

## Superficial Mycosis: Epidemiological and Mycological profile from District Jammu

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### ABSTRACT

Superficial mycoses, which are strictly limited to the outermost keratinized non-living layers of the skin and its appendages i.e., hair and nails are known to be caused by dermatophytes, non-dermatophytes and yeasts. During a clinico-mycological survey for superficial mycosis, the residents of District Jammu were screened for such infections. Diagnosis and identification of the recovered fungal isolates were based on direct microscopy, cultural and microscopic examinations. Among the recovered fungal isolates, maximum representation was of the genus *Aspergillus*. These infections were more prevalent among males than females. Moreover, variation in the prevalence of such infections was also observed with respect to age group, health status, and occupation of the patients. The isolations of diverse opportunistic fungal species from the human clinical samples clearly showed their potential to degrade the outermost keratinized layer of the skin eventually causing superficial mycosis. The correct and timely diagnosis of such infections and their causal agents is vital, which can further be helpful in adopting antifungal treatment.

**Keywords:** Superficial mycosis, Clinico-mycological profile, Fungal infections, North India

### INTRODUCTION

Fungi are omnipresent, inhabiting the soil, air, water, plants and human tissues. They show complex interactions with the human host in the form of symbiotic associations, either as commensalism, amensalism, parasitism or mutualism (Hall and Noverr, 2017). Of these, most of the interactions between the human host and the fungi are parasitic, causing damage to the host (Hall and Noverr, 2017; Sharma and Nonzom, 2023). Although fungal infections are common worldwide, only a few hundred species can result in human infections that ranges from superficial skin infections to deep or systemic infections involving internal organs. These are constantly evolving infections, resulting in the discovery of new genera and species implicating their contribution in human disease (Zotti *et al.*, 2010; Sharma and Nonzom, 2021a, b, c; Sharma and Nonzom, 2022).

Superficial mycosis, which constitute one of the major mycotic infections are restricted to the outermost non-living keratinized layer of the skin and its appendages viz., hair and nails. The major causal agents of superficial mycosis are dermatophytes which include mainly the species of *Trichophyton*, *Microsporum*, and *Epidermophyton*. However, nowadays, other opportunistic non-dermatophytic mycotic agents, such as, *Aspergillus*, *Alternaria*, *Fusarium*, *Curvularia* and *Talaromyces*, etc. and yeasts, such as, *Candida*, *Geotrichum*, and *Trichosporon* are also reported to cause skin, hair and nail infections frequently (Sharma and Nonzom, 2021c; Grover and Roy, 2003). These pathogenic fungi can be categorized as true pathogens that inhabits the healthy individuals with no underlying disease or

opportunistic/ accidental pathogens that affects the immunosuppressed individuals (Sharma and Nonzom, 2021c). However, there are some reports on the ability of these opportunistic pathogens to cause disease in otherwise healthy individuals i.e., immunocompetent individuals (Nucci and Anaissie, 2002; Schmidt and Holmes, 2015). Globally, these superficial fungal infections are predicted to affect a billion people, thereby making them a major public health problem (Bongomin *et al.*, 2017).

The causal agents of these infections are keratinophilic in nature which produces keratinase enzymes capable of degrading keratin and invade the superficial layer i.e., the stratum corneum. Various probable risk factors for the acquisition of such infections include low socioeconomic status, large population size, exchanging or sharing fomites and clothes, nail trauma, and inadequate health facilities (Moto *et al.*, 2015). So far, few isolated cases of superficial mycoses (cutaneous and onychomycosis) in the Union Territory Jammu and Kashmir have been reported (Jandial and Sumbali 2012; Najotra *et al.*, 2015; Asifa and Farhath, 2017; Jahan *et al.*, 2021). However, few extensive district-wise surveys in Division Jammu targeted specifically on nail fungal infections such as in Jammu, Rajouri and Doda (Bhou, 2017; Kotwal, 2018; Sumbali and Sharma, 2022). Keeping in view the abovementioned factors, the current study was undertaken to study the prevalence of these infections (skin/hair/nails) in District Jammu and further diagnosis of the causal agents.

### MATERIALS AND METHODS

**Ethical approval and data collection:** As the present study involved human participation,

therefore ethical approval was granted by the Institutional Ethical Committee (IEC), University of Jammu (No. RA/19/3118 dated 23/08/2019) which follows the guidelines issued by Medical Council of India, India. All the necessary details of patients viz., name, sex, age, type or site of infection, clinical signs of infection, occupation, duration of infection, history if any, other predisposing factors and contact address of the patient along with their consent to give their clinical samples, capturing pictures and publishing the research findings was taken.

