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ORIGINAL ARTICLE

Prevalence of dermatophytosis among primary school children in Oke-oyi community of Kwara state

SA Adefemi, LO Odeigah, KM Alabi

Department of General Medical Practice, University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria

Abstract

Background: Dermatophytic infections have been known to impact negatively on health and well-being of children. This study was undertaken to determine the prevalence, clinical types as well as the etiologic organisms of dermatophyte infection among primary school children aged 5-16 years in Oke-Oyi community in Kwara state.

Materials and Methods: A 4-months descriptive cross-sectional survey was carried out among 602 children aged 5-16 years in Oke-Oyi community, in Kwara state.

Results: The prevalence of clinically suspected dermatophytoses lesion was 29.9% (180/602). Dermatophyte accounted for 5.0% (30/602) on Sabouraud dextrose agar culture, while non-dermatophyte molds represent majority of isolate i.e., 15.4% (93/602). Tinea capitis is the commonest clinical type, followed by Tinea coporis and then Tinea pedis. Multiple infections are noted in nine respondents. Three species of dermatophytes belonging to only two of the three genera of dermatophytes were responsible for human infection in the area studied, of which *Trichophyton mentagrophyte* is the commonest, followed by *Microsporum audouinii* and *Trichophyton verucossum*. Among the non-dermatophytes, *Aspergillus fumigatus* and *Candida albicans* predominate.

Conclusion: This study demonstrates that the prevalence of dermatophytoses in the school studied was significant. Control efforts should target this vulnerable group to reduce its prevalence.

Key words: Children, prevalence, dermatophytosis, etiology, clinical types

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Introduction

Dermatophytes are a unique group of fungi that infect keratinous tissues of lower animals and humans.[1] They are characterized by their ability to invade the superficial layers of the epidermis, particularly, the stratum corneum and the high keratin–concentration containing appendages, the hair and nails of the living host.[2,3] Only under exceptional circumstances do they survive or proliferate in the deeper tissues of the body.[4]

These fungi have worldwide distribution, and at present, there are 40 recognized species in the dermatophyte genera.[5] Of these, about 25 species belonging to the genera Epidermophyton, Microsporum and Trichophyton are presently known to infect man.[1]

Address for correspondence:
Dr. S. A. Adefemi
Department of Family Medicine, Federal Medical Centre, Bida, Nigeria
E-mail: samueladefemi@yahoo.com

The distribution, frequency, and etiological agents of dermatophytosis vary according to the geographic region studied, the climatic variations, the socioeconomic level of the population, the time of study, the presence of domestic animals and age of the individual.[6]

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,[7] these age group is similarly at greater risk of contracting infectious diseases.

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Studies are very few, if any in this environment that had looked at the prevalence of dermatophytic infection among primary school pupils, hence the need to know the actual magnitude of the problem as well as the etiological agent.

Materials and Methods

This study was a cross-sectional survey, involving all school children aged 5-16 years in each of the two public primary schools in Oke-Oyi, a semi-urban community of Kwara state in Ilorin East Local Government. This study was approved by the Ethical Committee of the University of Ilorin Teaching Hospital and Consent to carry out this study was obtained from the Local Education Authority. The study was carried out between April and August of 2005. Structured questionnaire was administered to clinically suspected dermatophyte infected pupils by interview. The diagnostic criteria utilized include: Annular lesion with activity at the edges, and central clearing on the skin of any part of the body; Scaling patches on the scalp with or without hair loss or erythema; Onycholysis (nail plate separation from nail bed), thickened, discolored (white, yellow, brown, black) broken and dystrophic nails. All assenting primary school pupils aged 5-16 years in the two selected schools whose parents have given a written consent for their inclusion in the study were included while pupils who are outside the age-group 5-16 and without any skin lesion or with skin lesion but which did not meet the clinical suspected diagnostic criteria of dermatophyte infection were excluded. In addition pupils who met the clinical suspected diagnostic criteria of dermatophyte infection but are on antifungal treatment (oral or topical), orthodox or traditional, 2 weeks to the period of study were also excluded.

