

# Mycological Studies of three skin Infections: Atropic dermatitis (Eczema), Tinea corporis (body Ring worm) and Seborrheic dermatitis (Dandruff) of the Scalp and Skin in Rural Communities in North-Central, Nigeria

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**Abstract:** *Aim:* Skin diseases are common and often have an impact on an individual's health-related quality of life. Skin disorders or rather, infections can be isolated and identified to aid in diagnosis of the particular infection and can be characterized generally or specifically by their symptoms. They can also be managed and control by certain measures. Skin fungal infections continue to place a burden on health care and are a serious concern internationally in terms of cost and resource impact. The purpose of this research is to determine the fungi associated with certain skin infections. *Methods:* A mycological evaluation of three skin conditions; Eczema, Ringworm and Dandruff, was conducted on 30 cases. Direct microscopy by lacto-phenol cotton blue (LPCB) tease mount and culture was undertaken to isolate the fungal pathogens in each case. *Results:* The commonest dermatophyte isolated was *Microsporum spp* (41.7%). Dandruff cultures grew a high proportion of species of a non-dermatophyte mould, *Aspergillus*, of which *Aspergillus niger* (25%) was the commonest specie isolated. Total LPCB positivity rate was 100% and total culture positivity rate for dandruff was 40%, for Ringworm was 35% and for Eczema was 25%. *Conclusion:* This study highlights the fact that fungi also play a role in skin diseases, as either primary or secondary pathogens, and that inflammatory and non-inflammatory skin diseases are also in association with various moulds and/or dermatophyte genera.

**Keywords:** skin disease, infection, fungal, mould and eczema.

## 1. Introduction

Numerous commensal nonpathogenic microorganisms, including bacteria, archaea, viruses, and fungi, reside within the human body. These microorganisms are essential for the establishment and maintenance of human health and disease. Skin disorders or rather, infections can be isolated and identified to aid in diagnosis of the particular infection and can be characterized generally or specifically by their symptoms. They can also be managed and control by certain measures.

Treatment of these skin disorders is vast due to causative organisms. Topical steroids, systemic steroids, antibiotics, antifungal etc., can be used in treatment, in some cases treatment differs for children.

Skin diseases are prevalent and frequently impact a person's health-related life quality in remote areas where healthcare access may be limited and people rely on agriculture for food and income, skin diseases may have a greater impact. Numerous skin disorders may have a substantial impact on quality of life. According to the Global Burden of Disease (GBD) Study 2013, skin disease is the fourth (non-fatal) cause of disability globally [1]. Traditional culture-based approaches have described only a fraction of the microbial landscape of common resistant fungal skin illnesses in humans, such as athlete's foot and toenail infections. Human skin functions as a barrier against harmful bacteria and a habitat for a range of commensal microbiota. However, microbial variety is not restricted to bacteria; fungi also play crucial roles in microbial community stability, human health, and disease. [2].

Historically, fungal infections have been under diagnosed and difficult to detect, and treatment options have been limited. Determining the incidence of disease is one of the largest gaps in our knowledge of the epidemiology of fungal infections due to the fact that they are frequently unrecognized and difficult to detect. Skin infections caused by fungi continue to place a burden on health care and are a significant issue in terms of their cost and impact on global resources. Some are more challenging to treat than others, and the duration of treatment varies greatly depending on the location and severity of the infection. Numerous fungal infections share resemblances with other skin conditions, making diagnosis challenging at times [3]. Although some people are constantly dealing with fungal or fungal-associated skin disease, whether acute or chronic, research on fungi associated with skin infections is ongoing. The skin fungal diversity is more site-dependent. Although some people are constantly dealing with fungal or fungal-associated skin disease, whether acute or chronic, research on fungi associated with skin infections is ongoing. The skin fungal diversity is more site-dependent. Poorly educated or uneducated victims live comfortably with fungal-related skin infections.