### Study area and collection of clinical specimen

The present study was carried out in District Jammu (Jammu & Kashmir, India), the most populous district of the Union Territory Jammu & Kashmir. This area is characterized by a subtropical climate and people of this region are mostly dependent on agriculture (where they constantly come in contact with soil, plants etc. while working in fields) for their livelihood. This provides a congenial environment for the growth and proliferation of a number of causal agents of superficial mycosis.

After cleaning the affected part of the skin thoroughly with 70% alcohol, clinical samples were collected with the help of a sterilized blunt blade and forceps. Modified Sabouraud dextrose agar (SDA) medium supplemented with chloramphenicol (0.05 mg/ml) was used for the isolation of causal pathogens from the clinical specimen. For incubation, petriplates were kept at a temperature of  $28 \pm 2^\circ\text{C}$  for 8-14 days. Repeating the isolations thrice and obtaining the same fungus on media confirmed their pathogenic role in causing superficial mycotic infections.

### Identification of the recovered fungal species

**Direct Microscopy:** 10% KOH (potassium hydroxide) for skin and hair, and 40% KOH for nails was used to diagnose the presence of fungal elements in the clinical samples.

**Cultural and microscopic analysis:** For identification of the recovered fungal isolates, cultural characteristics viz., growth rate and culture characteristics, such as, colony colour, size, exudates, texture, pigmentation on surface or on the reverse were studied followed by their morphological and microscopic observations. The fungal cultures were mounted on a glass slide using stain lactophenol/lactophenol cotton blue for determining the dimensions (with the aid of ocular micrometre) and characteristics of hyphae, conidiophores, primary and secondary sterigmata and conidia.

## RESULTS AND DISCUSSION

During the survey, KOH test along with culture was positive in majority of the cases in accordance with the earlier studies (Bindu *et al.*, 2002;

Hanumanthappa *et al.*, 2012). Although KOH test is the simplest laboratory method of diagnosis but merely dependence on this test can give false results sometimes (Sharma and Nonzom, 2021c). Therefore, KOH test should be followed by culture test to ascertain the diagnosis of fungal infections.

In the present investigation, various clinical sites were involved in the infection such as hands, face, general body, neck, leg, scalp and nails (fingernails and toenails). However, similar to the findings of Ekwealor and Oyeka (2013), the most often infected clinical site was nail followed by skin and hair. In the present study, clinical symptoms include lesions, peeling of skin, maceration, fissuring, scaling, rashes, hyperkeratosis, dull and broken off hair, discolouration or brittleness of nails or complete destruction of the nail plate. The clinical manifestations in some of the investigated patients are shown in **Figure 1-3**. Survey of literature showed that mostly the clinical presentation of superficial fungal infections include rashes, annular erythematous plaques with scaling and raised leading edges, over glabrous skin, nail discolouration, nail separation, and thickening or brittleness (Lipner and Scher, 2015; Welsh and Gonzalez, 2015). Sometimes fungal infections show varied clinical presentations, making it confusing to distinguish them from other skin disorders. Therefore, clinical diagnosis of fungal infection must be supported by laboratory diagnosis which incorporates mycological examination including direct microscopy (using potassium hydroxide) and indirect examination (successful isolation of the causal agents in culture, their morphological and microscopic analysis).



**Figure 1:** Superficial mycosis of skin and hair among the investigated patients



**Figure 2:** Superficial mycosis of fingernails among the investigated patients



**Figure 3:** Superficial mycosis of toenails among the investigated patients

During the current study, it was observed that males were more frequently affected than females. This was in accordance with the other studies conducted within India and abroad (Grover and Roy, 2003; Ameen, 2010). This could be due to their greater involvement in sports, outdoor physical activities and preference for wearing closed footwear. Among the different occupational groups (farmers, students, housewives, defense personnel, etc.) studied, farmers were predominantly affected by such infections. This could be ascribed to their greater chances of exposure to pathogenic fungi dwelling in soil and the contact with infected animals. Moreover, the practice of animal husbandry, work-related injuries and wearing rubber shoes and nylon socks while working further enhance the probability of acquiring such infections (Sahin *et al.*, 2005; Ekwealor and Oyeka, 2013). Similar to our study, many other researchers have also reported higher prevalence of such infections in farmers (Ekwealor and Oyeka, 2013; Tom *et al.*, 2019).