Those with lesions compatible with dermatophytosis had samples taken from the affected parts after parental consent and pupil verbal assent. Skin lesions are sampled from the erythematous, peripheral, actively growing margins of the lesions. In hair samples, the dull, lusterless hair and stubs of hairs are chosen and plucked by sterile epilator forceps, while nail samples are taken from deeper part of the discolored or dystrophic parts of the nails. A portion of the obtained sample was placed on clean blotting paper for microscopy and another portion inoculated directly on Sabouraud dextrose agar (SDA) slant with chloramphenicol for mycological examination. This was immediately transported to the University of Ilorin Teaching Hospital Medical Microbiology laboratory in a black polythene bag where those collected for microscopy was subjected to 10% KOH and those inoculated on SDA agar is incubated at room temperature till the second day when it was transported to the Microbiology Laboratory of Obafemi Awolowo University Teaching Hospital, Ile-Ife, where it was incubated at room temperature and at 37^{0}C for minimum period of 3 weeks. Further sub-culture was done on plain SDA after the growth of the dermatophytes was established. Positive cultures were examined macroscopically and microscopically for species identification on the basis of cultural characteristics, pigment production, microscopic examination in lactophenol cotton blue preparation, and hair penetration test whenever necessary.

Those without growth were discarded as negative after 6 weeks. All data collected from the participants were entered into a database created specifically for this study using Epi-Info 6.04d. All data were kept confidential at all stages of the study. A *P*-value of <0.05 was taken as statistically significant.

Results

A total of 602 primary school pupils (398 males and 204 females) were surveyed from the two public schools in Oke-Oyi community, giving a male to female ratio of 2:1.

One hundred and eighty respondents (123 males and 57 females) were diagnosed to have dermatophytic lesion clinically. The overall mean age and standard deviation (SD) of the respondents was 8.99 ± 2.97 years.

Table 1 show that the male sex was more infected with dermatophytosis than their female counterparts clinically. The 9-12 year age-group was the most infected age-group with dermatophytoses.

Table 2 show the overall prevalence of fungal infection was 20.4% (123/602) while that of dermatophyte alone was 5.0% (30/602). The sex-specific prevalence of fungal infection was 21.6% (86/398) and 18.1% (37/204), respectively, for the male and female pupils and the sex-specific prevalence for dermatophytes were 4.8% (19/398) and 5.4% (11/204) for male and female respondents, respectively.

Table 3 show that of the 180 clinically suspected fungal infection cases, only 94 (52.2%) was mycologically proven. Single fungal infections were observed in 88/180 (48.9%) cases, of which dermatophytes account for 23/180 (12.8%) of these. Multiple infections of two species were observed in 15/180 (8.3%) of the cases, of which dermatophytes

Table 1: Demographic characteristics of respondents suspected clinically to have dermatophytoses

Age groups (years)	Sex		Total (N=180) n (%)
	Male (n)	Female (n)	
5-8	61	20	81 (45.0)
9-12	45	27	72 (40.0)
13-16	17	10	27 (15.0)
Total	123	57	180

n= No of respondents in observation, N=Total no of clinically suspected cases, %

Table 2: Sex distribution of respondents who were positive for fungi on culture with Sabouraud dextrose agar

Type of fungi	Sex		Total (N0=602) (N=180)
	Male=398 (n)	Female=204 (n)	
Dermatophyte (D)	19	11	30 (16.7)
Non-dermatophyte (ND)	67	26	93 (51.7)
Total	86	37	123 (68.3)

X^2=0.82, P= 0.366. n= frequency of respondents in observation, N^0 = total no of pupils surveyed, N=total no of clinically suspected cases. Multiple fungi infection = 15 (D + ND =7; ND + ND = 8)

Table 3: Isolation frequency (%) of dermatophytes and non-dermatophyte causing clinical lesion

