Dermatophytes Associated With Tinea Capitis Infection Among Primary School Children In Izombe, Oguta Imo State, Southeastern Nigeria

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Abstract*—Ringworm (tinea or dermatophytosis) is a highly contagious skin infection which exerts an unpleasant aesthetic status among pre-pubertal children. This study aimed at determining the prevalence of tinea capitis among pupils in Izombe community, Oguta L.G.A Imo State, South East Nigeria due the ongoing/uncontrolled gas flaring activity from the oil companies in the area. Hair clippings and scalp scrapings were collected from 50 pupils in 5 Primary Schools within the locality. The samples were seeded on Sabouraud Dextrose Agar supplemented with Chloramphenicol (S+C) and another to which Chloramphenicol and Actidione (S+C+A) were added, and examined microscopically for fungal elements using lactophenol cotton blue. Ethical approval was obtained from the school's Head Teacher. Statistical analyses were by simple percentage and pie chart. 37 samples (74.0%) were positive for dermatophytes, while 13(26.0%) were negative. Identified dermatophytes include: Microsporium audouinii 9(24.3%), Trichophyton tonsurans 7(18.9%), T. rubrum 7(18.9%), T. mentagrophytes 6(16.2%), T. schoelenii 3(8.1%), T. violaceum 3(8.1%), and T. soudanese 2(5.4%). The study revealed that Trichophyton species predominated by (75.7%) than Microsporium species (24.3%). The infection is age and gender dependent, and decreases with an increase in age. Males had a higher prevalence 28(75.7%) than females 9(24.3%). However, statistical analysis showed significant difference (P<0.05) among pupils in the age brackets of 5-7 and 8-10 years. The gas flaring may have contribution to the high prevalence of the dermatophytes.

Keywords—dermatophytes, tinea capitis, Izombe, Imo State, Nigeria

1. INTRODUCTION

Ringworm is a fungal infection of the skin. It is characterized by a red ring of small blisters or a red ring of itchy, scaly skin with circular rashes that grow outward as the infection spreads. Hair loss may occur in the area affected and it is extremely contagious. These mycotic infections are caused by a group of fungi that possess the propensity to colonize and infect superficial layers of the skin, hair, or nails. The group of fungi that invade keratinized tissues associated with the stratum corneum of the skin, hair, and nails on the living host are called dermatophytes [1]. Only under exceptional circumstances do they survive or proliferate in the deeper tissues of the body [2].

These fungi have worldwide distribution, and at present, there are about 40 recognized species in the dermatophytes genera [3]. Of these, about 25 species belonging to the genera *Epidermophyton*, *Microsporum* and *Trichophyton* are presently known to infect man [4]. Risk factors include using public showers, contact sports such as wrestling, excessive sweating, contact with animals, obesity, and poor immune function [5].

Ringworm has a worldwide distribution but is endemic in tropical regions as the growth of dermatophytes is facilitated by warm and moist conditions [6]. Apart from climate, the variability in distribution of dermatophytes worldwide is attributed to other factors such as population migration patterns, lifestyle, primary host range, secondary host immunity, the presence of domestic animals, age of the individual, presence of immunodeficiency diseases, and patients attribute to prompt treatment following clinical presentation and standard of living [7, 1].

Children are particularly susceptible to dermatophytic infections because of poor personal hygiene and poor environmental sanitation. As human contact among children is more frequently between the age of 4 and 16 years than in every childhood age brackets [8], these age group is similarly at greater risk of contracting infectious diseases.

Ringworm is quite common in Africa and its prevalence among children is 14-86%. Studies carried out in different parts of Nigeria have proven that

causative agents of ringworm vary from one location to another. Nwaeze [9] reported *Trichophyton schoenleinii* as the predominant cause of tinea capitis in Borno. In a similar study carried out on 2150 itinerant Quranic scholars in Kano State, *Trichophyton rubrum* was the most prevalent followed by *Microsporum audouinii*. [10] reported *Trichophyton mentagrophytes* as the most prevalent causative agent in a community in the southwestern part of Nigeria. Nweze and Okafor, [11] reported *Trichophyton tonsurans* as the most prevalent aetiological agent of tinea capitis in Anambra State, Nigeria.

By reasons of nomenclature, infections caused by ring worm have been named by appending the Latin name of the affected body part after the word ''Tinea'' [12]. Thus, Tinea capitis (ringworm of the scalp), Tinea corporis (ringworm of the body), Tinea barbae (ringworm of the beard and moustache), Tinea cruris (ringworm of the groin), Tinea manuum (ringworm of the hands), Tinea ungiuum (ringworm of the nail plate), Tinea pedis (ringworm of the feet) [13].

