



Epidemiology of dermatophytes among primary school children in Calabar, Nigeria

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Abstract

Background & Aims: Children are more susceptible to dermatophytes due to different predisposing factors, such as under developed immune system and high sensitivity of their skin to infection. This study investigated the epidemiology of dermatophyte infection among primary school children in Calabar municipality, Nigeria.

Methods: Students attending two primary schools, DPS and PCNPS in Calabar Municipality, were clinically screened. Samples were collected from children with physical signs of dermatophytes on skin, scalp, and nails, and who were present on the day of sample collection. Affected areas were scraped and swabbed. Cultures were done on SDA, and Lactophenol cotton blue was used to prepare isolates for microscopy.

Results: A total of 779 children aged 4-17 years were screened. 202(25.9%) were mycologically positive by culture. The occurrence of dermatophyte infection was significantly higher in young children aged 4-6 years than in older children. Male children were more frequently infected (17.6%) than females (8.3%). Trichophyton spp. was the most prevalent etiological agent (35.6%), followed by Microsporum spp. (31.7%), and Epidemophyton spp. (19.3%). Plates with mixed colonies constituted 13.4% of the entire culture. Dermatophytes were mostly isolated from the scalp (63.9%), followed by skin (32.2%), and nails (4%). The prevalence of dermatophyte infection among the two schools' children was 32.0% and 21.9% in DPS and PCNPS, respectively.

Conclusion: Dermatophyte infection is still prevalent among primary school children. Regular screening and use of educational health awareness of dermatophyte infection are recommended.

Keywords: Fungi, Dermatophytes, School, Children, Infection

Introduction

Dermatophytes are a group of specialized fungi that affect keratinized tissues of humans such as skin, nails, and hair. The infection is known as dermatophytosis.^{14,19} This infection or

disease is common nationwide and commonly found in developing countries and tropical areas with high humidity rates, improper personal hygiene, and overpopulation. It is found in children at schools and campuses.^{6,18}

Dermatophytosis, also known as tinea or ringworm, is caused by the fungi in the dermatophyte's genera *Microsporum*, *Trichophyton*, and *Epidermophyton*.^{1,13}

Dermatophyte infection can be transmitted through various methods: direct contact with an infected person, called anthropophilic; direct contact with an infected animal, known as zoophilic; direct contact with contaminated soil, known as geophilic; and indirect contact with contaminated fomites such as brushes, head ties, or beddings.^{3,12} The level of infection may depend on the person's age and the condition of his exposed skin. Dermatophytes are more prevalent in children because of their poor personal hygiene and environmental sanitation.^{1,11}

Dermatophytes can colonize the skin and appendages by the infestation of the skin. Dermatophytosis is usually classified according to the location of the affected site: dermatophytosis of the scalp (tinea capitis); dermatophytosis of the groin (tinea cruris or "Jock Itch"); the bearded skin of the face (tinea barbae); the feet (tinea pedis or athlete's foot); the body (tinea corporis); the hands (tinea manuum); and the nails (tinea unguium or onychomycosis).^{5,10} This infection varies from mild inflammation to acute inflammatory reactions.^{8,9} Dermatophyte infections may be uncomfortable and disfiguring, especially when the disease is widespread and the victims may become self-conscious of their bodies and distressed.¹⁷ In terms of treatment options, topical and systemic drugs are commonly used and effective; the cure rate of dermatophytosis is high.^{7,16} This study aims to determine the prevalence of dermatophytes among primary school children in two primary schools located within the Calabar metropolis.

Materials and Methods

Study population

The two schools selected are the most populated government approved primary schools in the area.

The sample size was determined using Leslie Kish (1965) formula as presented below.