Isolate	Frequency N (%)
None	71 (36.6)
Trichophyton mentagrophyte	22 (11.3)
Trichophyton verrucossum	3 (1.5)
Microsporum audouinii	5 (2.6)
Aspergillus fumigatus	45 (23.2)
Candida albicans	24 (12.4)
Mucor	19 (9.8)
Rhizopus	3 (1.5)
Alternaria spp.	2 (1.0)

account for another seven [7/180 (3.9%)]. The prevalence of dermatophytes (*Trichophyton mentagrophyte, Trichophyton verrucossum* and *Microsporum audouinii*) in the series was 30/602 (5.0%). Other non-dermatophytes; (*Aspergillus fumigatus, Candida albicans*, Mucor, Rhizopus and Alternaria *spp.*), accounts for the remaining 93/602 (15.4%).

T. mentagrophyte caused infection in the three clinical types found in the study. *M. audouinii* caused infection in Tinea capitis and Tinea coporis, while *T. verrucosum* only caused infection in the scalp. *T. mentagrophyte*, was the commonest species found in all the three affected parts, accounting for 22 (73.3%) of all cases of dermatophytes isolated, followed by *M. audouinii* and *T. verrucosum*.

Figure 1 show that the scalp is the commonest affected site of the body among the clinically suspected cases 137 (76.1%). This was followed by Tinea coporis and Tinea pedis. Multiple affected sites were present in only 9 (5.0%) cases.

Of the 180 clinically suspected fungal infection cases, only 94 (52.2%) was mycologically proven. Single fungal infections were observed in 87/180 (48.3%) cases, of which dermatophytes account for 23/180 (12.8%) of these. Multiple infections of two species were observed in 15/180 (8.3%) of the cases, of which dermatophytes account for another seven [7/180 (3.9%)]. The prevalence of dermatophytes in the series was 30/602 (5.0%). Other non-dermatophytes, accounts for the remaining {93/602 (15.4%)}. *T. mentagrophyte* was the predominant species, found in 22/30 cases (73.3%), followed by 5/30 (16.7%) of *M. audouinii* and 3/30 (10.0%) cases of *T. verrucosum*.

Discussions

Dermatophytic infection is a common infection that constitutes public health problem among children worldwide, including Nigeria.[7] In the present study, of the 602 children surveyed from the 2 public schools in Oke-Oyi community, the prevalence rate of culture proven dermatophytic infection was 5.0% (30/602). This is relatively low, compared to earlier local surveys among school children in Nigeria with rates between 7 and 15%.[7,8-10] The low prevalence of dermatophytes, in this study was unexpected, against the backdrop that almost all parameters known to favour person to person transmission, such as the presence of previous skin lesions, overcrowding in the home, practice of sharing personal belonging, practice of keeping pets and factors that suggest poor personal hygiene are present in the pupils surveyed.[11] Although the disparity in rates only affected dermatophyte but not fungal infection generally [116/602 (19.3%)]. This might not be unconnected with the local environmental and climatic conditions of the area studied, which probably favours the growth of other fungi over and above dermatophytes.[12] Also, the use of traditional remedies whose mechanism of action are unknown, by some of the respondents to treat their lesions, may perhaps have altered *in vitro* isolation of dermatophytes.

Another possible explanation for the low prevalence of dermatophytoses observed is that the study only looked at those with detectable signs of fungal infection. This has the potential of missing healthy asymptomatic carriers. Persons with asymptomatic carrier status of dermatophytic infection have been reported in literature to be both the reservoir of infection in the community and constitute almost similar prevalence to symptomatic cases.[13-14]

It is also not known whether there are substances produced by non-dermatophytes in culture which could inhibit growth of dermatophytes in coinfected samples, or whether fast growing, non-dermatophytic molds have overgrown dermatophytes which requires more stringent conditions for their isolation compared to non-dermatophytes.[15]

On the other hand, the finding of non-dermatophyte making up for the observed discrepancy in rates between earlier local studies and the current one, would suggest that those practices that entrench dermatophyte infection specifically, and fungi infection generally, are still much present within the community surveyed. This would have

to be dealt with in order to achieve reduction in the load of infection with fungal organisms generally.

