infections. Among the 15,950 patients screened for that study, 298 cases of suspected superficial fungal infection were identified. To identify the fungal species, the collected specimen (skin, nail, and hair) were subjected to direct microscopy with KOH and cultured on SDA. The prevalence of superficial fungal infection was 27.06% (83/298), dermatophytosis was 75.06% (63/83), and non-dermatophytosis was 24.04% (21/83). Trichophyton rubrum was the most common dermatophytic species (79.01%) and Candida (60.01%) was the most common non-dermatophytic species. Tinea corporis is the most common clinical presentation (78 %).

10.	A Naglot et. al.	2015	Chandigarh, india	632 people with dermatophytic infections have investigated. The study included 438 males and 196 females ranging in age from 1.5 year to 80 years. Skin scrapings, hair and nail clippings, and other clinical materials were collected. Direct microscopic examination and in vitro culture were used to evaluate all of the specimens. 377 (59.66%) of 632 patients had tinea. Tinea corporis (34.83 percent), tinea unguium (27.84 percent), tinea cruris (21.49 %), tinea pedis (11.15 %), tinea faciei (3.71 %), and tinea capitis were the anatomical locations of tinea (1.32 %). Trichophyton rubrum (50.15 %) is the most common causative agent, followed by Trichophyton mentagrophytes and Epidermophyton floccosum. As well as non-dermatophytic moulds (NDM) (10.80%) has isolated.
11.	H. Krishna Santosh et. al.	2015	Nellore, India	220 (73.83 %) of the 299 clinical specimens from confirmed cases were skin scrapings, 35 (11.42 %) were nail clippings, and 45 (14.78 percent) were hair plucking with a hair stub. Tinea corporis was the most common clinical type of dermatophytosis, accounting for 97/299 (32.22 %), followed by Tinea cruris 84/299 (27.86 %), Tinea pedis 42/299 (13.77 %), Tinea unguinum 35/299 (11.42 %), Tinea capitis 19/299 (6.5%), Tinea faciae

				15/299 (4.71 %), and Tinea barba (4.03 %). 140 of 298 Dermatophytosis cases tested positive for culture. Trichophyton rubrum is the most common isolate, accounting for 97/140. (69.29 %)
12.	Vishnu sharma et. al.	2015	Rajasthan, India	Dermatophytes have the ability to infect humans and other animals by invading tissue keratinized (skin, hair, and nails). Ring worm caused by fungal infections of the skin and nails are widespread and common in all people. Mycoses of various kinds Over the last few generations, mycotic infections have increased to more than 21-25 percent of the world's population. The review article incorporates knowledge of various dermatophytes and the diseases caused by them, their molecular identification, and treatment strategies.
13.	Vikesh kumar Bhatia et. al.	2014	Himachal Pradesh, India	A total of 202 samples collected from various ringworm/tinea conditions, including Tinea corporis, Tinea capitis, Tinea cruris, Tinea pedis, Tinea unguium, Tinea faciei, Tinea manuum, and Tinea gladiatorum. 75 samples (36.06 %) tested positive for dermatophyte species. after culture. Trichophyton spp. was the most common (98.64% of cases), followed by Microsporum gypseum (1.36 % cases). We did not, however, find any Epidermophyton spp. Trichophyton mentagrophyte was the most common spp. (63.05 %), followed by Trichophyton rubrum (35.01 %). The male to female ratio of positive cases was found to be