Dermatological and stable health care centers are out of reach to underdeveloped areas. Low number of dermatological centers with skin-related problems becoming more common to mankind. The impact of skin diseases depends on several factors and in particular on the nature of the disease itself. Inflammatory skin diseases such as; Eczema and Dandruff, are common and tend to have a significant impact on a patient's quality of life. The pathogenesis of these diseases has not been clearly elucidated. In recent years, skin microbiota has been shown to play an important role in inflammatory skin diseases [4] and skin diseases in general.

## **2. Materials and Methods**

### **2.1. Study Areas**

The study was carried out between the periods of June to August, 2021 in Veritas University Laboratory, FCT, Abuja. Sample collection was done within Angwanrogo community, located at the Idu Industrial layout in the Municipal Area Council of the Federal Capital Territory.

### **2.2. Sample Size**

A total of 30 samples were collected from varying parts of the body of 30 volunteers (10 lesioned skin scrapings each for eczema and ringworm and 10 hair-scalp scrapings for dandruff). Samples

were gotten from the young population with age range 4 – 6 years. The random sampling technique was used; wherein subjects were selected at random from a larger population.

### **2.3. Sample Collection**

#### **Skin Scrapings.**

Skin was cleaned with 70% alcohol and cotton swab; edges of lesion were scraped (as edge has greatest amount of viable fungus) with a blunt scalpel blade and skin scales were collected in a filter paper into a sterile petri dish and were labelled properly.

#### **Hair-Scalp Scrapings.**

Scalp was scraped from edge of hair and specimen was placed in a filter paper into a sterile petri dish and labelled and specimen was submitted to the laboratory in sterile petri dish. The flakes or scales were gathered by sectioning the hair and scraping a one-inch portion with a scalpel. Lactophenol cotton blue stain and potassium hydroxide mount were utilized for a microscopic evaluation of fungal development. The nature of mycelium and conidia production (macro and micro conidia) was essential in distinguishing between different genera and species.

### **2.4. Sterilization of Materials.**

The materials used in this research were all sterilized according to the nature of the material. All glass wears were sterilized using a hot air oven at the temperature of 160°C for 60 minutes; media for culture was sterilized with the aid of an autoclave at 121°C for 15 minutes; Plastics and working bench were sterilized with alcohol while inoculum wire was sterilized with hot flame in accordance with [5] methods.

### **2.5. Preparation of Culture Media**

The culture media was prepared according to the manufacturer's instructions.

#### **Inoculation of the Media.**

Skin and scalp Scrapings were infected using normal techniques onto the surface of SDA (Saboraud's Dextrose Agar), which had been mixed with an antibiotic; in this case gentamycin, to avoid bacterial contaminants. The plates were incubated at room temperature (35-37°C) for three days and then, up to a week. Sub-culture of isolates was by means of streak plate technique and incubation was allowed for a period of seven days.

### **2.6. Characterization and Identification Of Fungal Isolates**

Pure fungal isolates were sub-cultured onto Saboraud's dextrose agar for characterization and identification. The colonial characteristics of the isolates were based on form, size, color, shape, pigmentation, and surface. Microscopic examination of fungal isolates was carried out by means of Lactophenol cotton blue (LPCB) stain mounts using the teasers method. The nature of mycelium and conidia production (macro and micro conidia) was essential in distinguishing between different genera and species.

### 2.7. Lactophenol Cotton Blue Tease Mount

A drop of LPCB was positioned on the slide A tiny bit of the colony was put into the LPCB on the slide using a sterile iron needle, and this was teased into extremely small pieces using iron needles. A cover slip was placed on the wet preparation and pressed gently to get rid of air bubbles. This was examined microscopically using the x40 objective.

### Statistical Analysis.

All data generated was analyzed statistically using simple percentage method represented in charts.