Sample size = $Z_{1-\alpha/2}^2 p(1-p)$ Where;

d^2

$Z_{1-\alpha/2}$ = Is standard normal variate (at 5% type 1 error ($P < 0.05$) it is 1.96 and at 1% type 1 error ($P < 0.01$) it is 2.58. As in majority of studies, P values are considered significant below 0.05; hence, 1.96 was used in formula. p = Prevalence (Expected proportion in population based on previous studies). Prevalence (20.4%) of dermatophytosis among primary school children in Oke-oyi community of Kwara state, Nigeria¹ was used. d = Absolute error or precision, was set at 5% (0.05).

Children of ages 4-17 years old were screened during the month of April-July, 2021 for dermatophytosis on the skin, nails, and epilated hair. A total of 779 pupils of the two selected primary schools scattered across Calabar Municipality Local Government Area of Cross River State were screened. Out of this, 202 pupils were found with dermatophyte infection.

Sampling method and collection

Scraping: The infected lesion area was cleaned with cotton wool soaked in methylated spirit and scraped with a sterile surgical blade. The scrapings were collected on Whatman No 1 filter paper and then poured into sterile McCartney bottles that were labeled with a code.

Swabbing: The sterile swab stick was dipped into normal saline water before swabbing the surface of the infected area or lesion. The swab stick was labeled with a code. The samples were transported to the laboratory immediately after collection for further analysis.

Culture and identification

Samples collected were inoculated into Sabouraud Dextrose Agar (SDA) plates and incubated at room temperature (i.e., 25°C.) for 14 days. Distinct fungal colonies were obtained from the primary culture plates for identification. The dermatophytes were identified using the **Standard Tease Mount method as described by Campbell**.⁴

Ethical statement

Ethical clearance for the study was obtained from the Cross River State Health Research Ethics Committee with reference number RP/

REC/2022/784. The ethical statement was made available to the different primary school, and their informed consent was also obtained verbally and in writing before the commencement of the study. Confidentiality was maintained by labeling the samples with codes rather than participant names. All methods were carried out in accordance with relevant guidelines and regulations (Declaration of Helsinki).

Results

The age group and gender of the screened population are present in Table 1. The age group of the school children was categorized into years (4-6, 7-9, 10-12, 13-15, and ≤ 17 years). DPS had a total of 127 male and 182 female while PCNPS had a total of 189 male and 281 female students. Table 2 shows the number of schoolchildren that showed signs of dermatophyte infection. A total of 99 and 103 in DPS and PCNPS respectively showed signs of dermatophyte infection. It was observed that most of the students that showed signs of infection were in the lower class (Primary 1 to 3). It was also observed that male students

showed more signs of infection than their female counterparts. As presented in the table, primary 1, 2, 3, 4, 5, and 6 had a total number of 21, 18, 20, 17, 12, and 11 infected students respectively in DPS while in PCNPS, the total number of infected students were 27, 24, 18, 17, 18 and 9 in primary 1, 2, 3, 4, 5, and 6, respectively.

Table 1. Age group and gender of the screened population

School	Age group (years)	Gender	
		Male	Female
DPS	4-6	57	83
	7-9	31	51
	10-12	23	30
	13-15	11	16
	< 17	5	2
	Total	127	182
PCNPS	4-6	125	86
	7-9	89	65
	10-12	49	26
	13-15	18	9
	< 17	0	3
	Total	189	281

Table 2. School children with culture positive of dermatophytes in the studied population.

School	Class	No. in Class	No. infected (%)	Male (%)	Female (%)
DPS	Primary 1	57	21(36.8)	14(66.7)	7(33.3)
	Primary 2	55	18(32.7)	12(66.7)	6(33.3)
	Primary 3	52	20(38.5)	15(75.0)	5(25.0)
	Primary 4	50	17(34.0)	11(64.7)	6(35.3)
	Primary 5	46	12(26.1)	9(75.0)	3(25.0)
	Primary 6	49	11(22.4)	7(63.6)	4(36.4)
	Total	309	99(32)	68(68.7)	31(31.3)
PCNPS	Primary 1	75	27(36.0)	17(63.0)	10(37.0)
	Primary 2	79	24(30.4)	15(62.5)	9(37.5)
	Primary 3	84	18(21.4)	12(66.7)	6(33.3)
	Primary 4	86	17(19.8)	12(70.6)	5(29.4)
	Primary 5	77	8(10.4)	6(75.0)	2(25.0)
	Primary 6	69	9(13.0)	7(77.8)	2(22.2)
	Total	470	103(21.9)	69(67.0)	34(33.0)