				63:12. The much more affected age group was 20-50 years. (64.09%), followed by 1.5-20 years (28.04 %) and over 51 years (6.08 %).
14.	Meenakshi Sharma et. al.	2011	Jaipur, India	Diagnostic samples from 261 patients were examined with potassium hydroxide (KOH) and culture isolates were performed; causative agents were identified macroscopically and microscopically. KOH examination revealed that 183 (62.7 %) were positive, whereas 132 (50.08 %) were culture positive. Dermatophytes is isolated from 91/141 (64.31 percent) of the specimens tested. Trichophyton rubrum (75.05 %) is the most common isolate among dermatophytosis patients.
15.	Jaya Garg et. al	2009	Varanasi, India	The study included 155 patients who were medically suspected of having dermatophytosis. There were 105 skin scrapings and 50 hair samples. On clinical specimens, the KOH microscopy, fungal culture, and the results of the first round and nested PCR could be compared. The nested PCR for dermatophytes has positive in 83.08 percent of the specimens, followed by KOH microscopy (70.0 %), first round PCR (50.08 %), and fungal culture (25.08%).
16.	P. V. S. Prasad et. al.	2005	India	A smear of 10% potassium hydroxide prepared from the scaly area of the lesion revealed the presence of fungal hyphae. Trichophyton rubrum was grown on SDA media with gentamicin. He was treated with 1% clotrimazole gel

				and began to improve within a few days; a repeat culture should be performed after treatment. The skin lesion should be promptly identified, Pseudomonas aeruginosa should receive the proper antibiotic therapy, and surgical debridement should be performed. Clinicians need to be aware of the skin symptoms of ecthyma gangrenosum in order to prevent deadly septicemia in neutropenic patients.

DISCUSSION

DISCUSSION

Dermatophytosis is more prevalent in people between the ages of 21 and 30 in the current study (22.07 %). Also found a higher prevalence in the same age group. This age group has a higher incidence of dermatophytosis, which may be related to the fact that they engage in more outdoor activities, such as farming and manual labour, making them more susceptible to infection from exposure to the environment. However, a higher incidence was seen in the 10–20-year-old age group, with the most prevalent isolate accounting for 97/140. 69.29 percent in the current study, males (62.0%) were more frequently impacted than females (38 percent). Male to female ratio was 1.63:1.0 . The increased occurrence in men may be brought on by occupational risks related to the nature of their profession and a higher chance of exposure to infections. Additionally, it's possible that the lower female frequency is the result of rural Indians not reporting female patients to hospitals because of social stigma. In the current investigation, T. mentagrophytes (51.07%) outnumbered T. rubrum (34.05%), T. violaceum, and T. verrucosum as the most prevalent isolates (6.09 percent each). The most frequent isolate from mixed clinical types is T. rubrum (66.07%), followed by T. mentagrophytes (26.7%) and T. tonsurans (26.07%). (6.07 percent). The greater T. mentagrophytes isolation rate from mixed clinical types seen in this investigation could be due to shifting patterns in the predominance of dermatophyte species in this region of Karnataka.

The risk factors for disease spread were not fully examined because superficial dermatophytosis was previously simple to cure. Researchers are becoming more interested in potential risk factors as a way to improve treatment outcomes due to recent rises in infection and recurrence rates. The failure of treatment may be significantly influenced by familial dermatophytosis. In our investigation, the index case's spouse was always impacted. Close

physical contact transfer is shown in this conjugal spread, which may help to explain why tinea cruris is the most typical appearance.

In our investigation, every family (99%) acknowledged using neem and antibacterial soaps. Due to extensive promotion, a lot of people have recently started using antiseptic soaps in an effort to decrease skin infections. On the other hand, the recent rise in dermatophytic infections may be a sign that these soaps are interfering with the typical commensal skin bacteria, which may be a vital component of the body's natural defence system. These soaps are typically irritating, which can cause irritation and make it simpler for bacteria to penetrate the defences and infect people. Instead of being cleaned after every use, toilets are normally only cleaned once a day in a household. Tissues for toilet seat covers are seldom ever used. Poor hygiene is implicated by each of these elements as a known risk factor for dermatophytosis.

We made two significant demographic discoveries that need to be discussed.

The first was that, with a frequency of 8.08 percent compared to 33.08 percent in controls, CRD was less prevalent in younger patients (age 21). Eight patients in the earlier group, mostly, experienced recurring dermatophytosis (13.07 percent). In comparison to those over 61, where the majority of tinea cases were CRD, this age group saw fewer patients with CRD diagnoses. When compared to other tinea cases, CRD had a greater mean age.

The second factor was that females were more likely to develop tinea, although the CRD ratio remained the same in both sexes. Both genders appear to experience the same level of CRD prevalence.