## 3. Results

**Table 1.** Colonial morphology of fungal isolates

Fungal isolates	Colonial morphology
<i>Aspergillus niger</i>	Initial growth is white, becoming black later with conidial production, pale yellow on reverse
<i>Aspergillus fumigatus</i>	Blue-green, powdery and pale yellow on reverse
<i>Aspergillus flavus</i>	Yellow-green, powdery and pale yellow on reverse
<i>Microsporum spp.</i>	Slow forming, creamy to buff-colored colony with convoluted thallus
<i>Trichophyton spp.</i>	White to cream suede-like, cottony colony and pale yellow-brown to wine-red reverse

The isolation of fungal pathogens from hair-scalp scrapings of dandruff afflicted persons was carried out firstly by direct culture onto selective medium (Sabouraud dextrose agar) and followed by subculture. Isolated species from scrapings belonged to a single genus; *Aspergillus*. Few species yielded negative cultures (rates over 10%). Three different species (*Aspergillus niger*, *Aspergillus fumigatus* and *Aspergillus flavus*) were isolated from samples.

**Table 2.** Suspected fungal isolates from culture of Dandruff samples on SDA

Sample number	Suspected fungi
D1	1. <i>Aspergillus niger</i> 2. <i>Aspergillus flavus</i>
D2	<i>Aspergillus fumigatus</i>
D3	1. <i>Aspergillus niger</i> 2. <i>Aspergillus flavus</i> 3. <i>Aspergillus fumigatus</i>
D4	<i>Aspergillus niger</i>

D6	1. <i>Aspergillus flavus</i> 2. <i>Aspergillus niger</i>
D7	<i>Aspergillus niger</i>
D9	<i>Aspergillus fumigatus</i>
D10	<i>Aspergillus niger</i>

The isolation of fungal pathogens from skin scrapings of ringworm afflicted persons was carried out firstly by direct culture onto selective medium (Sabouraud dextrose agar) and followed by subculture. Isolated species from scrapings belonged to two genera; *Microsporum* and *Trichophyton*. Few species yielded negative cultures (rates over 20%).

**Table 3.** Suspected fungal isolates from culture of Ringworm samples on SDA

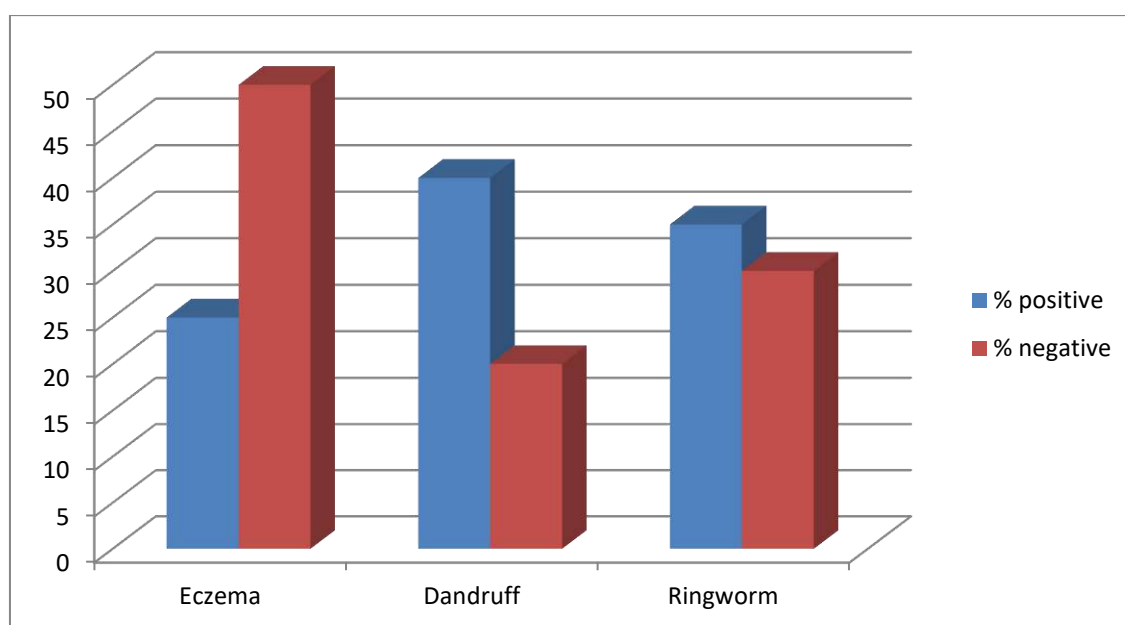
Sample number	Suspected fungi
R1	<i>Trichophyton spp.</i>
R3	1. <i>Trichophyton spp.</i> 2. <i>Microsporum spp.</i>
R4	<i>Microsporum spp.</i>
R5	<i>Microsporum spp.</i>
R7	<i>Trichophyton spp.</i>
R8	<i>Microsporum spp.</i>
R9	<i>Microsporum spp.</i>

