

**Original Article****Open Access****Prevalence of dermatophytoses among school children in a rural setting in Biase Local Government Area, Cross River State, Nigeria***¹Ukam, I. I., ¹Ukeye, A. A., ¹Akpanke, J., and ²Abia-Bassey, L.¹Department of Microbiology, Faculty of Biological Sciences, University of Calabar, PMB 1115, Calabar, Nigeria²Department of Bacteriology, Virology and Mycology, Faculty of Medical Laboratory Science, University of Calabar, PMB 1115, Calabar, Nigeria*Correspondence to: ukamjohn8@gmail.com; igborukam@unical.edu.ng; Tel: +2349074254995/+2348032327041; ORCID: [0009-0005-7645-5508](https://orcid.org/0009-0005-7645-5508)**Abstract:**

Background: Infections of the skin, nails and hair cause by dermatophytes species are common in both developing and developed countries, posing serious health challenge especially, among children of primary school age. This study is aimed at determining the prevalence and distribution of dermatophyte species among infected school children in Biase, Cross River State, Nigeria.

Methodology: This was a descriptive cross-sectional study of children with clinical features of dermatophytosis from 9 of the 55 government-approved primary schools in Biase local government area (LGA) of Cross Rives State, selected by stratified random sampling technique. All children in the 9 selected schools were first examined for dermatophytic lesions. Samples of the lesions were then collected and examined by direct microscopy, and also cultured on Dermatophyte Test Medium (DTM) and incubated aerobically at 26-29°C. Pure cultures of the isolates were further examined by macroscopy, microscopy and biochemical test reactions to phenotypically confirm the fungi identity.

Results: A total of 5946 primary school children were screened for dermatophytosis, 206 (3.5%) had clinically suggestive lesions, and 180 (3.0%) were mycologically confirmed to be dermatophytoses. The highest prevalence of infection was among children from the school in Obum/Etana (7.6%, n=17/223) while the least prevalence was Akpet central primary school (1.5%, n=24/1670) ($\chi^2=43.94$, $p<0.0001$). The prevalence of dermatophytoses was higher among school children in age group 8-10 years (3.3%, n=103/3114) and ≥ 11 years (3.3%, n=36/1096) than age group 5-7 years (2.4%, n=41/1736). The prevalence of infection among male school children (3.3%, n=100/2993) was slightly higher than female school children (2.7%, n=80/2953). A total of 9 species of dermatophytes were identified; *Trichophyton mentagrophytes*, *Trichophyton quinckeanum*, *Trichophyton violaceum*, *Trichophyton soudanense*, *Trichophyton tonsurans*, *Trichophyton schoenleinii*, *Microsporum canis*, *Microsporum gypseum* and *Microsporum audouinii*, with *T. soudanense* (59.1%, n=110) being the most frequently isolated while *T. tonsurans* (1.1%, n=2) was the least frequently isolated dermatophyte.

Conclusion: The prevalence of dermatophytoses among school children in Biase LGA of Cross River State, Nigeria is 3.0%, with high prevalence of infection among children in the age groups 8-10 and >11 years of age, and among parents/guardians that are low-income earners. Improved living condition of the people and standard hygiene practices may ameliorate the spread of dermatophytoses in the study setting.

Keywords: Dermatophytoses, Prevalence, School children; Rural setting.

Received May 1, 2026; Revised Jul 22, 2026; Accepted Jul 23, 2026

Copyright 2026 AJCEM Open Access. This article is licensed under the terms of the Creative Commons Attribution 4.0 International License [rel="license" href="http://creativecommons.org/licenses/by/4.0/">](http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution and reproduction in any medium, provided credit is given to the original author(s) and the source. Editor-in-Chief: Prof. S. S. Taiwo

Prévalence des dermatophytoses chez les écoliers en milieu rural dans la zone de gouvernement local de Biase, État de Cross River, Nigéria*¹Ukam, I. I., ¹Ukeye, A. A., ¹Akpanke, J., et ²Abia-Bassey, L.¹Département de Microbiologie, Faculté des Sciences Biologiques, Université de Calabar, PMB 1115 Calabar, Nigéria²Département de Bactériologie, Virologie et Mycologie, Faculté des Sciences de Laboratoire Médical, Université de Calabar, PMB 1115 Calabar, Nigéria*Correspondance à: ukamjohn8@gmail.com; igborukam@unical.edu.ng; Tél. : +2349074254995/+2348032327041 ORCID: [0009-0005-7645-5508](https://orcid.org/0009-0005-7645-5508)

Résumé:

Contexte: Les infections cutanées, unguéales et capillaires causées par des dermatophytes sont fréquentes dans les pays en développement comme dans les pays développés, et constituent un problème de santé publique majeur, notamment chez les enfants d'âge scolaire primaire. Cette étude vise à déterminer la prévalence et la répartition des espèces de dermatophytes chez les écoliers infectés de Biase, dans l'État de Cross River, au Nigéria.