The age and gender distribution of primary school children with dermatophyte infection are presented in Table 3. A total of 99 children with

apparent dermatophytosis were seen in DPS, out of which the highest percentage 59 (59.6%) was recorded in the age group 4-6 years. In PCNPS,



a total of 103 children presented with apparent dermatophytosis, and the highest percentage of occurrence of 65.0% was also recorded in the age group 4-6 years. The male students had the highest percentage of apparent dermatophytosis in the two schools as presented in the table. The group with the lowest apparent dermatophytosis was the age group ≤ 17 in the two schools with 3% and 1% in DPS and PCNPS, respectively.

Table 3. Age and gender distribution of primary school children in dermatophyte infection

School	Age	Frequency	Percentage (%)
DPS	4-6	59	59.6
	7-9	29	29.3
	13-15	8	8.1
	16-17	3	3.0
	Gender		
	M	68	68.7
F	31	31.3	
PCNPS	4-6	67	65.0
	7-9	24	23.3
	13-15	11	10.7
	16-17	1	1.0
	Gender		
	M	69	67.0
F	34	33.0	

Table 4 shows the dermatophytes agents isolated from the different sites of infection in this study. Out of the 202 samples collected from the two schools, after the incubation period, some plates presented with mixed colonies of dermatophytes which were (13.4%), *Epidermaphyton* spp. (19.3%), *Microsporum* spp. (13.7%), and *Trichophyton* spp. (35.6%). *Trichophyton* spp had the highest frequency and percentage of occurrence as presented in the table. The distribution of dermatophytes according to the site of infection is presented in Table 5. The most common site of dermatophyte infection was the scalp 129(63.9%), while the nail was the least 8(4%) as presented in the table.

Table 4. Dermatophytic agents isolated from the different sites of infection

Dermatophytic agent	Frequency	Percentage (%)
Mixed	27	13.4
<i>Epidermaphyton</i> spp.	39	19.3
<i>Microsporum</i> spp.	64	31.7
<i>Trichophyton</i> spp.	72	35.6
Total	202	100

Table 5. Distribution of dermatophytes according to the site of infection

Species	Frequency of occurrence	Scalp (%)	Skin (%)	Finger Nail (%)	Total (%)
Mixed	27	18(14.0)	9(13.8)	-	27(13.4)
<i>Epidermaphyton</i> spp.	39	23(17.8)	8(12.3)	8(100)	39(19.3)
<i>Microsporum</i> spp.	64	37(28.7)	27(41.5)	-	64(31.7)
<i>Trichophyton</i> spp.	72	51(39.5)	21(32.3)	-	72(35.6)
Total	202	129(63.9)	65(32.2)	8(4.0)	202(100)

Table 6 shows the observed and confirmed cases of dermatophyte infection in the studied population. The tables present the school, total population of the school, gender, population of different genders, number of infected children, and percentage of infected children. As presented in the table, a total of 779 school children were screened for signs of dermatophyte infection, out of which 202 children were present with signs of dermatophyte infection with 99 obtained from DPS and 103 from PCNPS. The number of non-infected children was 577. In DPS, the number of male children infected was 68 and female 31; included in PCNPS, the number was 69 males and 34 females as presented in the table. Table 7 shows the relationship between gender and dermatophyte infection in the studied population. The number of infected and not infected students (Male and Female) from the schools were subjected to chi-square test with significance level set at $p < 0.05$. The result revealed that there is a significant relationship between gender and dermatophyte infections with p value of $< .00001$ in both schools.

