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Dermatophytosis among Primary School Children in Jos, Plateau State Nigeria

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ABSTRACT

Dermatophytosis is a fungal infection of the hair, skin or nails and typically presents with red, itchy, scaly, or raised patches. The major risk factors for infection are contact sports, excessive sweating, contact with animals, poor hygiene and immunosuppression. The aim of this study was to determine the prevalence and etiologic agents of dermatophytosis among primary school children in Jos, Plateau State. A total of 598 elementary school pupils, aged 4-15 years with clinical features of superficial mycoses on different parts of the body and whose parents/guardians signed the consent were recruited to participate in the study. The specimens were collected aseptically by cleaning the infected area with 70% alcohol, and scrapping the actively growing edge of the lesions into a sterile foil paper using sterile scalpel blades for each lesion. The samples were transported to the laboratory and subjected to microscopy, culture and identification. Culture confirmed 530(88.6%) of the infections as dermatophytoses with the commonest being tinea capitis. The infection was more common in males than females with 63.4% and 36.6% respectively. The age group predominantly infected was 4-7 years responsible for 49.7% of the infection. *Trichophyton rubrum* was the commonest agent isolated as the cause of dermatophytosis among the study participants. This study revealed a high prevalence of dermatophytoses among the school pupils with males being more affected than female. Children aged 4-7 years are commonly affected with *Trichophyton rubrum* the major culprit. This emphasis the need for targeted treatment and control of dermatophytosis among primary school pupils.

Keywords: Dermatophytoses, *Epidermophyton floccosum*, *Microsporum canis, Tinea capitis, Trichophyton rubrum.*

INTRODUCTION

Infections of the skin, hair, and nails due to dermatophytes are a common problem across the globe depending on the climate and culture, the clinical picture can differ. Tinea pedis and onychomycosis are the most prevalent clinical forms in western countries, while tinea capitis and tinea corporis

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are more frequent forms in tropical areas.[1] Dermatophytoses usually refer to as "Tinea infection or ringworm" belong to a group of organisms that are able to colonize the keratin tissues and in response to their metabolic by-products, the host experiences inflammatory reactions. The causative organisms belong to three genera, *Microsporum*, *Epidermophyton* and *Trichophyton* being the most common culprit. They are usually restricted to the non-living cornified layer of the epidermis because of their inability to penetrate viable tissue of an immunocompetent host. Acid proteinases, elastase, keratinases and other proteinases reportedly act as virulence factors.[2]

Dermatophytes may be grouped into three categories based on host preference and natural habitat. Anthropophilic species predominantly infect humans, Geophilic species are soil based and may infect both humans and animals, and zoophilic species generally infect non-human mammals. It is also possible for humans to transmit Anthropophilic dermatophytes to animals, although this seems to be uncommon. Serious consequences are uncommon and infections can be self-limiting. However, the illness may be disfiguring and uncomfortable, especially when the lesions are widespread. Infrequently, dermatophytes may invade subcutaneous tissues and very rarely other sites, especially in immunocompromised hosts.[3]

It is a common superficial fungal infection found throughout the world. It occurs primarily in pre-pubertal children over the age of 6 months.[4] It can be transmitted through body contacts (person to person transmission) mainly in refugee camps or schools or through inanimate objects like clothes, combs or hair dressers equipment. To avoid a misdiagnosis, identification of dermatophyte infections requires both a fungal culture on Sabouraud's agar media and a light microscopic mycological examination from skin scrapings. Preventative measures of Tinea infections include practicing good personal hygiene, keeping the skin dry and cool at all times and avoiding sharing towels, clothing, or hair accessories with infected individuals.[5]

In recent times, infections caused by dermatophytes have assumed greater significance. The increasing number of patients with immunocompromised states, such as AIDS, diabetes mellitus, cancer and organ transplantation, has given these infections more prominence.[6,7] In fact, it has been estimated that 20 to 25% of the world's population are infected by dermatophytes and the incidence continue to increase on a steady basis.[8] The causative species vary with geographic region and vice versa.[9] However, the epidemiology of dermatophyte infection is affected by migration pattern, increase in tourism, locality and changes in socioeconomic condition of the people.