Méthodologie: Il s'agit d'une étude descriptive transversale menée auprès d'enfants présentant des signes cliniques de dermatophytose, scolarisés dans 9 des 55 écoles primaires publiques de la zone de gouvernement local (LGA) de Biase, dans l'État de Cross River. Les écoles ont été sélectionnées par échantillonnage aléatoire stratifié. Tous les enfants des 9 écoles sélectionnées ont d'abord été examinés afin de rechercher des lésions dermatophytiques. Des prélèvements de ces lésions ont ensuite été effectués et examinés par microscopie directe, puis mis en culture sur milieu de test pour dermatophytes (DTM) et incubés en aérobiose à 26-29 °C. Les cultures pures des isolats ont ensuite été examinées par macroscopie, microscopie et tests biochimiques afin de confirmer phénotypiquement l'identité des champignons.

Résultats: Sur un total de 5946 élèves du primaire dépistés pour une dermatophytose, 206 (3,5%) présentaient des lésions cliniquement évocatrices et 180 (3,0%) ont reçu un diagnostic mycologique de dermatophytose. La prévalence la plus élevée d'infection a été observée chez les enfants de l'école d'Obum/Etana (7,6%, n=17/223), tandis que la plus faible a été enregistrée à l'école primaire centrale d'Akpet (1,5%, n=24/1670) ($\chi^2=43,94$, $p<0,0001$). La prévalence des dermatophytoses était plus élevée chez les écoliers âgés de 8 à 10 ans (3,3%, n=103/3114) et de 11 ans et plus (3,3%, n=36/1096) que chez ceux âgés de 5 à 7 ans (2,4%, n=41/1736). La prévalence de l'infection chez les garçons (3,3%, n=100/2993) était légèrement supérieure à celle observée chez les filles (2,7%, n=80/2953). Au total, 9 espèces de dermatophytes ont été identifiées. Les dermatophytes suivants ont été identifiés: *Trichophyton mentagrophytes*, *Trichophyton quinckeanum*, *Trichophyton violaceum*, *Trichophyton soudanense*, *Trichophyton tonsurans*, *Trichophyton schoenleinii*, *Microsporum canis*, *Microsporum gypseum* et *Microsporum audouinii*. *T. soudanense* (59,1%, n=110) était l'espèce la plus fréquemment isolée, tandis que *T. tonsurans* (1,1%, n=2) était la moins fréquemment isolée.

Conclusion: La prévalence des dermatophytoses chez les écoliers de la zone de gouvernement local de Biase, dans l'État de Cross River (Nigeria), est de 3,0%. L'infection est particulièrement fréquente chez les enfants de 8 à 10 ans et de plus de 11 ans, ainsi que chez les parents/tuteurs à faibles revenus. L'amélioration des conditions de vie et des pratiques d'hygiène courantes pourrait contribuer à freiner la propagation des dermatophytoses dans la zone étudiée.

Mots-clés: Dermatophytoses, Prévalence, Écoliers Cadre rural.

Introduction

Dermatophytoses are superficial fungal infections caused by dermatophytes affecting the skin, hair and/or nails (1), and are generally termed tinea. Dermatophytes are filamentous fungi that invade and feed on keratinized tissue like skin, hair and nails, causing an infection (2). Dermatophytes are divided into three genera, of which *Trichophyton* (usually affecting skin, hair and nails), *Epidermophyton* (usually affecting skin) and *Microsporum* (usually affecting skin and hair) cause infection in humans. *Trichophyton rubrum* is the most common isolate observed in infections of the feet, body and nails.

Depending on the source of transmission, they are classified as anthropophilic, zoophilic and geophilic. They are clinically classified by infection site as tinea capitis (head), tinea faciei (face), tinea barbae (beard), tinea corporis (body), tinea manuum (hand), tinea cruris (groin), tinea pedis (foot) and tinea unguium (nails). Other clinical variants include tinea imbricata, pseudoimbricata, and Majocchi granuloma.

Globally, dermatophytoses affect approximately 20–25% of the population, with tinea capitis being one of the most common forms among school-aged children (3). The infection is

especially prevalent in tropical and subtropical regions where warm temperatures, high humidity, and overcrowded living conditions promote the growth and transmission of dermatophytes (4-5). These fungi have worldwide distribution, and at present, there are 40 recognized species in the dermatophyte genera (6). Of these species about 25 species belonging to the genera *Epidermophyton*, *Microsporum* and *Trichophyton* are presently known to infect man (2).

Children of primary school age are usually between ages of 3 and 14 years who show high sensitivity to various pathogens including dermatophyte infections due to their close contact with the soil, and relatively low immune status compared to adults. Their inability to keep themselves from dirt due to their frequent contact with soil and infected pets animals makes this age group even more vulnerable. This study is therefore aimed at determining the prevalence of the infection and distributions of dermatophytes among rural school children in Biase Local Government Area (LGA), Cross River State, Nigeria.

Materials and method:

Study area:

Biase Local Government Area (LGA) is located at 96 km south of Calabar, the capital

city of Cross River State, Nigeria. The LGA is bounded in the North by Yakurr and Abi LGA and in the South and Southeast by Akamkpa and Odupk- pani LGAs respectively. On the West, it is bound by Abia State. Politically, the LGA falls within Southern senatorial district of the State and has a total land mass of 1,285.56km³ with an area of 1.310km³.

Biase also has a population of 169,183 (2006, census), with about half of the population (84, 598) in the age bracket of 0-19 years, at the time. Located within the tropical rain-forest zone, the wet season of the LGA falls within the months of April and November of the year. It is predominantly a rural area and the

major occupation of the people is subsistence agriculture with few farmers branching out into palm oil business and plantation farming.