When compared to dogs or people, cats had a greater prevalence of dermatophytic infections (55.05%). M. canis was the dermatophyte most frequently reported to infect both people and animals (60.0 percent).

In particular, the co-dominance of nondermatophytic fungus in cutaneous infection, which suggests evolution and the inclusion of novel species in dermatophytosis, is highlighted in the current study's analysis of the current dermatophytosis situation in northeast India.

In comparison to culture isolation, KOH microscopy, and single-round PCR, the current study demonstrated that nested PCR was more sensitive for detecting dermatophytes in both skin and hair dermatophytoses. Nested PCR was utilised in this investigation to compensate for single-round PCR's decreased sensitivity when compared to KOH microscopy. Further nested PCR can be used to diagnose dermatophytoses that have recently had antifungal treatment, have uncultivable filaments, or that are difficult to distinguish from fake moulds.

Salicylic acid is a lipophilic monohydroxybenzoic acid, a phenolic acid, and a beta hydroxy acid (from the Latin salix, meaning "willow tree"). It is keratolytic and utilised as a peeling agent in a concentration of 21%–31%. Salicylic acid, which is found in Whitfield's ointment in 4% concentration, is used to treat superficial fungal infections, particularly tinea pedis. In order to improve the penetration of topical antifungals, the Indian Association of Dermatologists, Venereologists, and Leprologists' dermatophytosis manual suggests using salicylic acid (7 percent) as an adjuvant in the treatment of dermatophytosis.

CONCLUSION

CONCLUSION

India is a tropical nation. In India, chronic and recalcitrant dermatophytosis cases have recently increased. It is uncertain whether the observation should be attributed to changes in the host, environment, or causative organism because the consequences of this transformation are unknown. Potential risk factors among our participants included sharing of soaps and towels, washing clothes in the same container, sharing of bathrooms, abusing topical steroids and over-the-counter topicals, and using antiseptic soaps that kill normal flora. For supporting evidence, more study is required.

Because of altering epidemiological factors and the evolution of drug-resistant organisms, successful dermatophytosis management has become increasingly difficult. Appropriate drug dosage and period in a flexible patient aid in successful mycological cure. Aside from medication, broad-based actions, and lifestyle modifications are also important in preventing recurrences. Advances in disease management are predicted by new immunomodulatory therapies and enhanced diagnostic procedures.

To summarise, there are several different methods for testing dermatophyte antifungal sensitivity, but only the broth microdilution method is currently accepted for determining dermatophyte cellular sensitivity. Because this method is time-consuming and requires expertise, only a few mycology laboratories could perform it. Given the current state of dermatophyte tests for resistance and antifungal drug sensitivity should be performed if not always, then at least in instances of persistent or recurrent dermatophytosis or therapy failure. Because no CBP has been It is immediate to develop an ECV for dermatophytes if this value could help clinicians treat recalcitrant or resistant dermatophytosis.

Preferences for future research to enhance the results of dermatophytosis management include:

- • More accurate, quick, and prognostic diagnostic tests, like BSA, that can direct antifungal therapy in real time.
- Pathogens and antifungal resistance directly detected in clinical specimens.
- For monitoring and prevention, improved risk prediction models, along with genetic risk factors.
- Procedures for quickly achieving the strongest antifungal effect (e.g. combination therapy, therapeutic drug monitoring).
- • New immunomodulatory therapies to boost antifungal effectiveness while reducing immune-mediated harm
- Both regional and global dermatophytosis management collaboration schemes.

The current study found fungus diseases are more common in the wettest seasons pet animals like cats and dogs, that have the potential to transmit diseases to humans in close human contact. M. Canis is the primary infectious agent responsible for illnesses in susceptible hosts of various ages. To avoid human infections, when caring for pets, suitable precautions must be taken.

Salicylic acid doesn't actually harm the fungus, so resistance is unlikely to develop. Salicylic acid peeling of the superficial skin at a concentration of 30 percent was found to be safe, and it might be a viable option for the treatment of resistant tinea infection, particularly in the absence of novel antifungal medications.

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