Most Nigerians live in rural settlements, of which Izombe, Oguta L.G.A, Imo State is a good example. Residents in these areas are faced with challenges of lack of food, poor housing, overcrowding, education and health. All these factors predispose them to contracting debilitating and contagious diseases like ringworm infections. The source of infection of tinea capitis among the school children was found to be most likely the local barber who serviced the schools in all the villages, and this might explain the high incidence rate of *T. soudanese* in tinea capitis.

The intensity of ringworm infection as well as the species of the associated dermatophytes are yet to be studied in Izombe, Oguta L.G.A, Imo State as they cause skin demeaning lesions in primary school pupils especially those within the age bracket of 5 to 13 years. Hence, this study focuses on providing valuable pieces of information about the prevalence and causative agents of ringworm infections in the study area in a bid to add to existing knowledge.

On the basis of their natural habitats and host preferences, the dermatophytes can be classified into three groups:

1. Geophilic species**:** They occur as saprophytes of keratinous material (e.g., hair, feathers, horns, hooves, nails, etc.) in soil and occasionally cause infection in man and animals. Examples are *Microsporum gypseum* and *Trichophyton ajelloi* .
2. Zoophilic species**:** Zoophilic dermatophytes are those whose natural host is animals but which may also infect man. These are thought to have developed the ability to hydrolyze keratinous debris in the soil and evolved into “keratinophilic fungi” that parasitize animal host. Man acquires infection by direct and indirect contact with domestic animals (cats and dogs) and occasionally with wild animals. Examples are *T. verrucosum* and *M. canis*.
3. Anthropophilic species**:** A few dermatophytes have become adapted to human hosts and are termed anthropophilic. These are believed to have evolved from zoophilic fungi and are confined to man as a host. They are unable to colonize other animals and have no other environmental sources. On the other hand, geophilic species normally inhabit the soil where they are believed to decompose keratinaceous debris. These are transmitted indirectly via fallen hairs, desquamated epithelium, combs, hairbrushes, caps, swimming pools, showers, towels and less often by direct body contact. Examples are *T. rubrum, M. audouinii* and *Epidermophyton floccosum* [13].

In lesions, dermatophytes appear as hyphae and arthroconidia. Three types of hair infections can be seen in 10% KOH wet mount:

1. Ectothrix: In this, the fungus is present on the surface of the hair shaft. It is caused by *M. audouinii, M. canis* and *T. mentagrophytes*.
2. Endothrix: In this, the fungus is present within the hair completely filling the hair shaft. This is caused by *T. tonsurans* and *T. violaceum*.
3. Favus: In this, there is sparse hyphal growth and formation of air spaces within the shaft. This is caused by *T. schoenleinii* (Arora and Arora, 2012).
4. Transmission occurs via infected towels, linens, clothing (contributing factors are high humidity, heat, perspiration, diabetes mellitus, obesity, friction from clothes. It is can spread by using exercise machines that have not been disinfected after use, or by sharing footwear, such as rental bowling shoes, ski boots, ice skates or roller skates (Higgins *et al*., 2000; Prescott *et al*., 2002).

Tinea capitis develops when an inoculum from another individual or animal comes into a ‘compromised scalp’, which can occur when the stratum corneum of the scalp is exposed. This can be due to trauma of the scalp, tight hair braiding or hair styling with infected tools. In general, fungal spread is facilitated by poverty, poor hygiene and overcrowding [14].

III.Materials and Methods:

Study area and design

The study was carried out in Izombe community, Oguta L.G.A of Imo State, South East Nigeria. The community is located at 30km north-east of Imo State capital, Owerri and 150km from Port Harcourt. It occupies a geographical land mass of 59 sq. Kilometers (2.8 sq mi). Lies between $5^0$38’0’’N $6^0$52’0’’E/ 5.6 33330N 6.86667^{0}E (Wikipedia, 2016). It has an estimated human population figure of . The area under study has a tropical climate and two main seasons namely: rainy and dry seasons. The rainy season starts from March and ends around September while the dry season starts from October and ends by March. The community has various social structures and amenities such as clinics, boreholes, surface water, ditches, etc. It has an average minimum temperature of 22.5ºC and a

maximum temperature of 35.5 ºC. Her annual humidity is 74.3%, annual average rainfall is 240.6mm. The Oil exploration and production is done in the community by three major multinational oil companies. The community is known for the on-going gas flaring effects which has resulted in poor yield of crops, respiratory diseases and other health problems due to the release of poisonous chemicals e.g. green house gases heralding the unchecked encroachment of infectious skin conditions like Tinea capitis and Tinea corporis.