The isolation of fungal pathogens from skin scrapings of eczema afflicted persons was carried out firstly by direct culture onto selective medium (Sabouraud dextrose agar) and followed by subculture. Isolated species from scrapings belonged to a single genus; *Microsporum*. Few species yielded negative cultures (rates over 40%).

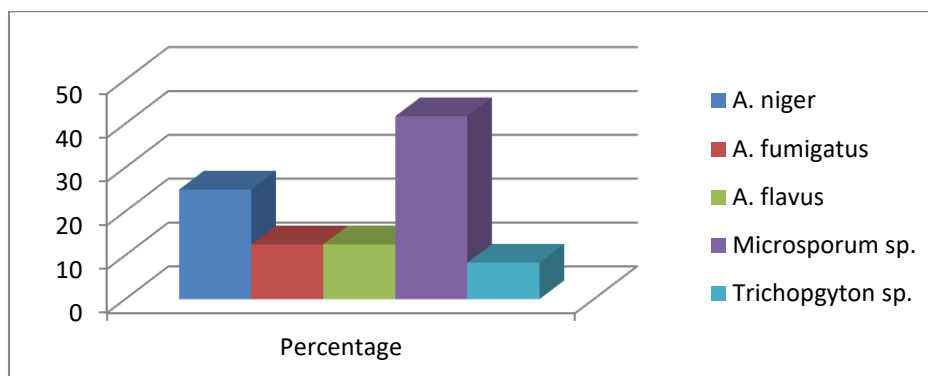
**Table 4.** Suspected fungal isolates from culture of Eczema samples on SDA

Sample number	Suspected fungi
E1	<i>Microsporum spp.</i>
E2	<i>Microsporum spp.</i>
E4	<i>Microsporum spp.</i>
E6	<i>Microsporum spp.</i>
E9	<i>Microsporum spp.</i>

The percentage of negative cultures was 50% for Eczema/Atopic dermatitis, 20% for Dandruff and 30% for Ringworm. *Microsporum* was the most common dermatophyte to be isolated. Culture positivity rate was 25% for Eczema, 40% for Dandruff and 35% for Ringworm. Percentage growth rates were represented.

**Figure 1.** Percentage occurrence of fungal isolates in skin infections

*Microsporum* (41.7%) was abundantly isolated from lesioned skin of Eczema and Tinea corporis/Ringworm whereas *Trichophyton* (8.3%) was isolated in small numbers. In the case of dandruff, from the genus *Aspergillus*; *A. niger* (25%) was abundantly isolated, followed by *A. fumigatus* and *A. flavus* (both 12.5%). A percentage representation of the data is seen in Figure 2.



**Figure 2.** Percentage of fungal isolates in samples

#### 4. Discussion

Studies of the relationship between fungi and Dandruff have focused on *Malassezia species* because they secrete lipase to hydrolyze sebum into fatty acids. According to an earlier report, Dandruff has been found to have a high number of *Malassezia* yeasts [6], another study put into light the presence of *Aspergillus* species in Dandruff afflicted scalps [7]. Investigation of the fungal species on dandruff infected scalps was carried using Lacto-phenol cotton blue tease mount and Culturing on Sabouraud's dextrose agar. Human fungal pathogens are associated with diseases ranging from dandruff and skin colonization to invasive blood stream infections, increasing morbidity and mortality [8].

This present study showed 25% *Aspergillus niger*, followed by 12.5% *Aspergillus fumigatus* and then 12.5% *Aspergillus flavus* in Dandruff afflicted scalps. According to the study carried out by [9], a significant number of *Aspergillus* species was obtained exhibiting the higher chances of pathogenicity and toxicosis of these individuals and the presence of the non-dermatophyte may be due to the ubiquitous nature of their spores in the environment, carried transiently on the scalp. Its discovery from hair-scalp should be considered significant.

