Tinea Capitis: Aetiology, Clinical Features, and Associated Sociodemographic Factors among School Pupils in Ilorin, Kwara State, Nigeria

OLARINOYE GM FMCP,[1] **KATIBI OS** FMCPaed, MMedSC Derm,[2] **APEH AJ** FMCP,[3]
FAYEMIWO SA MSc, FMCPath,[4] **OGUNBIYI AO** FMCP, FWACP, FRCP,[5] **GEORGE AO** FMCP, FRCP[5]
[1] Department of Medicine, Federal Medical Center Lokoja, Kogi State, Nigeria.
[2] Department of Paediatrics and Child Health, University of Ilorin Teaching Hospital, Kwara State, Nigeria.
[3] Department of Medicine, Jos University Teaching Hospital, Plateau State, Nigeria
[4] Department of Medical Microbiology and Parasitology, University College Hospital, Oyo State, Nigeria.
[5] Department of Medicine, University College Hospital, Oyo State, Nigeria.
Corresponding author: OLARINOYE GBOYEGA
Email: gboye9@yahoo.com; **Phone number**: +234 803453173

ABSTRACT

Background: Tinea capitis (TC) is an identified cause of physical and psychosocial distress among many children in our clime. The predominant aetiological agents have been known to vary with time and geographic location. We sought to determine the current pattern of causative dermatophyte species in our study population. We also aimed to describe the sociodemographic details and prevailing clinical features of TC among the studied children.

Methods: The study was a descriptive, cross-sectional study involving 204 children from public primary schools in the Nigerian city of Ilorin, Kwara State. Pupils with clinically diagnosed TC had KOH microscopy and fungal culture done.

Results: *Trichophyton tonsurans* was the most frequently isolated dermatophyte specie. The grey patch was the most common clinical type of TC. Frequently observed variables are male gender, low socioeconomic status, overcrowding, sharing of head garments and hair care instruments, carrying objects on the head and proximity to domestic animals. Over 50% of pupils reported physical or psychosocial distress, while 15.7% had developed permanent hair loss. Despite these, adequate orthodox management was rarely sought.

Conclusion: *Tinea capitis* and its consequences should not be overlooked. A holistic approach at the community level may help reduce the disease burden.

Keywords: Tinea capitis, dermatophyte infection, scalp

La Teigne du Cuir Chevelu: Étiologie, Caractéristiques Cliniques et Facteurs Sociodémographiques Associés Chez les Élèves D'ilorin, dans L'état De Kwara, au Nigéria

ABSTRAIT

Contexte: La teigne du cuir chevelu (TCC) est une cause identifiée de détresse physique et psychosociale chez de nombreux enfants de notre climat. Les agents étiologiques prédominants sont connus pour varier avec le temps et l'emplacement géographique. Nous avons cherché à déterminer le schéma actuel des espèces de dermatophytes responsables dans notre population d'étude. Nous avons également cherché à décrire les détails sociodémographiques et les caractéristiques cliniques prédominantes de TCC parmi les enfants étudiés.

Méthodes: L'étude était une étude transversale descriptive portant sur 204 enfants d'écoles primaires publiques de la ville nigériane d'Ilorin, dans l'État de Kwara. Les élèves atteints de TCC diagnostiqué cliniquement ont subi une microscopie KOH et une culture fongique.

Résultats: *Trichophyton tonsurans* était l'espèce de dermatophyte la plus fréquemment isolée. La tache grise était le type clinique le plus courant de TCC. Les variables fréquemment observées sont le sexe masculin, le faible statut socio-économique, le surpeuplement, le partage de coiffes et d'instruments de soins capillaires, le port d'objets sur la tête et la proximité d'animaux domestiques. Plus de 50 % des élèves ont signalé une détresse physique ou psychosociale, tandis que 15,7 % avaient développé une perte de cheveux permanente. Malgré cela, une prise en

charge orthodoxe adéquate était rarement recherchée.

Conclusion: *La teigne du cuir chevelu* et ses conséquences ne doivent pas être négligées. Une approche holistique au niveau communautaire peut contribuer à réduire la charge de morbidité.