The study area is made of four autonomous communities namely; Aborshi, Umunweama, Obeabor and Ndi-Uloukwu autonomous communities. The oil exploration and gas flaring activities are concentrated around the Aborshi autonomous community and the Umunweama area close to it. Hence the five chosen Primary Schools are located in and around Aborshi autonomous community. The public schools that serve the need of formal education in the community are; Aborshi Primary School, Central School, CMS Primary School, Holy Family Parish Primary School and LA Primary School. The Schools have poor structures and environmental conditions, thereby predisposing the pupils to prevalent ringworm infections (dermatophytoses).

A. Sample Collection and Processing

A total of 50 primary school pupils were randomly selected from the aforementioned Primary Schools in Izombe community and their ages ranged between 5-13 years. The diagnostic/inclusion criteria utilized include: ringed (annular) lesions with fringed edges, central clearing and scaly patches on the scalp (with or without hair loss). Scrapings from the edges or broken hairs from the margin of lesions consistent with dermatophytosis were swabbed with 70% ethanol. They were collected using sterile scalpel blade and collected into plain papers. Each of these papers was appropriately labeled with the students name, age, sex, date of collection, location of infection and subsequently taken to the Medical Laboratory unit of the Federal Medical Centre, Owerri within 24 hours for analysis. Information about the state of the classrooms/school compounds (environmental hygiene, amenities) and the children's' play pattern were also carefully gathered using both direct observation and/or interview methods during the study.

B. Microscopic Examination

Table 1: General prevalence of ringworm/dermatophytosis (%) within the Schools studied.

No Investigated	No Positive	Positive Pupils (%)	Negative Pupils (%)	Prevalence of dermatophytosis (%)
50	37	74.0	13	74.0

The collected samples were observed under the microscope using the standard methods according to Cheesbrough [15]. A portion of each sample collected from an affected area was reduced to mount on a glass slide to which 4 drops of 10% (v/v) KOH was added to the scalp/hair and skin scrapings, covered with a cover slip and slightly heated for one (1) minute to aid rapid penetration and complete tissue maceration. Each preparation was examined under low (X10) and high (X40) magnifications of a light microscope for fungal elements like hyphae and conidia, respectively.

C. Culture, Identification and Characterization of Dermatophytes

The scrapings were cultured on Sabouraud Dextrose Agar plates. The media were prepared according to the manufacturers' instructions with the addition of 0.05 g Chloramphenicol and another supplemented with Chloramphenicol and Actidione as described by Weitzman and Summerbell [4]. The samples were seeded unto the prepared media and incubated for 3 weeks at room temperature and examined for growth weekly [15]. A thin preparation of the fungal culture was made with a drop of lactophenol cotton blue solution on a glass slide, covered with a coverslip and observed under a microscope. Dermatophytes were identified based on macroscopic and microscopic features, pigmentation (obverse and reverse), macroconidia, microconidia and/or other fungal elements [16].

D. Data Analysis

All data gathered were analyzed using frequency distribution table and expressed as simple percentages. With significant difference at ($P<0.05$).

Table 2: Distribution of dermatophyte species isolated in the Schools studied

Dermatophytes isolated	No. of isolates (%)
M. audouinii	9 (24.3)
T. tonsurans	7 (18.9)
T. rubrum	7 (18.9)
T. mentagrophytes	6 (16.2)
T. schoenlenii	3 (8.1)
T. violaceum	3 (8.1)
T. soudanense	2 (5.4)
Total	37(100)