Study design:

This was a community-based descriptive cross-sectional study, which allows for the determination of the prevalence of tinea capitis (scalp) and tinea corporis (skin) at a specific point in time among primary school children in the rural setting. This design also allowed for assessment of related risk factors associated with prevalence of dermatophytes infection among the study participants.

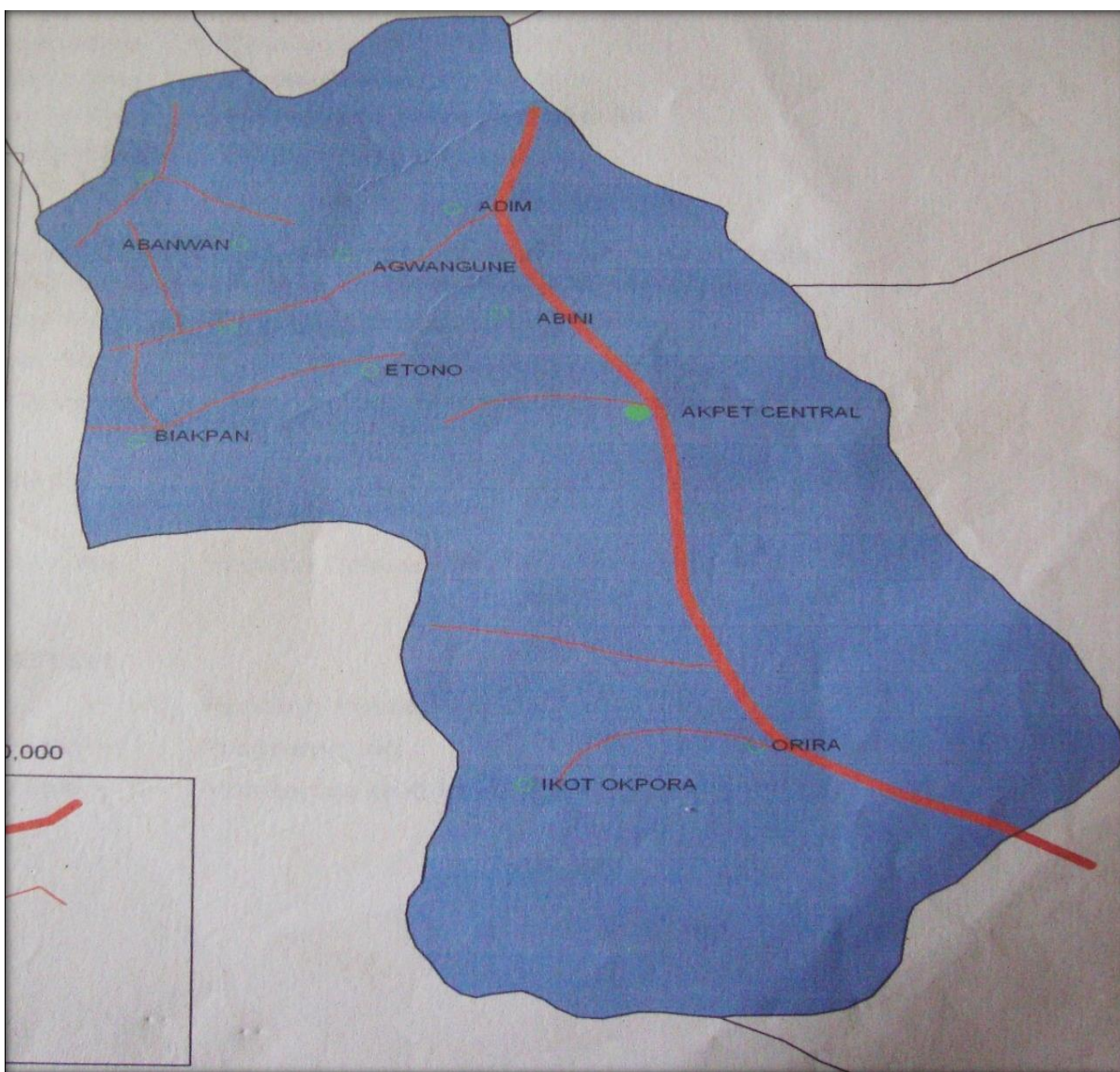


Fig 1: Map of Biase Local Government Area of Cross River State, Nigeria showing the geo-political wards selected for the study

Study population, sample size, and participants selection:

The sample size of 206 children with clinically suggestive dermatophytic lesions was determined using the formula described by Araoye (7). A total of 9 out of 55 government-approved primary schools in Biase LGA were selected for the study by stratified random sampling technique. All the children in the 9 selected schools were examined for dermatophytoses.

Lesions in children suggestive of dermatophytoses of the body include active, raised, scaly skin lesion with border that spread outward with central clearing, with accompanying itching/pruritus. Lesions in children with scalp infections include non-inflammatory patchy hair loss, scaling, dull brittle hair, 'black dots' where hair breaks; inflammatory purulent swelling with sinus tracts and hair loss; and favus. Children on antifungal or local medication two weeks before the commencement of the study, were excluded. The study was conducted during the rainy season (April to July 2024).

Ethical approval:

The field work commenced only after due approval from the Ethical Committee on Research of the Cross River State Ministry of Health (UCTH NHREC NO: NHREC/07/10/2012). Verbal consents of parents were obtained following assembly announcement by head teachers to the pupils, prior to the commencement of the study in all the 9 communities.