Mots-clés: Teigne du cuir chevelu, infection dermatophytique, Cuir chevelu

Introduction

Tinea capitis (TC) is a dermatophyte infection of the scalp, most often seen among pre-pubertal children. It is common among primary school-aged pupils in Nigeria and other parts of Africa and Asia.[1-5] The prevalence of TC among Nigerian children varies widely between 14—50%.[2,5-11] The presence of cosmetically unsightly lesions and accompanying physical symptoms can cause physical and psychosocial distress among affected children. This can affect their quality of life negatively.[12] However, in the face of life-threatening public health concerns such as malnutrition, malaria, HIV, COVID-19 and other infectious diseases in our environment, TC seems to have gained little attention over the years.

Several clinical features, social determinants and causative dermatophyte species of TC have been noted from numerous available reports.[5, 6,13-17] Some of these have varied with individual authors, time and geographic location. A prevalence study on dermatophytosis carried out around our study location about 15 years ago identified *Trichophyton mentagrophytes* as the commonest causative specie of TC.[7] The study, however, did not specifically highlight the individual properties of TC infection among the study population.

This study further expands our local literature on TC, especially in Kwara State, Nigeria, where reports have been sparse. It describes the recent epidemiology, prevailing clinical features and the current dermatophyte species responsible for the infection in this region. With emerging discussions on the preferential use of oral antifungals based on groups of invading dermatophytes species,[18] a periodic assessment causative aetiological agents of TC will be helpful. Additionally, better insight into the variables associated with TC and the relationship between them may help to understand further the nature and scope of the disease in our environment and birth a community-based approach to reducing the burden of TC and its complications.

The objectives of this study were to determine the current dermatophyte species responsible for TC in the study population, as well as the prevailing clinical features and sociodemographic factors associated with the infection.

Materials and Methods

We carried out a descriptive, cross-sectional study involving children from public primary schools in Ilorin, Kwara State, Nigeria. Participants were selected through a multi-stage sampling technique, where stratification started with schools' Local Government Areas and continued down to specific classrooms within each selected school. Fieldwork lasted five months (November 2017 to March 2018). Ethical clearance was obtained from the Ethical Review Committee of the University of Ilorin Teaching Hospital Kwara State. Parental consent and verbal consent were obtained for every child. Assent was additionally gotten from those that were eight years old and above. Non-consenting pupils and those with non-consenting parents were excluded from the recruitment process.

Gross scalp examination in a well-lit environment was carried out to observe for varying degrees of hair loss, scaling, crusting, folliculitis and boggy swellings. A clinical impression of TC was made when features consistent with any of the clinical types of Tinea capitis (grey patch, black dot, diffuse scaling, diffuse pustules, favus and kerion) were noted. Children with clinically diagnosed TC were recruited for the study. Participants had their clinical and socio-demographic data obtained with a structured, interviewer-administered questionnaire. Parents were occasionally contacted when participants could not provide some required information. A general physical examination was performed on each study participant. The extent of scalp involvement was estimated in percentage, using a visual assessment tool proposed by Olsen *et al*. for evaluating alopecia areata (Fig 1).[19] Scalp scrapings were taken from the edge of identified

scalp lesions for fungal microscopy and culture. Specimens for microscopy were prepared in 10% potassium hydroxide and observed for fungal elements after allowing about 30 minutes for dissolution of keratinized tissue. The second portion of each specimen was cultured on Sabourauds Dextrose agar, incubated at 23^{0}C—27^{0}C and observed on alternate days for evidence of fungal growth. Macroscopic and microscopic features of growing fungi were used for the identification and speciation of dermatophyte fungi. Specimens that showed no fungal growth after four weeks of incubation were considered negative and discarded.

Data generated from the study were entered into Statistical Package for Social Sciences (SPSS) version 22. Clinical data, as well as findings on mycology, were represented using descriptive statistics. Pearson's Chi-square test was used to test for a significant relationship between acquired qualitative data. Statistical significance was established where $p < 0.05$.

Results

The age and sex distribution of the participants are highlighted in Table 1. Their age range was between 4 and 16 years, with a mean of 9.4 ± 2.7 years.