A variety of fungus have been linked to Alzheimer's disease. *Malassezia* yeasts are one of the most common fungus associated with Alzheimer's disease, particularly in adult patients with head-neck lesions. The most common species in healthy people are *Malassezia globosa* and *Malassezia restricta*; nevertheless, a number of investigations have identified There was no change in the number of *Malassezia* species isolated from healthy and AD skin, indicating that these fungi are opportunistic in AD. Regardless, the extent of *Malassezia* colonization varied with AD severity, increasing up to 2-5-fold in severe AD cases compared to mild or moderate instances [10]. Furthermore, the *Malassezia* species discovered on Alzheimer's disease patients' lesions differ geographically.

The relationship between *Candida* species colonization or infections and the severity of Alzheimer's disease is unknown. *Candida* cultures from the gastrointestinal tract and nasopharynx are found in greater numbers in Alzheimer's disease patients than in healthy controls. It is hypothesized that the skin and mucosal flora are affected by the misuse of topical and systemic antibiotics and corticosteroids, promoting *Candida* species growth [11]. The epidemiology of *Trichophyton*, *Epidermophyton*, and *Microsporium* species, as well as their role in the pathology of Alzheimer's disease patients, remains largely unknown. The atopic-chronic dermatophytosis syndrome refers to the association of atopic diseases and dermatophyte infections with increased

total IgE and Trichophyton-specific IgE levels. According to these reports, Alzheimer's patients are more susceptible to these fungi than healthy people [12].

This present study showed 20.85% *Microsporum* spp. followed by 8.3% *Trichophyton* sp. in victims suffering from Atopic dermatitis. In line with [12], this is further proof for our observation that patients with AD are susceptible to infection by dermatophytes and that dermatophytes are in association with Atopic dermatitis. In the course of this present study, there were no reports on the presence of other fungi; moulds or yeasts in persons with AD.

According to [13]. Tinea corporis is a common infection that is more prevalent in hot, humid climates. *Trichophyton rubrum*, the most prevalent infectious agent in the world, is responsible for 47 percent of tinea corporis cases. *Trichophyton tonsurans* is the most prevalent dermatophyte that causes tinea capitis, and those infected with anthropophilic tinea capitis are more likely to develop tinea corporis. Consequently, the prevalence of tinea corporis caused by *T tonsurans* is on the rise. *Microsporum canis* is the third most prevalent cause of tinea corporis infections, accounting for 14% of cases [14]

In the current study, the presence of both dermatophyte genera was observed, characteristically distinct, with one prevailing over the other. The ratio of *Microsporum* spp. was significantly higher to that of *Trichophyton* spp., with 20.85% *Microsporum* spp. and 8.3% *Trichophyton* spp [15], stated the relationship between *Microsporum canis* and patients with Tinea corporis; "Patients with Tinea corporis with close contact with infected cats or dogs are commonly infected with *Microsporum canis*.

## 5. Conclusion

In the present study, it was concluded that certain fungi are association with skin infections as either opportunistic microorganisms or the main cause of the infection, in the case of Ringworm. Lacto-phenol cotton blue (LPCB) tease mount was found useful in the identification of isolated fungi. Sabouraud's dextrose agar was found to useful in culturing fungi from skin and hair scrapings in victims suffering from eczema, ringworm or dandruff. The findings provide useful information on the mycological aspect of some skin infections.

### *Recommendation.*

The medical research unit should encourage the pharmaceutical industry to conduct researches on the mycological aspects of skin infections, especially those linked to morbidity and mortality rates.

Health workers should be educated about pathogenic fungi associated with inflammatory and non-inflammatory skin infections.

Funding should be made available for mycological research on non-fungal skin infections and awareness should be created for this cause.

### *Ethical Approval.*

Approval was granted for this research for the purpose of attaining human samples, from the office of the National Health Research Ethics Committee, Abuja, Nigeria with approval number: FHREC/2021/01/04/07-05-21.

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