Data collection using a structured questionnaire:

A structured questionnaire was used to collect information on socio-demographic characteristics from the participants. The information includes sharing of personal belonging such as towels and combs, number of children per household, size of residential building, pet animals and access to basic social amenities.

We classified the socio-economic status of participants' parents as 'low income', 'average income' and 'above average income' earners based on sales output after a 4-day market cycle for petty farmers and traders, provision store owners, and businessmen, while others were assessed based on monthly salaries of civil and public servants.

Physical examination of participants for dermatophytic lesions:

Each child had a general examination conducted (head to foot) in good light to by trained nurses recruited from local health facility of selected communities, to identify children with suspected dermatophytic lesions who were then recruited based on the selection criteria for further examination.

Collection of specimens:

Each infected site was first cleaned with a sterile cotton wool soaked in 70% alcohol before collection of specimens. Skin and hair specimens were collected into pre-sterilized paper envelopes. Scales from skin lesions were collected by scraping outward with a blunt scalpel-blade from the edges of the lesion where most viable fungus was likely to be found. Specimen from scalp included hair stubs, the content of plugged follicles and skin scales. Specimens were appropriately labelled and transported to the microbiology laboratory of the University of Calabar Teaching Hospital, Calabar, for microbiological analysis.

Direct microscopic examination of specimens:

One to two fragments of hair or a portion of skin scrapings was placed in a drop of 10% or 20% potassium hydroxide (KOH) on a clean slide and a clean cover slip placed over it. The preparation was gently warmed by passing it over a flame several times. Dark pigmented hair required more time to allow digestion and clearing of the keratin for discerning it. For this reason, dark-haired specimens were allowed to stand for over 10 minutes. Microscopic examinations of each slide was done under low power (10x) and high power (40x) magnification to detect the presence of fungal elements as well as observe the type of hair infection exhibited.

Culture of specimens:

A portion of hair stubs or skin scrapings were inoculated on slopes of dermatophyte test medium (DTM, NEOGEN corp. USA). All slopes were incubated at room temperature (26-29°C) and examined periodically every other day for growth. Each slope was allowed to stand for at least 21 days before discarded as negative. Contaminated cultures were sub-cultured into fresh media to separate dermatophytes from contaminants. All sub-cultures were incubated at room temperature for at least 3 weeks before discarding as negative.

Morphological and microscopic identification of dermatophytes:

Gross morphological characteristics and detailed microscopic features of each dermatophyte isolate were observed. The colonial characteristics noted included colour (surface and reverse), texture and topography. For microscopic features, a fragment of each colony was tease out on a clean slide with the aid of sterile pins on a drop of lactophenol cotton blue after which clean cover slip was placed on it. Each preparation was slightly warmed over a flame. The slide thus prepared was examined under the compound light microscope using both low

(10x) and high power (40x) magnification.

The characteristic features of the hyphae, large multicellular macroconidia and smaller unicellular microconidia of each isolate was observed and noted. Identification was based on the criteria enumerated by Rebell and Taplin (8), and Rippon (9).

Slide culture technique:

Slide culture using Potato Dextrose Agar (PDA, BBL) was set up for fungi that did not sporulate to facilitate their identification as described in Haley and Callaway (10).

Pure culture of dermatophytes and biochemical identification tests:

Pure cultures of every isolate were prepared before biochemical tests were performed. This was done by sub-culturing individual isolate onto fresh Sabouraud dextrose agar (SDA, BBL) without antibiotics and incubated at room temperature (26-29°C) until pigment developed in front and/or back of colony or granular areas are observed. Subcultures were held for 10-14 days at which time lactophenol cotton blue preparations of fungal fragments were made and examined.

Urease test was used to further identify and differentiate between *Trichophyton mentagrophytes* and *Trichophyton rubrum* isolates. A slant of Christensen's urea agar was inoculated

with a fragment of *T. mentagrophytes* colony and incubated at room temperature for 7 days. Medium turns bright pink which rapidly hydrolysed urea while the colour remained the same for suspected *T. rubrum* isolates.

Statistical analysis:

Data generated in the study were analyzed using SPSS version 20.0 (IBM Corporation, Armonk, New York, USA) for test of significance. Data were presented in tables, frequency and percentage. The Chi (χ^2) square test was used to compare the prevalence of dermatophytoses between the different demographic characteristics, socio-economic status and school locations. P-value ≤ 0.05 was considered statistically significant.

Results:

A total number of 5946 primary school children (2993 males and 2953 females) from 9 localities in Biase LGA of Cross River State, Nigeria, were physically screened for dermatophytoses. Of these number, 206 (3.5%) children had clinically suggestive dermatophytic lesions, and 180 were mycologically-confirmed to be dermatophytoses by microscopy and/or culture, given a dermatophytoses prevalence of 3.0% in the study population (Table 1).