Potassium hydroxide (KOH) microscopy was positive in 150 cases (73.5%), while 135 pupils (66.1%) had positive cultures. *Trichophyton tonsurans* was the commonest isolate. It was cultured from 41.2% of all participants. Other cultured species were *Trichophyton mentagrophytes*, *Microsporum audouinii*, *Trichophyton schoeleinni*, *Trichophyton rubrum* and *Microsporum gypseum* (Fig 3). There were no cases of mixed growth. Observed clinical types of TC were grey patch, black dot and diffuse scaling, favus and kerion (Figs 2a-2c). A combination of both inflammatory and non-inflammatory lesions of TC was observed in 2 children. One had favus and black dots on different parts of the scalp, while the other was a case of kerion and grey patch. There was no notable association between the clinical types of TC and dermatophyte species.

However, we observed that culture rates were significantly highest (87.1%) among children with TC's black dot clinical phenotype (Table 2). The two cases of kerion were caused by *Microsporum audouinii* and *Trichophyton tonsurans*, respectively, while the only positive culture in a child with favus yielded *Trichophyton tonsurans*.

Over 79% of pupils had lesions affecting more than one scalp region. The frontal area was the most frequently affected (89.7%), while the temporal area was the least involved (53.9%). The estimated extent of scalp involvement using the visual assessment tool varied widely between 2-70% of the total scalp area, with a mean and median of 21.7 ± 14.3% and 20%, respectively. We also observed that 32 (15.7%) of the studied children had focal patches of scarring alopecia (Fig 3d). Other regional dermatophyte infections were noted in 7 cases (3.4%); 2 children had tinea faciei while five had tinea corporis. Dermatophytid reaction was noted in 2 children (Fig 4). Tender cervical lymphadenopathy was found in 10 pupils (4.9%). These included 5 of the six children with inflammatory forms of Tinea capitis (kerion and favus).

Associated complaints in some participants were scalp pruritus (25.1 %), scalp pain (11.1%) and burning sensation on the scalp (2.4%). Up to a third of participants (34.3%) reported a history of similar lesions, which had either partially or entirely resolved. Over 81% of the children were aware that they had scalp lesions. About half of all participants (51.5%) reported feeling embarrassed by the presence of their lesions.

A history of physical contact with other children with similar scalp lesions was noted in 74.9% of cases. Identified contacts were mostly other schoolmates or individuals within and around their homes. Most participants live in homes with one or two bedrooms. Some (8%) live in large compounds, where many rooms are shared with extended family members. At home, the mean and median number of roommates per child is 3.11 (±0.9) and 3.0, respectively, while in school, the mean population of pupils per classroom was 34.8 (± 6.6). About 77.8% of pupils have domesticated animals around their homes or in the immediate environment where they live. These include goats, sheep, cats, dogs, birds, cows, and rabbits. The majority (80.6%) of them share hair care instruments (clippers, combs, hairbrushes) and head garments (caps, hijabs and

scarves) with other people. Over half (65%) carry items in contact with the soil on their heads. These include buckets used to fetch water for domestic use and trays containing hawked and sold items on behalf of their parents or guardians.

Most participants had both parents being either semi-skilled or unskilled labourers (78.1%), while 15.9% had one of both parents being unemployed (usually their mothers). Working parents were mostly local artisans, petty traders, motorcycle operators, taxi drivers, and small-scale tailors and farmers. Only 6% had a parent engaged in skilled employment that included teaching, nursing, and engineering.

None of the participants had sought treatment from a hospital. Most (70.2%) had been treated using topical agents, often at the discretion of their parents or caregivers. Common products used were shea butter, herbal preparations, engine oil, medicated soaps, toothpaste and unspecified ointments in tubes. In a few cases (10%), orthodox agents like plain antifungal creams, and triple action creams (which contain an antifungal, an antibiotic and a steroid) were dispensed at nearby patent medicine stores or pharmacies. Additionally, nearly a third (31%) of participants have, at some point, had their lesions scraped off with a razor blade in an attempt to achieve resolution.

Discussion

Tinea capitis is a common superficial fungal infection in Nigeria, especially among individuals of primary school age. Although spontaneous resolution can occur with increasing age, chronic infection among pre-pubertal children is associated with physical and psychosocial consequences.