Among the isolated fungal pathogens, the maximum representation was of the genus *Aspergillus* (7 species) followed in decreasing order by *Alternaria* (4 species), *Candida*, *Sarocladium* and *Talaromyces* (3 species each), *Chaetomium*, *Curvularia*, *Eurotium* and *Fusarium* (2 species each) whereas *Bipolaris*, *Byssoschlamys*, *Cladosporium*, *Epicoccum*, *Exserohilum*, *Nigrospora*, *Phialemonium*, *Rhizopus*, *Syncephalastrum*, *Stemphylium* and *Trichothecium* were represented by single species (**Table 1**). Various other studies have also reported the incidence of non-dermatophytes from clinical samples capable of causing diseases in humans (Gupta *et al.*, 2003; Hazarika *et al.*, 2019; Tom *et al.*, 2019). This could be attributed to the alteration of immunity, especially in immunocompromised patients, due to which a number of non-dermatophytic fungi turn into opportunistic pathogens, eventually causing infections, including superficial mycosis. Some of the fungal pathogens isolated from the investigated patients of District

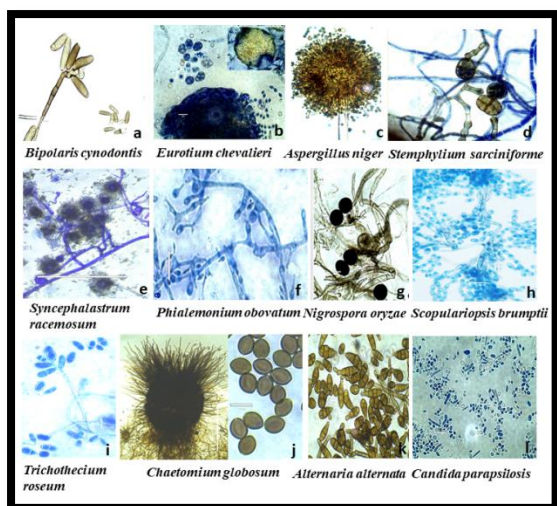
Jammu are tabulated in **Table 1** and shown in **Figure 4**.

In the present study, among the various co-morbidities associated with superficial mycosis, diabetes mellitus was found to be the most frequent. The probable reasons could be low immunity, defective carbohydrate metabolism and poor peripheral circulation in diabetic patients, which make them susceptible to the fungal infections, including superficial mycosis (Gulcan *et al.*, 2011; Sharma and Nonzom, 2022). This supports the findings of many similar studies (Mlinaric-Missoni *et al.*, 2005). Various other risk factors observed during the present survey include low socio-economic conditions, delay in seeking medical facilities, lack of knowledge regarding the epidemiology and the preventive measures of such infections, farming as main occupation especially in rural areas, habit of exchanging foot-wears, clothes and barber shop materials etc. This corroborates with the findings of former studies (Olutoyin *et al.*, 2017; Tom *et al.*, 2019). Although such infections, may hardly cause mortality, they may hamper the normal functioning of the social life of the patients. Psychosocial consequences of such infections include anxiety, depression and low self-esteem of the patient. In addition, these may have significant impact on the feelings and personal relationships of the patient (Narang *et al.*, 2019).

**Table 1:** Pathogenic fungal isolates (filamentous fungi and yeasts) recovered from the infected skin, hair and nails among the investigated patients of District Jammu

<b>Etiological agents</b>	<b>Clinical samples</b>
<i>Alternaria</i>	Skin and Nail
<i>Aspergillus</i>	Skin and Nail
<i>Bipolaris</i>	Skin and Nail
<i>Byssoschlamys</i>	Skin
<i>Chaetomium</i>	Skin and Nail
<i>Cladosporium</i>	Skin and Nail
<i>Curvularia</i>	Skin and Nail
<i>Epicoccum</i>	Skin
<i>Eurotium</i>	Skin and Nail
<i>Exserohilum</i>	Nail
<i>Fusarium</i>	Nail
<i>Nigrospora</i>	Hair and Nail
<i>Phialemonium</i>	Skin
<i>Rhizopus</i>	Nail
<i>Sarocladium</i>	Skin
<i>Syncephalastrum</i>	Nail
<i>Stemphylium</i>	Skin
<i>Talaromyces</i>	Skin and Nail
<i>Trichothecium</i>	Nail
<i>Candida</i>	Skin, Hair and Nail





**Figure 4: a-l** , Various recovered fungal species detected to cause superficial mycosis among the investigated patients of District Jammu

## CONCLUSION

Although superficial fungal infections as such do not cause mortality, their clinical significance lies in their high morbidity, recurrence, and cosmetic disfigurement, thus causing a major public health problem. Direct microscopy, cultural and microscopic examinations are vital tools for the correct diagnosis and effective management of fungal species causing superficial mycoses. Repeated isolations of non-dermatophytes in the present study clearly signifies that, in addition to dermatophytes, non-dermatophytes can act as significant contributors to the growth of superficial mycosis. Therefore, large-scale population-based studies on epidemiology and contributing risk factors must be carried out to address this growing health care challenge and to augment the prevention strategies to lower the incidences of such infections.

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