Table 1: Prevalence of suspected and confirmed dermatophytoses among the school children with respect to demographic characteristics in Biase LGA, Cross River State, Nigeria

Characteristics	No screened	No with clinical lesion	No with confirmed lesion*	χ^2	p value
Age group (years)					
5-7	1736	51 (2.9)	41 (2.4)	3.700	0.1572
8-10	3113	118 (3.8)	103 (3.3)		
≥ 11	1096	37 (3.4)	36 (3.3)		
Sex					
Male	2993	112 (4.7)	100 (3.3)	1.813	0.1781
Female	2953	94 (2.2)	80 (2.7)		
Total	5946	206 (3.5)	180 (3.0)		

*Confirmed by positive microscopy and/or culture; χ^2 = Chi square

Table 2: Prevalence of dermatophytes infection among primary school children in Biase LGA Cross River State, Calabar, Nigeria

School location	No screened	No with clinical lesion	No with confirmed lesion*	Prevalence (%)
Ipene	300	16	13	4.3
Ibini	475	25	22	4.6
Obum/Etana	223	20	17	7.6 ⁺
Agwagune	752	29	26	3.6
Urugbam	340	19	17	5.0
Ikot okpora	673	20	18	2.7
Abanwan	392	19	16	4.2
Biakpan	1121	30	26	2.3
Akpet central	1670	28	25	1.5 ⁺⁺
Total	5946	206	180	3.0

*Confirmed by positive microscopy and/or culture; $\chi^2=43.94$, $p<0.0001$; ⁺=highest prevalence; ⁺⁺=lowest prevalence

The prevalence was higher among the male school children (3.3%, $n=100/2993$) than the female school children (2.7%, $n=80/2953$), but the difference was not statistically significant ($\chi^2=1.813$, $p=0.1781$). The prevalence was higher among school children in the age group 8-10 years (3.3%, $n=103/3114$) and age group ≥ 11 yrs (3.3%, $n=36/1096$), compared to age group 5-7 years (2.4%, $n=41/1736$), but the difference was also not statistically significant ($\chi^2=3.700$, $p<0.1572$) (Table 1). The prevalence was highest for children in Obum/Etana locality (7.6%, $n=17/223$) and lowest for child-

ren in Akpet central (1.5%, $n=25/1670$) ($\chi^2=43.94$, $p<0.0001$) (Table 2).

The distribution of clinical types of dermatophytoses by age of the children, presented in Table 3 shows that school children age group 5-7 years had significantly higher frequency of tinea capitis (81.8%, $n=36/44$) and lower frequency of tinea corporis (18.2%, $n=8/44$), compared to children in age group 8-10 years (57.4%, $n=61/106$ vs 42.5%, $n=45/106$) and age group ≥ 11 years (60.0%, $n=18/30$ vs 30.0%, $n=12/30$) ($\chi^2=8.175$, $p<0.0168$).

Table 3: Clinical types of dermatophytoses with respect to age and gender of children in Biase LGA, Cross River State, Nigeria

Characteristics	Tinea capitis (%)	Tinea corporis (%)	Total	χ^2	p value
Age group (years)					
5-7	36 (81.8)	8 (18.2)	44	8.175	0.0168*
8-10	61 (57.4)	45 (42.5)	106		
≥11	18 (60.0)	12 (40.0)	30		
Sex					
Male	72	28 (28.0)	100	2.220	0.136
Female	43	37 (46.2)	80		
Total	115 (63.9)	65 (36.1)	180		

χ^2 =Chi square test; *=statistically significant

Table 4: Distribution of the dermatophyte isolates according to the sites of infection in school children from Biase LGA, Cross River State, Nigeria

Isolates	Tinea capitis (%)	Tinea corporis (%)	Total (%)
<i>Trichophyton mentagrophytes</i> (Z)	6 (5.0)	20 (30.8)	26 (14.0)
<i>Trichophyton quinckeanum</i> (Z)	0	6 (9.2)	6 (3.2)
<i>Trichophyton violaceum</i> (A)	7 (5.8)	8 (12.3)	15 (8.1)
<i>Trichophyton soudanense</i> (A)	89 (73.6)	20 (30.8)	110 (59.1)
<i>Trichophyton tonsurans</i> (A)	2 (1.7)	0	2 (1.1)
<i>Trichophyton schoenleinii</i> (A)	8 (6.6)	4 (6.2)	12 (6.5)
Sub-total	112 (65.9)	58 (34.1)	170 (91.4)
<i>Microsporum canis</i> (Z)	0	3 (4.6)	3 (1.6)
<i>Microsporum gypseum</i> (G)	1 (0.8)	4 (6.2)	5 (2.7)
<i>Microsporum audouinii</i> (A)	8 (6.6)	0	8 (4.3)
Sub-total	9 (7.4)	7 (10.8)	16 (8.6)
Total	*121 (65.0)	65 (35.0)	*186 (100.0)

*=Additional 6 isolates were identified from mixed infections; A = Anthropophiles; G=Geophiles; Z=Zoophiles

The distribution of dermatophytes species according to clinical sites of infection presented in Table 4 showed that 65.0% (n=121/186) of dermatophyte species were isolated as causal agent of tinea capitis compared to 35.0% (n=65/186) for tinea corporis. *T. soudanense* was the principal agent responsible for 73.6% (n=89/121) of tinea capitis, followed by *M. audouinii* (6.6%, n=8/121), *T. schoenleinii* (6.6%, n=8/121), *T. violaceum* (5.8%, n=7/121), *T. mentagrophytes* (5.0%, n=6/121), *T. tonsurans* (1.7%, n=2/121) and *M. gypseum* (0.8%, n=1/121). Similarly, *T. mentagrophytes* (30.8%, n=20/65) and *T. soudanense* (30.8%, n=20/65) were the major etiologic agents of tinea corporis, followed by *T. violaceum* (12.3%, n=8/65), *T. quinckeanum* (9.2%, n=6/65), *T. schoenleinii* and *M. gypseum* (6.2%, n=4/65) and *M. canis* (4.6%, n=3/65).