Similar, lower prevalences of dermatophytoses were reported from studies among school children in Palestine (1%),[16] and in Iraq (2.7%).[17] The lower prevalence in these studies was attributed to routine practice of strict inspection of children by teachers who in turn prevent infected children from attending school until treated and cured, rather than improvement in hygiene standard. The finding of non-dermatophytes as increasing causes of fungal infection as in this study has also been reported by El-Batawi *et al* in their study where non-dermatophytes accounted for almost 60% of the total number of positive cases in patients with onychomycosis.[18]

A number of previous reports indicated that the prevalence of dermatophyte infection was higher in children younger than 11 years than older children, with the peak in the age range 7-11 years.[7,8-10,16,19,20] This was confirmed in this study, though not statistically significant ($P>0.05$) [Figure 1]. The age predilection is believed to result from the fungistatic properties of fatty acids of short and medium chains in post pubertal sebum.[14,21] Other researchers, like Omar in Alexandria,[13] Figueroa in south-western Ethiopia,[22] Adel-Hafez in Sohag governorate,[23] as well as Venugopal and Venugopal in Saudi Arabia,[24] have also subscribed to this age differential. The additional reason cited in their study is the poor hygiene common at this age. It is expected that the younger the age, the poorer will be the hygiene, and the more likely it is to contact infectious diseases. As children approach their teenage age, they become more concerned with their outlook and are neater. These reasons are also advanced for the observed preponderance among those aged 12 and younger in this study.

Gender-related studies on the prevalence of dermatophyte have been fragmentary, with some studies claiming that males predominate,[7,8-10,16,20,25] while in some, it is the female sex,[12,13,26] though none of these studies shows a statistically significant difference. This study found more

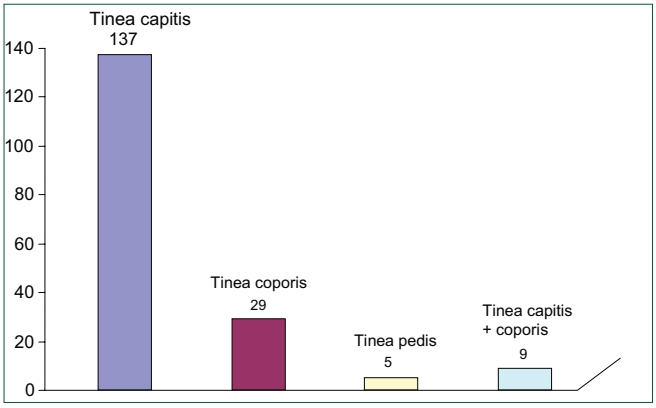

Figure 1: Clinical types of dermatophytosis lesions

females than male infected with dermatophyte and this was not statistically significant either. As dermatophytic infection relates to personal hygiene and cleanliness, girls appear to be neater than boys, as they pay more attention to their outlook, especially, as they approach teenage age. Thus, the finding was unexpected. Also, there were more boys in the schools surveyed than girls as well as more boys with clinically suspected dermatophytosis, thus this may have made the sex prevalence of the boys to be lower than that of the girls.

Tinea capitis, a condition commonest in pre-pubertal children, and often affecting boys more than girls,[7] is the commonest encountered infection in this study and accounted for 76.1% of cases, followed by Tinea coporis 29(16.1%) and then Tinea pedis 5(2.8%). Nine children (5.0%) had multiple site affectation (Tinea capitis plus Tinea coporis). This finding is consistent with most local and international studies, especially those studies that looked at other sites of the body.[8,27,28] The reason why Tinea capitis is commoner in this environment than other clinical types may not be unconnected with the hair care practices i.e., contamination from place of barbing, sharing of materials and poor personal hygiene. Multiple clinical types of dermatophytosis, of 5.0% in this study were higher than that reported in Barcelonan children.[3,15] This finding of a higher multiple site affectation, might be related to the ability of some strains of dermatophyte to affect more than one site concurrently in the same person.

