

Research Article

A Microbiological Study of Dermatophyte Infection among Primary School Children in Mowe, Ogun State, Nigeria

A.F. Ayorinde, O.O. Adesanya and O.A. Alaran

Department of Biological Sciences, Redeemer's University, Mowe, Ogun State, Nigeria

Abstract: Understanding the most prevalent species of Dermatophytes, the age group and sex most affected could form the basis for control and cure. Investigations were carried out on the distribution of Dermatophytes of the scalp (*Tinea capitis*) among primary school children in two primary schools in Mowe-Ofada area of Ogun State, Nigeria. One of the schools (NUD primary school) located in an urban area while the other (St David's primary school) is situated in a rural area. A total of seventy-eight children were examined. The samples were collected by scraping and the use of sterile swab. Fungal culturing and microscopy methods were later used to identify the Dermatophytes. Out of 78 children examined 45 (57.7%) were positive while 33 (42.3%) were negative. The species identified include: *Microsporium audouinii* 3 (6.7%), *Trichophyton tonsurans* 8 (17.8%), *Trichophyton terrestre* 4 (8.9%), *Trichophyton mentagrophyte* 3 (6.7%), *Microsporium gypseum* 2(4.4%), *Microsporium canis* 3 (6.7%) and *Trichophyton verrucosum* 4 (8.9%). The infection was more prevalent in males (94.8%) than in females (5.1%) with *T. tonsurans* (42.1%) have the highest percentage of infection, while *M. gypseum* (4.9%) had the least. There was a significant difference ($p>0.005$) in Dermatophytes infection from the two schools, St David's primary school 32(71.1%) and NUD primary school, 13(28.9%). *T. tonsurans* (10.4%) was the most prevalent species in both schools, while the least was *M. gypseum* (2.6%). The highest infection occurred among the 5-7 age bracket (53.3%), ($p>0.005$) compared with other age brackets. Ages 12-14 (15.6%) had the lowest number of infections.

Keywords: Children, dermatophytes, infection, *Microsporium*, primary schools, *Trichophyton*

INTRODUCTION

Dermatophytes are a group of molds which are related morphologically and physiologically and can cause dermatophytosis infections (Simpanya, 2000). They are microscopic fungi parasitizing keratinized tissues (skin, hair and nail) of man and animals. These fungi cause superficial infections in humans and animals (Chukwu *et al.*, 2011)

There are 3 major genera of Dermatophytes. These are *Epidermophyton*, *Microsporium* and *Trichophyton*. *Epidermophyton*, are characterised by large thin-walled, multicellular, club-shaped and clustered bunches of macroconidia. No Microconidia are produced. However, *Microsporium*, produces both microconidia and macroconidia. Macroconidia are multiseptate, with echinulations on the cell wall. The thickness of the cell wall and shape varies depending on the species (Weitzman and Summerbell, 1995; Simpanya, 2000). *Trichophyton* produces smooth walled macroconidia and microconidia. Macroconidia are thin walled and cigar-shaped (Centre for Food Security and Public Health, 2005)

Dermatophytes can exist in two states. These are the anamorphic and teleomorphic states (Cabañes,

et al., 1997). In anamorphic states, dermatophytes are saprophytic and reproduce asexually by simple sporulation of arthro-, micro- and macroconidia produced from specialised conidiogenous cells. (Simpanya, 2000) One species of *Epidermophyton*, approximately 18 species of *Microsporium* and 18 species of *Trichophyton* are considered valid members of this group (Irene and Summerbell, 1995; Simpanya, 2000). Teleomorphic states, also known as the "perfect" state because dermatophytes in this state reproduce sexually or have a sexual phase in their life cycle. Most members of the sub division *Ascomycotina* belong to this form (Simpanya, 2000).

Dermatophytes are classified into 3 major ecological groups. These are Geophiles, Anthropophiles and Zoophiles. Geophiles exist as saprophytes in the soil. Their distribution depends on the availability of keratin (Ellabib and Khalifa, 2001). Anthropophiles, species are primarily adapted for parasitism of man, but some species occasionally cause ringworm in animals (Simpanya, 2000). Contacting the disease requires human contact, thus, the spread of anthropophiles is more common in communities like schools, barracks, prisons and the family. Also the variation in the site of infections by dermatophytes (anthropophiles) occurs

Corresponding Author: A.F. Ayorinde, Department of Biological Sciences, Redeemer's University, Mowe, Ogun State Nigeria

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based on their affinity for different types of keratin. The difference in the keratin composition in the feathers of birds for instance, varies from that in the hairs of humans and that influences the kind of dermatophyte that becomes a parasite in birds and humans. Apart from the type of keratin present, amino acids and other biochemical contents present may influence the type of dermatophyte that becomes a parasite (Barry and Hainer, 2003).