Out of the total 9 dermatophyte species isolated, *T. soudanense* was the most frequent agent (59.1%, n=110/186) identified, followed by *T. mentagrophytes* (14.0%, n=26/186) while *T. tonsurans* was the least frequent species isolated (1.1%, n=2/186). Generally, 91.4% (n=170/186) of the dermatophyte isolates be-

longed to the *Trichophyton* genera while only 8.6% (n=16/186) belonged to the *Microsporum* genera in the study. Of the 9 dermatophyte species isolated, 5 were anthropophilic, 3 were zoophilic and 1 was geophilic.

Table 5 shows the socioeconomic status of parents in relations to the infected school children based on monthly income per capital. The overall prevalence of dermatophytes infection was higher among children whose parents /guardians were low-income earners (73.3%, n=132/180) than the average income earners (26.7%, n=48/180), and this trend occurred across the 9 localities, while none of the parents/guardians of the school children were above average income earners.

Fig 2 is the picture of a flat colony of *T. mentagrophytes* with fine saw teeth isolated from skin of infected children. Fig 3 is a picture of a small white, fluffy bottomed-smooth walled, blunt ended macroconidia up to 6 cells on Lactophenol Cotton Blue (LCB) stain. Fig 4 is a picture of diffuse alopecia with pronounced scaliness caused by *T. mentagrophytes*. Fig 5 is a picture of erythematous lesions showing central clearing caused by *M. canis*.

Table 5: Socio-economic status of parent/guardian of school children with dermatophytoses in the locality based on monthly earning per household

School location	No with confirmed lesion ⁺	Actual earnings per month (in USD) for affected household		
		Low income*	Average income**	Above average income***
Ipene	13	10 (76.9)	3 (23.1)	0
Ibini	22	17 (77.3)	5 (22.7)	0
Obum/Etana	17	13 (76.5)	4 (23.5)	0
Agwagune	26	20 (76.9)	6 (23.1)	0
Urugbam	17	11 (64.7)	6 (35.3)	0
Ikot okpora	18	12 (66.7)	6 (33.3)	0
Abanwan	16	10 (62.5)	6 (37.5)	0
Biakpan	26	21 (80.8)	5 (19.2)	0
Akpet central	25	18 (72.0)	7 (28.0)	0
Total	180	132 (73.3)	48 (26.7)	0

⁺=Confirmed by positive microscopy and/or culture; One US dollar (1\$) = ₦1,424.14 (rate as at March 2024); * = Low-income earners: ₦30,000 - ₦100,000 per month; ** = Average income earners: ₦100,000 - ₦250,000 per month; *** = Above average income earners: ≥ ₦250,000 per month



Fig 2: Flat colony of *Trichophyton mentagrophytes* with fine saw teeth isolated from skin of infected children

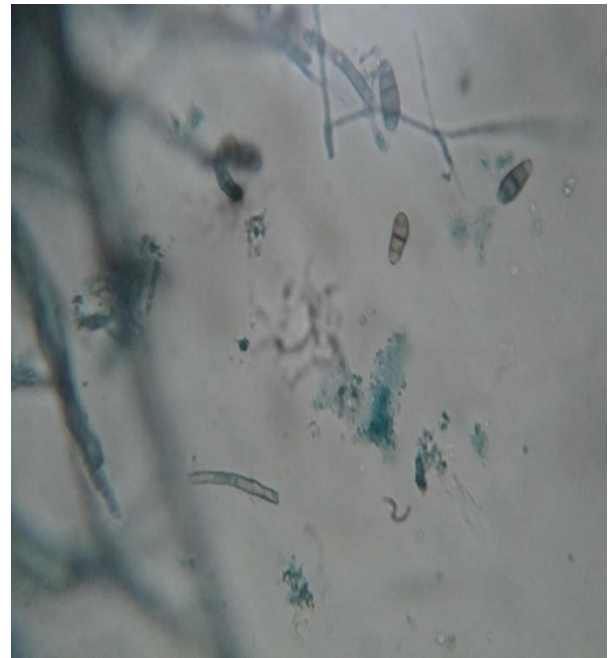


Fig: 3 shows a small white, fluffy bottomed-smooth walled, blunt ended macroconidia up to 6 cells on lactophenol cotton blue (480x). Snapshot, taken using a digital camera (Sharp product, USA) via the binoculars



Fig 4: Diffused alopecia with pronounced scaliness caused by *Trichophyton mentagrophytes*



Fig 5: Erythematous lesions showing central clearing caused by *Microsporum canis*.

