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Fungal and Yeast Involvement in Skin Diseases

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Abstract- A mycological investigation of skin scrappings, blood and aspirates from apparent clinical cases of cutaneous infection involving 100 patients was made. All samples were cultured on Sabouraud dextrose agar (SDA) for three weeks. A total of 27(43.5%) and 18(29.0%) fungi and yeasts respectively were isolated from the skin. Blood cultures yielded 8(9.9%) yeast species only from the patients while culture of aspirates showed more growths of yeasts (2 isolates) than filamentous fungi (1 isolate). The following dermatophytes and filamentous fungi were isolated from the skin: *Microsporum ferrugineum, Trichophyton mentagrophytes, T. rubrum, T. verrucosum and T. schoenleinii; A. fumigatus, A. niger, A. flavus and Penicillium species. Trichophyton mentagrophytes had the highest occurrence (50%) while Microsprum ferrugineum* and *Trichophyton verrucosum* were least in occurrence(9.1%) each. Five yeast species, *Candida albicans, C. tropicalis, C. krusei, Rhodorulla* species and *Torulopsis* species were also isolated from skin lesions. *Torulopsis* species was the most occurring yeast whereas *Candida krusei* and *Rhodotorulla* species showed the lowest occurrence (5.6%) each. Torulopsis species and *Candida tropicalis* were recovered from blood and aspirate of patients. Prevalence of fungi and yeast was similar in male and female patients. Fungi and yeast are involved in skin diseases.

Keywords: *fungi, yeast, skin disease.*

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Fungal and Yeast Involvement in Skin Diseases

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Abstract- A mycological investigation of skin scrappings, blood and aspirates from apparent clinical cases of cutaneous infection involving 100 patients was made. All samples were cultured on Sabouraud dextrose agar (SDA) for three weeks. A total of 27(43.5%) and 18(29.0%) fungi and yeasts respectively were isolated from the skin. Blood cultures yielded 8(9.9%) yeast species only from the patients while culture of aspirates showed more growths of yeasts (2 isolates) than filamentous fungi (1 isolate). The following dermatophytes and filamentous fungi were isolated from the skin: *Microsporum ferrugineum, Trichophyton mentagrophytes, T. rubrum, T. verrucosum* and *T. schoenleinii; A. fumigatus* , *A. niger*, *A. flavus* and *Penicillium* species. *Trichophyton mentagrophytes* had the highest occurrence (50%) while *Microsprum ferrugineum* and *Trichophyton verrucosum* were least in occurrence(9.1%) each. Five yeast species, *Candida albicans, C. tropicalis, C. krusei, Rhodorulla* species and *Torulopsis* species were also isolated from skin lesions. *Torulopsis* species was the most occurring yeast whereas *Candida krusei* and *Rhodotorulla* species showed the lowest occurrence (5.6%) each. Torulopsis species and *Candida tropicalis* were recovered from blood and aspirate of patients. Prevalence of fungi and yeast was similar in male and female patients. Fungi and yeast are involved in skin diseases.

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I. Introduction

Skin is the most accessible organ of the body, the one most easily traumatized and therefore frequently subjected to infection. Normal human skin is colonized by large numbers of microorganisms that live harmlessly as commensals on its surface[1]. Skin diseases therefore is a complex subject involving diverse microorganisms that exhibit varying aetiological and pathogenic mechanisms.

Fungal diseases of the skin are a common public health problem worldwide. The prevalence of skin fungal diseases is expected to reach 20-25% of the world's population and its incidence continues to rise[2]. Fungal skin diseases constitute an important clinical and public health problem in tropical areas of the world where they are rarely managed[3].

There are many species of fungi that cause skin diseases in man. These are mainly Dermatophytes (Trichophyton species, Epidemophyton sp and Microsporon so), *Malassezia furfur* and Candida species and less commonly *Aspergillus species, Trichothecium roseum, Cladosporium sp* and *Fusarium sp*[4].

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The diseases caused by fungi (mycoses) can be clinically classified as superficial, deep or systematic mycoses[5]. Dermatophytes are the most important microorganism which cause superficial mycosis and the lesions are characterized by circular disposition, desquamation alopecia and erythema of the edges[6]. They invade and destroy the skin, hair and nails. These diseases have been reported in various studies from developing countries as the most common dermatozed[7,8]. They are also responsible for most of the skin infections among school children[9].

Fungal skin diseases constitute the majority of skin conditions seen by physicians in primary, secondary and tertiary health care centres in Nigeria[11-12].

They make the individual uncomfortable, unsightly and present a cosmetically poor appearance[13]. The situation is enhanced in a tropical country like Nigeria by warm humid weather, crowded living and poor sanitary conditions which are prevalent and support infection on human skin[14].

This study therefore seeks to investigate the rate of involvement of fungi and yeast in diverse kinds of skin diseases that present.