Table 6. Observed and confirmed cases of dermatophytes infection in the studied population

School	Total population	Gender	Population	Infected	Percent infected	School Prevalence (%)
DPS	309	Male	127	68	54	32
		Female	182	31	17	
PCNPS	470	Male	189	69	37	22
		Female	281	34	12	
Total	779		779	202	26	

Table 7. Relationship between gender and dermatophytes infection in the studied population

School	Gender	Not infected	infected	Chi-square value	p-value
DPS	Male	59	68	45.79	< .00001
	Female	153	31		
PCNPS	Male	120	69	39.34	< .00001
	Female	247	34		

Note. Significant level at $p < 0.05$

DPS had the highest prevalence of dermatophyte infection (32.0%) while PCNPS had 21.9% of dermatophyte infection.

Discussion

Dermatophytes are fungi that require keratin for growth. They can cause infections of the epidermis and areas rich in keratin such as hair, skin, and nails which are known as Tinea.^{2,3} Dermatophyte infection is very common worldwide. It is more frequent in developing countries due to risk factors of crowding, low socio-economic status, and improper personal hygiene. Risk factors leading to epidemic potential are most notably in overcrowded places like schools and refugee camps.¹⁷ It is also common in children due to a lack of saturated acids in sebaceous gland secretion during childhood.⁶

In this study, primary school children were examined for the prevalence of dermatophyte infection. 779 school children from two primary schools located within the Calabar metropolis were examined. According to the findings obtained in this study 99(32.0%) and 103(21.9%) students from DPS and PCNPS, respectively, were shown to have dermatophyte infection in samples collected from them. More

cases of dermatophyte infection were found in males 137(17.6%) than in females 65(8.3%). This may be because females are often more conscious of their hygiene than males. This corresponds to a similar study conducted in Egypt that showed that male primary school children had dermatophyte infection than their female counterparts.³

The result of this study also revealed that dermatophyte infections were more common in the 4-6 age group than in other age groups. This might be a result of unhygienic practice or play patterns observed in children in that age group or attributed to a lack of saturated fatty acids in children's sebaceous gland secretions (considered as natural protective mechanisms) that first appear at puberty and persisted into adulthood.¹⁰ The culture of samples obtained in this study was positive as all the samples collected showed growth of either single species of fungi or mixed. After proper morphological characterization and microscopy of the isolates, the following were identified: *Epidermophyton spp.* 39 (19.3%), *Microsporum spp.* 64 (31.7%), and *Trichophyton spp.* 72 (35.6%). This is in agreement with an Egyptian study which also observed the predominance of *Microsporum spp.* in school children whereas Kamal et al.⁹

reported *Trichophyton spp.* as the most prevalent in primary school children.³ The present study revealed that the scalps of the school children were mostly infected with dermatophyte. The distribution of the dermatophytes according to the site of infections was 127(63.9%) scalp, 65(32.2%) skin, and 8(4%) nails.

According to this finding, the prevalence of dermatophyte infection in the two primary schools was 32.0% and 21.9% in DPS and PCNPS, respectively. This prevalence rate observed in this study may be evidence that dermatophytosis is common among the studied population. Also, this study revealed a significant relationship between the gender and dermatophyte infection in the studied population. There was no case where girls refused or were reluctant to show diseased skin to the examiner. This finding indicated an epidemiological change and requires more in-depth studies.

Conclusion

The prevalence of dermatophyte infection among primary school children in Calabar municipality is relatively high. Factors contributing to the high frequency and chronic occurrences in the schools may include poverty, poor living environment, and low level of material education. Preventable measures in the form of screening by the school nurse or assigned school health team as well as using educational programs to promote health knowledge among primary school children and teachers could help in controlling any preventable risk factor such as pet contact, class crowding, as well as personal hygiene.

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