Discussion:

Infections of the skin, nails and scalp cause by dermatophytes species are common in developing and developed countries alike. As reported by Rodriguez-Cerdeira et al., (11), the frequency of the infection ranges from 0.4% to 87.7% in Africa, 0.2% to 74.0% in America, 0.04% to 78.6% in Europe, and 0.01% to 91.2% in Asia. However, the species involved and the resulting clinical entities vary both geographically and with time. This study reports the prevalence of dermatophyte infection of 3.0% in a community-based study of school children in a local government area of Cross

River State, Nigeria, with the highest prevalence of 7.6% in a school at Obum/Etana and lowest prevalence of 1.5% in a school at Akpet central. The prevalence in this study is lower than the study by Anosike et al., (12) in Northern Ebonyi State who reported a 21.1% prevalence of the infection among primary school pupils and by Ndako et al., (13) in Nasarawa LGA of Kano State, who also reported higher prevalence of 58.2% among children in the same age group.

The most frequent clinical type of dermatophyte infection among the school children was tinea capitis, which accounted for 63.9% and was observed to be more frequent in children aged 8-10 years and ≥ 11 years old. This agrees with the studies of Ajao and Akintunde (14), and Egere and Gugnani (15) conducted in the 1980s, which reported that tinea capitis was most frequent among children aged 5 to 10 years. Although the prevalence of dermatophytoses was higher among male (3.3%) than female (2.7%) children in our study, there was no significant association of the infection with gender ($p=0.1781$).

Of the 9 dermatophyte species isolated, 5 were anthropophilic, 3 was zoophilic and 1 geophilic. The slightly higher frequency of anthropophilic species is attributed to such factors as sharing of personal items like combs, towels, pillows, hairbrushes, unsterilized clippers from barbers' shop and body contacts, which facilitates person-to-person transmission. Furthermore, more, majority of the dermatophytes belong to the *Trichophyton* genera (91.4%) while *Microsporum* genera only constituted 8.6%. Although, no member of the genus *Epidermophyton* was identified in the study, species belonging to this genus have been recovered from lesions of tinea corporis and tinea pedis from studies conducted in various part of Nigeria, including Enugu, Kano, Abakaliki and Lagos state (16-17).

Trichophyton soudanense was the predominant etiologic agent of tinea capitis constituting 73.6%, ($n=89$) of the total isolates causing scalp infection, confirming an earlier study by Ekanem and Gugnani (18) which identified *T. soudanense* both as the most prevalent of all dermatophyte isolates (54.7%) in the old Cross River State and the principal etiologic agent of tinea capitis. *Microsporum audouinii* accounted for only 6.8% of the dermatophytes isolates responsible for the infection of scalp, with all occurring among the male school children. Further, low prevalence of tinea corporis in the riverine area of Agwagune caused by *M. canis* (4.6%, $n=3/65$) was recorded in this study. This may be linked to frequent association of children with infected pet animals such as dogs and cats.

A previous study by Ndako et al., (13) in Kano, Northern Nigeria reported 15.4% prevalence of *M. canis* while the same organism was reported as the most frequently isolated agent of tinea capitis in most of Central and Southern Europe, Puerto-Rico, and Saudi Arabia (19-22), affirming the impact of geographical location on the epidemiology of the infection. *Microsporum gypseum* on the other hand, was the only geophilic species encountered in this study and represented 2.7% of dermatophytes isolates identified. The 5 cases involving this specie occurred among school children in St. Martin's primary school Ibini and community primary school Obum/Etana probably due to their constant and direct interaction with soil. These two localities were the most underdeveloped of all the rural settings investigated compared to Biakpan and Akpet central that had features of an emerging sub-urban area, which may explain why the latter had lower prevalence of infection in the study.

Six cases of mixed infections were recorded in this study, representing 3.2% of dermatophytes isolates, out of which 5 cases were mixed infection involving *T. soudanense* and *T. violaceum*; *T. soudanense* and *M. audouinii*, and *T. violaceum* and *T. schoenleinii*. Majority of the population affected by this disease came from household with low-income earnings, linking poverty and lack of basic social amenities to the burden of the infection in rural settings.

The major limitation in this study is the descriptive cross-sectional design that cannot establish cause-effect relationship between risk factors and dermatophytosis as only association can be determined. Another limitation is that no molecular confirmation of dermatophytes was performed, which may lead to misidentification with the phenotypic methods used.

Conclusion:

The prevalence of dermatophytoses in school children in Biase LGA of Cross River State, Nigeria is 3.0%, with high prevalence of infection among children in the age groups 8-10 and >11 years of age, and among parents/guardians that are low-income earners. Improved living condition of the people and standard hygiene practices may ameliorate the spread of dermatophytoses in the study setting.

Contributions of authors:

UII and AL were involved in the conceptualization, design and writing of the manuscript; UII was involved in data collection and analysis of results; Ethical approval of the study

was facilitated by UAA. AL supervised the research work. UAA and AJ edited the manuscript. All authors read and approved the manuscript for publication.

Source of funding:

No external funding was received.

Conflict of interest:

No conflict of interest is declared.