There are several known clinical types of dermatophytoses. However, in Africa and several other countries in Latin America and the Middle East, there is a kind of variability and geographical/regional associations in the pattern of dermatophytic infections. For instance, tinea capitis is known to be very common in Western Africa especially among children and several species of dermatophytes are known to be responsible. *Tinea cruris, tinea pedis, tinea corporis* and *tinea unguium* are caused by *Trichophyton rubrum* in many urban areas of developing countries[10] and even in developed countries[11,12] *Microsporum audouinii* is the predominant dermatophyte species in many parts of Africa. *Trichophyton violaceum* is reportedly endemic in several parts of South and Northern Africa and *Trichophyton soudanense* in central Northwestern parts of Africa[13,14] Conversely, *Microsporum canis* predominates other dermatophytes in Southern and Central European countries as the most common cause of tinea capitis while *Trichophyton mentagrophytes* and *Trichophyton rubrum* are the cause of increasing cases of tinea unguium and pedis, respectively.[15,16]

Children are particularly susceptible to dermatophytic infections because of their poor personal hygiene habits and poor environmental sanitation. As human contact

among children is more frequent between the ages of 4 and 16 years than in very early childhood, these age group is similarly at greater risk of contracting infectious diseases.[4] hence, there is the need to determine the prevalence and etiologic agents of dermatophytosis among primary school children in Jos, Plateau State Nigeria.

MATERIALS AND METHODS

This was a cross-sectional study of 598 primary school pupils across five[5] selected schools in Jos South local government area of Plateau State, North-central Nigeria. The study area was selected purposely while the schools were chosen by balloting without replacement. The sample size was determined using the formula provided by Araoye, 2003(17), at 95% confidence interval and a 5% expected error of margin. A local prevalence of 44.6% obtained from a previous study was used.[18] By calculating and adding 10% attrition, sample size of 598 was used. The calculated sample size was distributed to the five selected schools proportionately taking into consideration the total number of pupils in each school. The pupils were finally recruited by using a simple paper balloting containing YES or NO and those who picked YES were recruited into the study.

Sample Collection

The recruited participants with lesions suggestive of superficial fungal infection were administered a structured questionnaire by interview. Before samples were collected, the affected area was cleaned with 70% alcohol. Scrapping samples from affected area of skin, nails, and scalp/hair depending on the clinical lesion, were collected into a sterile foil paper aseptically from the edge of the lesion using sterile blade/razor. A new blade was used for each lesion. Each of these papers was appropriately labeled with the age, sex, date of collection, school name, code of the patient, and site of infection. The samples were taken the same day to the bacteriology laboratory of the National Veterinary Research Institute Vom for microscopy and culture.

Direct Microscopy using Potassium Hydroxide

A wet mount of a portion of each specimen was prepared in one to two drops of 20% potassium hydroxide on a clean grease free microscopic slide. After leaving the preparation to stand for about 5 minutes for the digestion of keratin to occur, it was examined under low (x10) and high (x40) power magnification for the presence of fungal elements (hyphae and conidia).[19]

Culture

The clinical specimens were inoculated onto Sabouraud's Dextrose Agar (SDA) plates containing chloramphenicol and cycloheximide to inhibit the growth of bacterial contaminants and non-dermatophytic moulds. All inoculated plates were incubated at 2530°C for 4-6 weeks and examined every 2 days for evidence of growth. A culture plate was considered negative when there was no growth after 6 weeks of incubation. The identification of dermatophytes from positive cultures were based on colonial characteristics in pure culture and microscopic morphology of fungi using lactophenol cotton blue stain.[20] Further identification was carried out via fermentation and assimilation test. The former is indicated by the production of gas and colour change while a positive assimilation test using carbohydrate impregnated disks is indicated by the presence of growth.

Data Analysis

The data obtained from the study were analysed using Statistical Package for Social Sciences (SPSS) version 21 (IBM SPSS Inc, USA). Proportions were compared using Chi-square with confidence limit (p-value) of < 0.05 considered significant.

RESULTS

Out of the 598 pupils recruited for this study, 530(88.6%) had dermatophytosis using culture. The infection was more common among pupils age group 4-7 years with a prevalence rate of 297(49.7%) compare to 218(36.5%) in age group 8-11 years. The least was observed in age

group 12-15 years old
as they were affected in 83(13.8%). This different in infection across age group was not statistically significant (Table 1, $p = 0.23$).

There was a significant relationship ($p = 0.01$) (Table 2) between prevalence of dermatophytosis and the sex of the patient. The infections were more common among males than the female pupils. The infection was found in 336(63.4%) of the males compare to 194(36.6%) of the females. This same trend was also observed across the five schools. The infection was found to be more common in school PB with prevalence of 177(33.4%) followed by 162(30.6) in school PC. School PA and PD were infected in 113(21.3%) and 46(8.7%) respectively. The least infected school was PE with a prevalence rate of 32(6.0%). However, in all the schools, male pupils were more infected with dermatophytosis than their females' counterpart (Table 2).