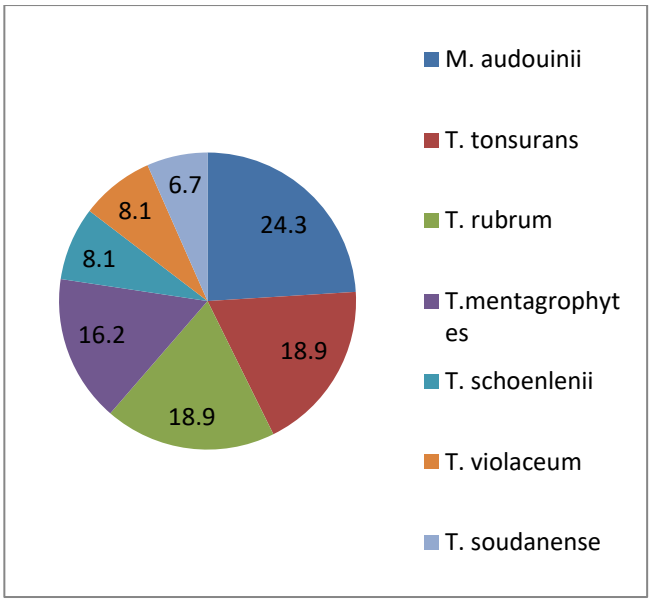
V.DISCUSSION

Dermatophytosis which is an important public health problem among children both in Nigeria and the world over, [19] remains endemic in Nigeria due to lack of information on its prevalence and absence of control measures [20].

From this study, 42.9% of primary schoolchildren in Izombe community of Oguta Local Government Area of Imo State, South-East Nigeria were infected with various species of dermatophytes. Among the isolates, *M. audouinii* with a prevalence of (24.3%), *T. mentagrophytes* (16.2%), *T. rubrum* (18.9%) and *T.*

soudanense (5.4%) are anthropophilic species which occur in pre-pubertal children. *T. tonsurans* with a

Fig 1: Pie-chart representing the prevalence of the dermatophyte species isolated



prevalence of (18.9%) is an endothrix species: this falls in accordance with the work of Ngwogu [21], and it is believed to be prevalent in the rural communities of South Eastern Nigeria. One of the greatest factors hindering the prevention and eradication of dermatophytoses is the presence of healthy (asymptomatic) dermatophyte carriers. Majority of the pupils examined showed no physical symptoms of infection, yet their samples yielded significant growth of dermatophytes. This agrees with the findings that asymptomatic carriers of dermatophytes may be comparable to symptomatic patients [19]. This study revealed a higher prevalence rate

Table 3: Sex Distribution of dermatophytes within the studied schools

Sex Male	Female	Male (%)	Female (%)
33	17	66.0	34.0

of dermatophytosis (74.0%) compared with a study among school children in Ile- Ife, Nigeria (14.0%), Iraq (2.7%) and Isu, Nigeria (31.6%). The study showed a higher prevalence in boys than girls. This is in agreement with a similar study that also showed higher prevalence and distribution of dermatophytosis in males (73%) than in females (27%) in Cross River State which is also an oil producing area, and (54.1%) in boys to (45.9%) in girls examined within Isu L.G.A, Imo state [22]. The higher prevalence recorded to have occurred in boys than in girls, may be attributed to the playing habits of the boys compared with girls, which frequently expose them to these dermatophuytes in their natural habitats. Also, the fact that boys visit barbing salons may often contribute to this high prevalence. More so, the high prevalence seen in this study than others may be attributed to the oil producing activities among these areas which results in high environmental temperature and humidity that supports the growth of these dermatophytes on children with grown hair [23].

Poor infrastructure, dirty environments, dirty classrooms and filthy homes may be the contributing factors to the high prevalence of dermatophytes among school children. Some children who sit on un-cemented floors can contact the infection from the soil. This corroborates with the work of Dike-Ndudim [22], which recorded high frequency of anthropophilic species isolated from students.

Table 4: Percentage distribution of dermatophytoses among studied Schools in relation to the included age groups.

School	No. Examined	No. Infected (%)	Age Groups (years) (%)			TOTAL
			5-7	8-10	11-13	
School I	10	11(29.7)	6(16.2)	4(10.8)	1(2.7)	11(29.7)
School II	10	9(24.3)	5(13.5)	2(5.4)	2(5.4)	9(24.3)
School III	10	8(21.6)	6(16.2)	2(5.4)	0	8(21.6)
School IV	10	6(16.2)	3(8.1)	2(5.4)	1(2.7)	6(16.2)
School V	10	3(8.1)	2(5.4)	1(2.7)	0	3(8.1)
Total	50	37(100)	22(59.5)	11(29.7)	4(10.8)	37(100)

VI.CONCLUSION

This work establishes the fact that dermatophytes are prevalent among the school children in Izombe. Ringworm of the scalp (tinea capitis) is predominant in the area as an oil producing community where oil drilling, gas flaring and other oil producing activities take place.

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