References:

- Gupta, A. K., and Summerbell, R. C. Tinea capitis. *Med Mycol.* 2000; 38 (4): 255-287. doi: [10.1080/714030949](https://doi.org/10.1080/714030949)
- Weitzman, I., and Summerbell, R. C. The dermatophytes. *Clin Microbiol Rev.* 1995; 8 (2): 240-259. doi: [10.1128/CMR.8.2.240](https://doi.org/10.1128/CMR.8.2.240)
- Hay, R. J., Johns, N. E., Williams, H. C., et al. The global burden of skin disease in 2010. An analysis of the prevalence and impact of skin conditions. *J Invest Dermatol.* 2014; 134 (6): 1527-1534. doi: [10.1038/jid.2013.446](https://doi.org/10.1038/jid.2013.446)
- Adefemi, S. A., Odeigah, L. O., and Alabi, K. M. Prevalence of dermatophytosis among primary school children in Nigeria. *Nig J Clin Pract.* 2011; 14 (1): 23-28. doi: [10.4103/11193077.79235](https://doi.org/10.4103/11193077.79235)
- Ameen, M. Epidemiology of superficial fungal infections. *Clin Dermatol.* 2010; 28 (2): 197-201. doi: [10.1016/j.clindermatol.2009.12.005](https://doi.org/10.1016/j.clindermatol.2009.12.005)
- Wilmington, M., Aly, R, and Frieden, I. J. *Trichophyton tonsurans* tinea capitis in the San Francisco Bay area: increased infection demonstrated in a 20-year survey of fungal infections from 1974-1994. *J Med Vet Mycol.* 1996; 30: 285-287. doi: [10.1080/02681219680000481](https://doi.org/10.1080/02681219680000481)
- Araoye, M. O. Research methodology with statistics for health and social sciences. 1st Edition. Nathadex Publishers. 2004: 115 - 129;
- Rebell, G., and Taplin, D. Dermatophytes, their recognition and identification. Coral gables, FL: University of Miami Press. 1974: 1-109
- Rippon, J. W. Medical Mycology: The pathogenic fungi and the pathogenic actinomycetes. Philadelphia, PA: W. B. Saunders. 1974; 508-522.
- Haley, L. D and Callaway, C. S. Laboratory methods in medical mycology (pp.55-62). Atlanta, Georgia: US Department of Health and Education and Welfare.
- Rodriguez-Cerdeira, C., Martinez-Herrera, E., Szepletowski, J. C., et al. A systematic review of worldwide data on tinea capitis: analysis of the last 20 years. *J Euro Acad Dermatol.* 2021; 35 (4): 844-883. doi: [10.1111/jdv.15954](https://doi.org/10.1111/jdv.15954)
- Anosike, J. C., Keke, I. R., Uwaezuoke, J. C., et al. Prevalence and distribution of ringworm infections in primary school children in parts of Eastern Nigeria. *Mycoses.* 1991; 34 (9-10): 409-412.
- Ndako, J. A., Osemwegie, O. O., Spencer, T. H. I., et al. Prevalence of dermatophytes and other associated fungi among school children in northern Nigeria. *J Med Med Sci.* 2012; 1(3): 49-56.
- Ajao A. O., and Akintunde, C. Studies on the prevalence of tinea capitis in Ile-Ife, Nigeria. *Mycopathol.* 1985; 89 (1): 43-48. doi: [10.1007/BF00437131](https://doi.org/10.1007/BF00437131)
- Egere, J. U., and Gugnani, H. C. Etiology of derma-

- tophytosis in Eastern Nigeria: a 7-year study. *Mykosen*. 1982; 25 (4):178-181.
16. Nweze, E. I., and Okafor, J. I. Prevalence of dermatophytic fungal infections in children: A recent study in Anambra State, Nigeria. *Mycopathol*. 2005; 160 (3): 239-243. doi: [10.1007/s11046-005-0124-0](https://doi.org/10.1007/s11046-005-0124-0)
 17. Adeleke, S. I., Usman, B., and Ihesiulor, G. Dermatophytoses among itinerant Qur'anic scholars in Kano, Northwest Nigeria. *Nig Med Pract*. 2008: 33-35
 18. Ekanem, L. S., and Gugnani, H. C. Etiology of dermatophytoses amongst school children in Cross River State of Nigeria. *Mykosen*. 2009; 30 (10): 493-498. doi: [10.1111/j.1439-0507.1987.tb04097.x](https://doi.org/10.1111/j.1439-0507.1987.tb04097.x)
 19. Vazquez, V., and Sanchez, J. L. A clinical and mycologic study of tinea corporis and pedis in Puerto Rico. *Int J Dermatol*. 1984; 23: 550-551. doi: [10.1111/j.1365-4362.1984.tb04209.x](https://doi.org/10.1111/j.1365-4362.1984.tb04209.x)
 20. Mercantini, R., Moretto, D., Palamara, G., Mercantini, P., and Marsella, R. Epidemiology of dermatophytoses. Observed in Rome, Italy, between 1985 and 1993. *Mycoses*. 1995; 38,415-419. doi: [10.1111/j.1439-0507.1995.tb00074.x](https://doi.org/10.1111/j.1439-0507.1995.tb00074.x)
 21. Monod, M., Jaccoud, S., d Zaugg, C., Lechenne, B., Baudraz, F., and Panizzon, R. Survey of dermatophyte infections in the Lausanne area of Switzerland. *Dermatol*. 2002; 205 (2): 201-203. doi: [10.1159/000063913](https://doi.org/10.1159/000063913)
 22. Brajac, I., Stojnic-Sosa, L., Prpic-Massari, L., Loncarek, K., and Gruber, F. The epidemiology of *Microsporum canis* infections in Rijeka area, Croatia. *Mycoses*. 2004; 47 (5-6): 222-226. doi: [10.1111/j.1439-0507.2004.00990.x](https://doi.org/10.1111/j.1439-0507.2004.00990.x)