Table 3 showed the detail distribution of clinical manifestation of dermatophytosis among the study population in relation to sex of study. Tinea capitis was the predominant clinical manifestation accounting for 389(73.4%) of the cases of which 270(50.9%) were males and 119(22.5%) females. This was followed by tinea faciei and tinea pedis responsible for 64(12.1%) and 24(4.5%) of the cases, respectively. Others were tinea corporis (4.2%), tinea manuum (4.0%) with the least being tinea unguium (1.9%). This distribution according to clinical manifestation was statistically significant at $p = 0.01$ (Table 3).

This study also revealed that the commonest causative agent of dermatophytosis among the study population was *Trichophyton rubrum* (48.7%), followed by *T. mentagrophytes (25.3%) and Trichophyton tonsurans (9.1%). Epidermophyton floccosum and Microsporum gypseum* were isolated, whereas *Microsporum canis* was isolated in 1.9% of the cases while *Trichophyton schoenlienii* was the least isolated (0.4%). However, as shown in table 4, the distribution of the causative agents across the five selected schools differed. While *Trichophyton rubrum* was still the commonest agent among the schools, not all the species were isolated in all the schools.

Table 1: Prevalence of dermatophytosis in relation to age

Age (Years)	Positive (%)	Negative (%)	Total
4-7	265(44.3)	32(5.4)	297(49.7)
8-11	196(32.8)	22(3.7)	218(36.5)
12-15	69(11.5)	14(2.3)	83(13.8)
Total	**530(88.6)**	**68(11.4)**	**598(100)**

$x^2 = 2.95$, df = 2, $p = 0.23$

Table 2: Prevalence of dermatophytosis in relation to sex

School	Male		Female		Total positive (%)
	No. Tested	No Positive (%)	No. Tested	No Positive (%)	
PA	74	68(60.2)	52	45(39.8)	113(21.3)
PB	108	106(59.9)	76	71(40.1)	177(33.4)
PC	109	105(64.8)	63	57(35.2)	162(30.6)
PD	41	34(73.9)	22	12(26.1)	46(8.7)
PE	31	23(71.9)	22	9(28.1)	32(6.0)
Total	**363**	**336(63.4)**	**235**	**194(36.6)**	**530(100)**

$x^2 = 14.23$, df = 4, $p = 0.01$
Key: PA = Primary School A **;** PB = Primary School B**;** PC = Primary School C**;** PD = Primary School D**;** PE = Primary School E

Table 3: Distribution of clinical manifestations of dermatophytoses in relation to sex.

Site	Male	Female	Total
Tinea capitis	270(50.9%)	119(22.5%)	389(73.4%)
Tinea faciei	26(4.9%)	38(7.2%)	64(12.1%)
Tinea manuum	12(2.3%)	9(1.7%)	21(4.0%)
Tinea corporis	11(2.1%)	11(2.1%)	22(4.2%)
Tinea unguium	5(0.9%)	5(0.9%)	10(1.9%)
Tinea pedis	12(2.3%)	12(2.3%)	24(4.5%)
Total	**336(63.4%)**	**194(36.6%)**	**530(100%)**

$\chi^2 = 25.46$, df = 5 , $p = 0.01$

Table 4: Distribution of Aetiologic agents of Dermatophytoses among Primary Schools in Jos South

Aetiologic agents	PA	PB	PC	PD	PE	Total
Trichophyton rubrum	58(10.9 %)	79(14.9%)	71(13.4%)	32(6.0 %)	18(3.4%)	258(48.7%)
Trichophyton mentagrophytes	28(5.3%	36(6.8%)	54(10.2%)	6(1.1 %)	10(1.9%)	134(25.3%)
Trichophyton tonsurans	18(3.4%)	22(4.2%)	0(0.0%)	8(1.5%)	0(0.0%)	48(9.1%)
Trichophyton schoenlienii	0(0.0%)	2(0.4%)	0(0.0%)	0(0.0%)	0(0.0%)	2(0.4%)
Epidermophyton Floccosum	2(0.4%)	18(3.4%)	20(3.8%)	0(0.0%)	4(0.8%)	44(8.3%)
Microsporon canis	2(0.4 %)	5(0.9%)	2(0.4%)	0(0.0%)	0(0.0%)	9(1.7%)
Microsporon gypseum	5(0.9%)	15(2.8%)	15(2.8%)	0(0.0%)	0(0.0%)	35(6.6%)
Total	**113(21.3%)**	**177(33.4%)**	**162(30.6%)**	**46(8.7%)**	**32(6.0%)**	**530(100%)**