II. Materials and Methods

a) Study Area

This prospective study was carried out at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi NAUTH is the largest tertiary hospital and referral centre in Anambra State Nigeria.

b) Subjects

Individuals aged 1 year and older with varied skin disease referred to the mycology section of microbiology laboratory for further assessment were invited to participate and enrolled at the time of presentation to the laboratory.

c) Sample Collection

Skin scrappings, venous blood and aspirates (where applicable) from 100 patients with clinical cases of cutaneous infection were collected after thorough physical examination. The clinically apparent lesions described as dry, scaly and matted or seranguinous were cleaned with 70% alcohol. Epidermal scales at the active edges of the lesions were scrapped using sterile surgical blades. The scrappings were collected in a piece paper, carefully folded and then placed in an envelope for storage in air-tight containers.

Aspirates were taken from pustular lesions or nodules where present. After cleaning the arm,

tourniquet was applied to dilate the upper arm and 1ml of venous blood was withdrawn from the cubital region of the forearm. These samples were properly labeled and a brief history of the disease taken.

d) Processing of Samples

Each skin scrapping was inoculated onto Sabouraud Dextrose Agar (SDA) incorporated with 0.05mg/ml Chloramphenicol and Streptomycin 40mg/ml. Duplicate inoculations were made. They were incubated at room temperature (25-28^{0}C) and at 37^{0}C respectively for 21 days, examining daily for fungal and / or yeast growths.

Aspirates were also inoculated on SDA and incubated at 37^{0}C for 48hours.

One mililitre (ml) amount of blood specimens were introduced asceptically into 5ml of Sabouraud Dextrose Broth contained in MacCathney bottles. Duplicate inoculations were made. They were incubated at 37^{0}C for 48 hours before being subcultured onto solid medium, SDA. Incubation of blood cultures and subsequent subculture onto SDA continued for 21 days after which negative cultures were discarded.

e) Characterization and Identification of Isolates

The mycological identification was based on macroscopic and microscopic examination of culture isolates. Macroscopic examination of dermatophytes was characterized by duration of growth, surface morphology and pigment production on the reverse[15]. Microscopic examination of fungal growth was observed with Lactophenol cotton blue stain. Nature of mycelium and conidia formation help to differentiate various genera and species[16].

All cream to white-tan pasty colonies with characteristic yeast smell were stained by Gram's method examined microscopically. Budding yeast cells of Candida species were identified by germ tube formation, sugar fermentation and sugar assimilation[17].

Ethical approval for the study was obtained from the ethical committee of the hospital. All patients consented to participate in the study.

III. Results

A total of one hundred and fifty-seven samples consisting of 62 skin scrapings, 81 blood and 14 aspirates, collected from 100 patients were cultured. Culture of the skin scrapings revealed that 27(43.5%) isolates yielded fungi whereas 18(29.0%) of the isolates were yeast-like organisms. Eight (9.9%) of the eight-one blood samples yielded yeast-like organisms. Similarly, 1 (7.1%) of 14 aspirate samples cultured yielded a fungus and 2 (14.3%) yeast-like organisms(Table 1).

Table 1: Proportion of Fungi and Yeasts in Skin, Blood and Aspirates of Patients

Nature of sample	No examined	No positive for fungi (%)	No positive for yeasts (%)
Skin scrapings	62	27(43.5)	18(29.0)
Blood	81	0(0)	8(9.9)
Aspirate	14	1(7.1)	2(14.3)
Total	157	28(17.8)	28(17.8)

Five species of dermatophytes were isolated from 100 patients who had superficial infections: *Microsporum ferrugineum, Trichophyton mentagrophytes, T. rubrum, T. verrucosum* and *T. schoenleinn. T. mentagrophytes* had the highest occurrence (50%) followed by *T. rubrum* (18.2%). Five yeast species including *Candida albicans. C.tropicals, C.krusei, Rhodotorulla sp* and *Torulopsis, sp* were also recovered from skin lesions. *Torulopsis sp* was the most occurring yeast (44.4%) while *C. krusei* was the least occurring (5.6%) *Aspergillus niger* was the most common filamentous fungi (44.4%) isolated from the skin whereas *A. flavus* was the least recovered (11.1%). *Torulopsis sp* (50%) and *Candida tropicals* (50%) were isolated from the blood as presented in Table 2,

Table 2: Prevalence of Fungi and Yeast Isolates in Skin, Blood and Aspirates of Patients

Fungal species	Skin	Blood	Aspirates
Dermatophyte			
Microsporum ferrugineum	2(9.1)	-	-
Trichophyton mentagrophytes	11(50)	-	-
T. rubrum	4(18.2)	-	-
T. verrucosum	2(9.1)	-	-
T. schoenleinii	3(13.6)	-	-
Total	**22**	**0**	**0**
Filamentous fungi			
Aspergillus niger	4(44.4)	-	-
A. fumigates	2(22.2)	-	-
A. flavus	1(11.1)	-	-
Penicillium sp	2(22.2)	-	1(100)

Total	9	0	0
Yeast species			
Candida albicans	5(27.8)	-	-
C. tropicalis	3(16.7)	3(37.5)	1(50)
C. krusei	1(5.6)	-	-
Rhodotorulla sp	1(5.6)	-	-
Torulopsis sp	8(44.4)	5(62.5)	1(50)
Total	18	18	2

Fungi were isolated more from males (57.6%) than from females (42.4%). Similarly, yeasts were more frequently isolated from males (60.7%) than females (39.3%) Table 3.