Species of genus Trichophyton were responsible for majority of cases of dermatophytes isolated, a finding which concurs with other studies.[19,21,29]

The most common species of Trichophyton isolated was *T. mentagrophytes* 22 (73.3%). There were 13 males and 9 females infected with this organism, and the age group 9-12 [16/30 (53.3%)] was the most affected. *T. mentagrophytes* was also the commonest cause of Tinea capitis [19/30 (63.3)]. The fungus is said to be cosmopolitan, and is one of the most common dermatophytes infecting man and animals.[30] Infections in humans are often acquired due to contact with soil and domestic animals or others, such as cattle, horses and birds. Sequel to the findings of playing with animal pets as a significant risk factor for acquisition of fungal infection in this study, and more specifically certain types of animal pets, e.g., cats and dogs,[11] it is believed that the preponderance of *T. mentagrophytes* might have been acquired through this mode.[31] Other dermatophytes isolated are *M. audouinii* 5/30 (16.7%), and *T. verrucossum* 3/30 (10.0%). It is of note that *T. mentagrophytes* caused infection in the three clinical types identified in this study.

The finding of *T, mentagrophytes* as the commonest dermatophyte in this area is at variance with earlier reports identifying some strains as prevalent in specific parts of

the country. Microsporum audouinii was reported to be prevalent in Eastern and Western Nigeria.[10,21] *Trichophyton schoenleinii* in Northern Nigeria,[30] while the "soudanense"-like variety *Trichophyton violaceum* occurring in the middle belt.[19] Recent update from the South Eastern part of Nigeria suggests a changing epidemiology from *M. audouinii* to *Trichophyton tonsurans* in Anambra and *Trichophyton soudanense* in Delta states.[32] In the middle belt to which the community surveyed belonged, this reason can also be advanced for the observation of *T. mentagrophytes* as the commonest infecting species of dermatophytes. However, because no such study had been previously carried out in the community or in this area, the assertion of a change in etiology must be taken with caution.

Comparable results were, however, reported by Al-mosawi *et al.*, whose predominant isolate was *T. mentagrophytes* from the healthy scalps of children in two primary schools in Basra.[33] Furthermore, Ezeronye in a recent study in cross-river, found *T. mentagrophytes* as the second most common species of isolate from Tinea capitis lesion.[21] *M. audouinii* was the only microsporum species identified and it is the second commonest isolate in this study. It represented 16.7% of total isolate of dermatophyte. It was also reported to be the main cause of Tinea capitis among school children in Ile-Ife, Osun state and Awka, Anambra state.[34] *T. verrucossum* accounted for 10.0% of isolate of dermatophyte in this study. It was found only in males and causes only Tinea capitis. This finding of *T. verrucossum* causing Tinea capitis concurs with one other study.[19] Dermatophytes of the genus Epidermophyton was not isolated at all in this study.

Conclusions

The prevalence of culture confirmed dermatophytic infections in the age group 5-16year in Oke-Oyi public primary school was 5.0%. Hence dermatophytic infections are a public health problem among the school-aged children studied.

The commonest clinical variety encountered is Tinea capitis caused mainly by *T. mentagrophyte*. Other forms encountered are Tinea coporis and Tinea pedis. Multiple clinical dermatophytic infections of 5.0% are also noted in this study.

Limitation

The following are the limitations of this study: The cross-sectional nature of the study, sampling of primary school children of age group 5-16 years, asymptomatic carriers which were not evaluated in this study and absence of a Wood light that enhances isolation of infected hair and its subsequent epilation for culture on SDA culture,

Authors contributions

All of the authors read and approved the final manuscript. ASA had primary responsibility for protocol development, data collection, preliminary data analysis, and writing the manuscript. OLO participated in the development of the protocol, supervised the design and execution of the study, contributed to the final data analyses and manuscript. AKM participated in the development of the protocol, supervised the design and execution of the study, contributed to the final manuscript.

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