DISCUSSION

This study showed that dermatophyte infections were majorly prevalent amongst school age children with prevalence rate of 88.6%. This signified that the disease is still endemic in Nigeria, largely because of absence of control measures. This finding was contrary to 40.4% and 49.5% reported by two separate studies among primary school pupils in South-west Nigeria,[21,22] but in agreement with a study reported among children in Ethiopia.[23] The high prevalence in this study, may not be unconnected with the socioeconomic background of the study population, environmental and risk factors such as over-crowding, climate, level of hygiene, nature of school infrastructure and amenities. Frequent contact with domestic animals and contact sports facilitates transmission and create epidemiological circumstances for re-infection of human hosts by dermatophytes. These factors may largely account for the high prevalence recorded in this study. It has also been documented by other studies that sharing of personnel effects such as clippers, combs, and towels can serves as a means of transmitting dermatophytosis.[24,25]

Although the prevalence was not statistically significant in relation to age, the age group 4-7 years were responsible for half of the infection with a rate of 265(44.3%) and decreases with increasing age. This age group has been reported as the most affected with dermatophytosis.[26] The high prevalence of dermatophyte infection in this prepubertal age group has being attributed to poor hygiene and absence of saturated fatty acids that provide a natural protective mechanism against fungal infections.[26] The playful habits of these children always bring them in constant contact with soil and seldom have regular bath which predisposes them to fungal spores. Several studies across Nigeria have also corroborated this report that dermatophytosis is more common among this age group.[25,27] However, there are studies that have reported high prevalence of infection in older age group. A study in Puducherry, India, has reported more prevalence of dermatophytosis in 21-30 years than in the school age pupils and the clinical presentation was that of tinea corporis compare to tinea capitis that was seen more among younger age group.[28] This was attributed to

strenuous outdoor manual work with excessive perspiration among the elder age group.

A higher prevalence was observed in respect to sex and selected primary school. The infection was significantly associated with males than the female pupils at $p = 0.01$. This was similar to other reports across Nigeria.[18,26] The adventurous nature of males and physical engagement of male children in contact sports such as wrestling, football, boxing, coupled with a tradition that subjugate females over males in tending to animals in household farms have been given as factors that pre-dispose males to high prevalence of dermatophytosis.[29] Furthermore, males visit barbers more and, in this case, a single clipper and combs are mostly used. Emele and his colleague also stated that, scalp infection in females is less due to steroid-mediated inhibition of dermatophyte growth by progesterone and other similar compounds.[30] The tattered nature the classrooms floor, school environmental hygiene and overcrowding which promote physical contacts might have been responsible for the variation in prevalence among the selected schools.

Conversely, some previous studies have reported higher infections among females.[25,31] The reason to this may be attributed to hair dressing and styling practices such as tight hair braiding, shaving of the scalp among female primary school pupils, plaiting, and the use of hair oils which may promote transmission of disease. However, the precise role of such practices remains a subject of study.[32]

The predominant clinical manifestations of dermatophytosis in this study was tinea capitis involving 73.4%. This was followed by tinea faciei and tinea pedis respectively. Tinea unguium was the least common clinical presentation among the study population. This finding was corroborated by several other studies that tinea capitis was the commonest presentation of dermatophytosis among prepubertal age group.[25,33] However, a study conducted in Greece has reported tinea unguium as the dominant clinical manifestation of dermatophytosis.[34] These varying reports in clinical presentation depends on the predominant risk factors among the study population.

Of the 530 dermatophyte species isolated in this study, *Trichophyton rubrum* was the commonest species isolated accounting for (48.7%) followed by *Trichophyton mentagrophytes* (25.3%). The least isolated species was *Trichophyton schoenleinii* (0.4%). The high prevalence of *Trichophyton rubrum* may be due to its anthropophilic nature. In a similar study carried out in Kano State Nigeria, among 2150 itinerant quranic scholars, *Trichophyton rubrum* was the most prevalent.[35] This was contrary to finding of Ayanbimpe and colleagues in 2008 who reported *Trichophyton soudanense* as the most common dermatophytic agent,[18] while *Microsporum spp* was reported in Kano state as the most prevalent aetiologic agent of superficial infection mycoses which was attributed to the constant exposure of the children to domestic animals.[36]

CONCLUSION

Infection of dermatophytes among primary school children in Jos, Northcentral Nigeria, is very high. Tinea capitis was the most common clinical presentation. A higher occurrence was seen among the age group 4-7 years with males being the most affected. *Trichophyton rubrum* was the most prevalent aetiologic agent isolated. Hence there is a need to create awareness and health education on preventive measures among these school age group.

Ethical Consideration:

Approval for this study was obtained from the ethics Committee of the Plateau State Ministry of Health and Universal Basic Education Board with reference number MOH/MIS/202/VOLT/X. A written informed consent was obtained from the schools' authorities, the parents and guardians of the pupils recruited for this research. The pupils were also educated on the health implications of dermatophytosis and their assent obtained before sampling.

Consent for Publication:

All the authors reviewed and gave their approval for this

article to be submitted for publication.

Competing of interest

There are no conflicts of interests among the authors.

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