Zoophilic species are basically animal pathogens, often with a single preferred animal host or very limited host range, outside which they are found only in exceptional circumstances (Simpanya, 2000).

Traditionally, most commercially available identification systems of dermatophytes are based on physiological (growth temperature), nutritional (sugar assimilation and/or fermentation, enzyme production profiles) and morphological characteristics (Elsayed *et al.*, 2010). *Tinea capitis* is generally identified by the presence of branching hyphae and spores on KOH microscopy. If hyphae and spores are not visualized, Wood's lamp examination can be performed. If KOH microscopy and Wood's lamp examinations are negative, fungal culture may be considered when *Tinea capitis* is strongly suspected (Barry and Hainer, 2003).

A majority of studies carried out in Nigeria by various researchers had pupils (especially in public primary school) and students (junior and senior secondary schools) as their target population. This is most likely due to the poor personal hygiene nature of most children in this age group (1-15 years). Weitzman and Summerbell (1995) and Ajao and Akintunde (1985), reported prevalence among primary school children between 5 and 10 years of age and more prevalent among the poor families having minimum of five children, while it is less prevalent in families having one to four children. Adeleke *et al.* (2008) in their study reported the most prevalent species among children as *T. rubrum* followed by *M. audouinii*. However, Nweze (2001) study of children reported that *Trichophyton schoenleinii* was the most prevalent aetiological agent followed by *T. verrucosum* and *Microsporum gallinae*.

On Sex and infection, Sanuth and Efuntoye (2010) observed that the infection was more common among the male than the female.

Popoola *et al.* (2006) examined dermatophytic infections by direct microscopy and culture-based laboratory diagnostic methods. The aetiological agents identified were *Microsporum canis*, *Microsporum audouinii*, *Trichophyton interdigitale*, *Trichophyton soudanense* and *Trichophyton tonsurans*. Erhard *et al.* (2008) used an advanced technique of MALDI-TOF mass spectrometry to identify the species that remained unidentified after using the cultural-based laboratory diagnostic methods and the species identified were *Trichophyton rubrum*, *Trichophyton interdigitale*, *Microsporum canis*, *Trichophyton tonsurans*.

The aim of this study was to provide knowledge of the epidemiology and mycological characteristics of

dermatophytosis involving hairs (*Tinea capitis*) among primary school students in a rural and urban settings in Southwestern Nigeria.

MATERIALS AND METHODS

Study site: Two schools were selected and sampled. St David primary school in the rural area and NUD primary school located in an urban area, both in Mowe-Ofada, Ogun state, Nigeria.

Sample size: Number of samples collected in St David primary school was fifty-two, while the number collected from NUD primary school was twenty-six. Hence the total number of samples collected was seventy-eight.

Collection: Consent was sought from parents of the pupils through the Heads of the schools before commencement of work.

All hair samples were collected from St David primary school and N.U.D primary school, Mowe, Ogun state using a sterile blade to scrape the surface and a sterile cotton swab to aseptically swab the infected portion of the head. The swabs were placed in a brown envelopes and then transported back to the biological laboratory of Redeemer's University, Mowe, Ogun State, Nigeria, for further examinations.

Collection period: The samples were collected from both schools over a period of nine weeks from March to May 2012.

Cultures: All samples were aseptically inoculated on Potato dextrose agar and Sabouraud dextrose Agar both containing streptomycin and incubated at 30°C for 3-4 days during which, macroscopic observations were made. Pure cultures from both media were then inoculated on Sabouraud dextrose agar (SDA) and incubated at 30°C for 4-5 days to confirm if the isolates were dermatophytes.

Identification: In identifying fungal isolates, microscopic and macroscopic characteristics were employed. After 4-5 days of incubation, the physical characteristics such as colony colour and colony appearance were observed. Also, smear of each isolate was prepared and stained with lactophenol and observed under the microscope. The mycelium and spore characteristic were noted using Mycology online, Atlas 2000 and Mycology Review 2003.