Table 3: Gender distribution of Fungi and Yeast among Patients

Gender	No of patients examined	No positive for yeast	No positive fungi (%)
Males	54	17(31.5)	19(35.2)
Females	46	11(23.9)	14(30.4)
Total	100	28(28.0)	33(33.0)

Different fungi and yeast species were isolated from various body sites (Table 4).

Table 4: Common Skin Diseases, Body Sites and Microorganisms Involved

Skin disease	Body site affected	Fungi isolated	Yeast isolated
Tinea capitis	Scalp	*Microsporum ferrugineum* *Trichophyton mentaphytes* *T. rubrum* *Penicillium sp*	*Candida tropicalis* *Rhodotorulla sp*
Tinea corporis	Hand, trunk face, groin leg, buttocks	*T. mentagrophytes* *T. verrucosum* *Penicillium sp* *A. fumigatus ,A.niger*	*Candida krusei* *C. albicans* *Torulopsis sp*
Tinea imbricate	Breast	*T. rubrum* *T. mentagrophytes*	-
Paronychia (Tinea unguium)	Toe web Toe nail	*T. schoenleinii* *Penicillium sp* *T. mentagrophytes* *A. niger*	- *C. albicans* *C. tropicalis*

IV. Discussion

This study has revealed the skin as most susceptible to infections by fungi (43.5%) and yeast (29.0%) as compared to blood (0%) and (9.9%) respectively, lending credence to the work of Yahya *et al.*[18] that skin is the most accessible organ to infection. The result of the species of dermatophytes isolated from skin diseases which include *Microsporum ferrugineum, Trichophyton mentagrophytes, T. rubrum, T. verrucosum* and *T. schoenlleinii* is in agreement with previous studies in Korea, Iran, India and Jos, Plateau State, Nigeria.[19-23]

An earlier study carried out about 30 years ago in Eastern Nigeria[24] also isolated these dermatophytes. This implies that fungal infections are still highly prevalent in these areas. *Trichophyton mentagrophytes,* one of the several dermatophytes that cause cutaneous mycoses and *T. rubrum* were the most common dermatophytes isolated from skin lesions. This finding is in consonance with the work of Ta'ama *et al*[23] who recovered *T. mentagrophytes* constantly and that of Kannan *et al*[22] where *T. rubrum* was the most prevalent causative agent implicated in skin fungal infections.

Majority of dermatophytes were isolated from scalp (Tinea capitis) of patients. Among these were two members of a family. It had been reported.[2,14,25] that frequent interchange, poor sanitary conditions, sharing of hair brushes, combs and hats have played some role in the spread of the disease. These conditions may be responsible for the observation made in the case of the two family members.

Non-isolation of *Trichophyton tonsurans* from any of the clinically observed lesions in this study is a deviation from earlier reports.[24,26] in Eastern and Northern parts of Nigeria where this fungus was frequently encountered. The relative small sample size of this study may have accounted for it.

In the screening for systemic involvements in patients with long standing skin diseases, *Candida*

tropicalis (50% of the total yeast, isolates made), Rhodotorula species (37.5%) and Torulopsis species (12.5%) were isolated. Previous studies[5,27] had shown that *Torulopsis* species and *Candida tropicals,* both opportunistic pathogens, were capable of establishing themselves in the blood. The patient's defenses may have been weakened by some other processes for these pathogens to be recorded from blood. Petmy *et al*[28] reported that it may have been as a result of frequent usage of antibiotics, immunosuppressive drugs and various conditions like organ transplantations, lymphoma, leukemia and human immunodeficiency virus (HIV) infection. This study did not however, attempt to establish if there had been any previous but continuing disease, clinically or through laboratory diagnosis. However, some of the patients had been on antibiotics for long periods, a situation that may promote human infection by the yeasts.[17] In one of the cases studied, Rhodotorula species, was isolated from the skin of an infant (1 year old). This condition may be the result of certain complications such as napkin dermatitis or due to no clearly defined pre-disposing factor.

The pathogenic status of *Candida tropicals* and *Torulopsis* species was further highlighted in this study as these were isolated from aspirates.

Prevalence of fungal skin infections in males and females were similar (33.0% vs 28.0%). Similar studies[19,23] supports our finding showing that large numbers of people are often affected by fungal skin diseases irrespective of their gender.

V. Conclusion

Fungi and yeasts are involved in skin diseases. *Trichophyton mentagrophytes* was the most common dermatophyte while *Torulopsis* species was the highest occurring yeast involved in skin diseases. Prevalence in males and females were similar.

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