Characterization: The isolates were characterized according to their morphological characteristics. If there is suede-like to powdery beige khaki color on the surface with a dark brown reverse *T. tonsurans* was suspected, When colony growth is slow, white and

sometimes yellow or grey on the surface without any characteristic pigment on the reverse *T. verrucosum* was suspected. When colonies are flat, spreading, light tan-white in colour with a dense suede surface and their reverse is yellow-brown to reddish brown *M. audouinii* was suspected. Furthermore, when the growth is rapid, cream to yellow on the surface with yellow to yellow-orange reverse *M. canis* was suspected, When Colony growth is moderately rapid, powdery to granular, white to cream colour on the surface with a yellow, brown or red-brown reverse, *T. mentagrophyte* was suspected. Rapid colonial growth, which becomes powdery to granular, cream or pale cinnamon on the surface with a beige to red- brown reverse, *M. gypseum* was suspected. Finally, where colonies are flat, with a suede-like to granular, white to cream color, buff to yellow or greenish- yellow with a yellowish brown but some have a deep rose red reverse, *T. terrestre* was suspected.

Urease activity: The pure culture isolates were inoculated into urea broth tubes (one tube was left uninoculated to serve as control) and labeled appropriately. The test tubes were incubated at 37°C for 24-48 h. After incubation, the tubes were observed. The appearance of a pink color indicated a positive test and a yellow-orange color indicated a negative test. The urease activity was carried out as a confirmatory test for the identification of organisms. If the test result was positive, *T. mentagrophytes*, *T. tonsurans*, *M. canis*, *M. gypseum* were suspected and when it turns out negative, *T. verrucosum*, *T. terrestre* were suspected.

Fungal staining and microscopy: Pure isolates that were confirmed to be Dermatophytes on the Sabouraud Dextrose Agar (SDA) were then stained using Lactophenol cotton blue. A drop of Lactophenol was placed on a clean slide and using an inoculating needle, a small piece of the fungal mycelium free of the medium, was removed. The mycelium was then transferred to the Lactophenol, spread out and the slide was covered with a cover slip, with great caution to avoid bubbles. The slides were then observed under a light microscope.

RESULTS

Forty five (57.7%) of the samples were positive to cultures of dermatophytes while 34(42.3%) had no growth (Non-infection).

Seven species were identified. These include: *M. audouinii*, *T terrestre*, *T. tonsurans*, *T.verrucosum*, *M.canis*, *T. mentagrophytes* and *M. gypseum*.

St David primary school had the highest number of infection 33 (73.3%) while NUD had the lowest number of infection 12 (26.7) (Table 1). Table 2 shows the age distribution and percentage of children infected and not infected with Dermatophytes. Age group 5-7

Table 1: Prevalence of dermatophytes infection found on the head among school children in mowe

School	No of population%	No of infection%	No of non-infection (no growth)
St David primary school	52 (66.7)	33 (73.3)	19(57.6)
N.U.D primary school	26 (33.3)	12 (26.7)	14 (42.4)
Total	78	45	33

Table 2: Age distribution of the school children infected and non-infected with dermatophytes

Age group (years)	Infected		Non-infected	
	St David	NUD	St David	NUD
5-7	18 (56.3)	7 (58.3)	10 (52.6)	11 (78.6)
8 -11	8 (25.0)	4 (33.3)	6 (31.6)	2 (13.3)
12-14	6 (18.8)	1 (8.3)	3 (15.8)	1 (6.7)
Total	32	13	19	14

Table 3: Species, frequency and percentage distribution of dermatophytes spp based on sex

Organism suspected	No of isolate			Percentage (%)
	Male%	Female%	Total	
<i>M. audouinii</i>	3 (4.1)	-	3	3.8
<i>M. canis</i>	2 (2.7)	1 (25.0)	3	3.8
<i>M. gypseum</i>	2 (2.7)	-	2	2.6
<i>T. terrestre</i>	4 (5.4)	-	4	5.1
<i>T.tonsurans</i>	7 (9.5)	1 (25.0)	8	10.4
<i>T.verrucosum</i>	4 (5.4)	-	4	5.1
<i>T.mentagrophyte</i>	3 (4.1)	-	3	3.8
Unidentified	16 (21.6)	2 (50.0)	18	23.1
No growth	33 (44.6)	-	33	42.3
Total	74	4	78	100

M = Microsporum; T = Trichophyton

Table 4: Species, frequency and percentage distribution of dermatophyte species based on school

Organism suspected	No of isolate			Percentage
	St David	NUD	Total	
<i>M. audouinii</i>	3 (5.8)	-	3	3.8
<i>M. canis</i>	2 (3.8)	1 (3.8)	3	3.8
<i>M. gypseum</i>	1 (1.9)	1 (3.8)	2	2.6
<i>T. terrestre</i>	3 (5.8)	1 (3.8)	4	5.1
<i>T. tonsurans</i>	6 (11.5)	2 (7.7)	8	10.4
<i>T. verrucosum</i>	3 (5.8)	1 (3.8)	4	5.1
<i>T. mentagrophyte</i>	2 (3.8)	1 (3.8)	3	3.8
Unidentified	13 (25.0)	5 (19.2)	18	23.1
No growth	19 (36.5)	14 (53.8)	33	42.3
Total	52	26	78	100

years had the highest infection prevalence when compared with other age groups in both schools-St David (56.3%) and NUD (58.3%) while the least age group with infection in both schools was age group 12-14 years, St David (18.8%) and NUD (8.3%). Table 3 shows the percentage distribution of identified Dermatophytes species in relation to sex. 91.1% of all infected children were males while 8.9% were females. Out of the infected males, 60.9% were identified into species while 39.0% could not be identified into species. The most prevalent species among the Males was *T. tonsurans*(9.5%) while the least were *M. canis* (2.7%) and *M. gypseum* (2.7%). Also out of the infected females, 50.0% were identified and 50.0% could not be

identified and the species identified were *T. tonsurans* (25.0%) and *M. canis* (25.0%). Table 4 shows the percentage distribution of identified Dermatophytes species in relation to school. 42.3% of all infected were from St David primary school and 15.4% from NUD primary school. The most prevalent species in St David primary school was *Trichophyton tonsurans* (11.5%) and the least was *Microsporum gypseum* (1.9%), while in NUD primary school, the most prevalent was *Trichophyton tonsurans* (7.7%) and the least were the other 5 species (3.8% each). *M. audouinii* was not found in NUD primary school.

DISCUSSION

Two primary schools were examined for the presence and types of Dermatophytes (*Tinea capitis*). The dermatophytes isolated were *T. terrestre*, *T. tonsurans*, *T. mentagrophyte*, *T. verrucosum*, *M. canis*, *M. audouinii*, *M. gypseum*. Enweani *et al.* (1996) in their study from two public primary school in Ekpoma, Edo state, Nigeria observed that *Microsporum audouinii*, *Trichophyton mentagrophytes* were predominant. Also, Nweze (2001) in his study of prevalence of dermatophytes among Primary School Children in Borno State, Nigeria observed *Trichophyton schoenleinii* as the most prevalent followed successively by *Trichophyton verrucosum*, *T. mentagrophyte*, *T. tonsurans* and *Microsporum gypseum*.

In this study, 45(57.7%) were discovered to be infected with dermatophytes and the infection was common in male (91.1%) than female (8.9%) and the common organisms were *T. tonsurans*, *T. verrucosum* and *T. terrestre* which is similar to the report of Sanuth and Efuntoye (2010) who studied some primary school children in other parts of Ogun state and discovered that 274(19.52%) were infected by the disease and the infection was common among the male (76.11%) than the female (23.99%) They reported further that the most common causative agent was *M. audouinii*. The dermatophytes were prevalent in males because they were involved in numerous activities like football, farming where they come in contact with soil particles. The most prevalent organism in this study is *T. tonsurans* which is a common cause of dermatophyte associated with the scalp while the *T. terrestre* and *T. verrucosum* are known to be normal flora of the soil which could have occurred as a contaminant on the head when they come in contact with soil, cattle or fomites.

Furthermore, the result of this study showed that Dermatophyte infection was prevalent among children between 5-7 years of age which concurs with the reports of Ajao and Akintunde (1985), who reported that Dermatophytes infection is more frequent among primary school children usually between 5 and 10 years

of age. Also, Adeleke *et al.* (2008) in their study of 2150 Quranic school children examined in Kano State, discovered that the age groups mostly affected were children between 10-14 years. The difference in infection among the various age groups between the ages could be due to poor hygiene

In this study, species that could not be identified were also reported. Thus, advanced laboratory techniques have to be employed in accordance with Raymond and Marc (2008), who identified Dermatophytes from their DNA samples using a PCR-RFLP method. Also, Erhard *et al.* (2008) identified Dermatophytes using an advanced technique of MALDI-TOF mass spectrometry. This was used to identify the species that remained unidentified after using the cultural-based laboratory diagnostic methods and the species later identified were *Trichophyton rubrum*, *Trichophyton interdigitale*, *Microsporum cani* and, *Trichophyton tonsurans*.

Also, it was observed that St David primary school had greater Dermatophyte infections (*Tinea capitis*) when compared to NUD primary school. This could be due to the fact that St David primary school is located in the rural community and the children are more exposed to soil, animals and other factors that can cause infection, while NUD primary school located in an urban community has less of those items.. However, both schools had *Trichophyton mentagrophyte*, *T. verrucosum*, *M. gypseum*, *M. canis*, *T. terrestre* and *T. tonsurans*.

Awareness of dermatophytosis should be created amongst parents of primary school pupils.

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