Trichophyton tonsurans was the commonest of six isolated dermatophytes in our study. This is in contrast to a 2005 study carried out among public primary schools within our study location, where *Trichophyton mentagrophytes* was the commonest cause of TC and *Trichophyton tonsurans,* was not cultured at all.[7] The current prevalence of *Trichophyton tonsurans* in Ilorin highlights a marked chronological variation in the pattern of infectious agents responsible for the disease. A near similar observation was the transition from *Trichophyton mentagrophytes* to *Trichophyton rubrum* as the reported prevailing cause of TC among children in Oshogbo, Osun State, Nigeria.[5,13] There is also a significant regional variability between culprit dermatophyte species in Nigeria. *Epidemophyton floccosum* and *Trichophyton rubrum* were recently identified as the prevailing agents in areas within the South-West, while *Trichophyton tonsurans*, *Trichophyton soudanense* and *Trichophyton rubrum* were predominant in reports from Eastern, Central and Northern States of the country, respectively.[13,14,16,20] Internationally, *Trichophyton tonsurans* is generally thought to be the commonest aetiological agent of TC in temperate regions, especially the United States (US) and United Kingdom (UK),[21-24] while more frequently encountered isolates from Africa, parts of Asia, South America, as well as Central and Southern Europe include *Trichophyton Mentagrophytes*, *Microsporum audouinii*, *Trichophyton soudanense*, *Trichophyton violaceum*, *Microsporum canis* and *Microsporum ferrugineum*.[1,17,21,25,26] The high prevalence of *Trichophyton tonsurans* in the US and UK has been partly ascribed to the relatively reduced efficacy of the widely used griseofulvin against the species over many years. Thus, *Trichophyton tonsurans* may have persisted at the expense of other more susceptible dermatophyte species like *Microsporum canis*.[27] We are not sure if a primary antifungal drug resistance or human movement across regions may have contributed to the predominance of *Trichophyton tonsurans* in our study. It is also possible that the anthropophilic nature of *Trichophyton tonsurans*, coupled with the high frequency (74.9%) of participants who have had contact with other infected persons, may have played a significant role.

The black dot clinical type of TC was significantly associated with positive cultures (p=0.001). Over 87% of children with this clinical phenotype had positive cultures irrespective of the causative dermatophyte species. This is in tandem with findings made in a study from Rajasthan, where most (44.5% out of 61%) of all positive cultures were from participants with the black dot clinical type of TC.[28] A possible explanation for this may be that hair shaft disruption is mediated by viable dermatophyte

fungi likely to grow on culture media. The active perilesional edges in the black dot clinical variant are also relatively easier to define when compared to other clinical types. Hence, this may increase the probability of getting a good yield while harvesting scalp scrapings. It is conventionally assumed that infection with species that cause an endothrix pattern of hair shaft invasion (e.g. *Trichophyton tonsurans*, *Trichophyton violaceum* and *Trichophyton soudanense*) manifest clinically as the black dot, while ectothrix invasion by dermatophytes like the *Microsporum* species and *Trichophyton Mentagrophytes* result in the grey patch clinical type.[18,29,30] We, however, found no consistently significant association between any cultured dermatophyte species and the observed clinical types of TC. Reports from within and outside Nigeria have also corroborated this observation.[5,31-33] A possible explanation is the suggested ability of some dermatophytes to cause both endothrix and ectothrix patterns of hair shaft invasion.[31] Additionally, other variables, such as host immune status and the individual immune response, can influence the resultant clinical phenotype of TC.[32, 34] The impact of treatment with corrosive topical agents and traumatic physical procedures on the overall appearance of scalp lesions is also worth considering. *Microsporum audouinii*, the commonest etiologic agent for kerion, was isolated from one of the two children with the lesion. The other case yielded *Trichophyton tonsurans*, which can also cause kerion.[35] The only culture-positive sample taken from a child with favus also yielded *Trichopyhton tonsurans* and not *Trichophyton schoeleinii* as more often expected.[30]

The mean percentage extent of scalp affectation was about 20%, with most pupils having multiple sites involved. The presence of fairly extensive lesions may be due to poor treatment of primary lesions and further spread to previously uninvolved sites on the scalp. There was notably marked predilection (90.6%) for the frontal area of the scalp, possibly as a result of contact with potential fomites like water containers and hawking trays, which a significant number of our participants carry routinely on their bare heads. The resulting micro-trauma could aid dermatophyte penetration and proliferation on the affected part of the scalp. Additionally, these items frequently get placed on the ground where infective fungal elements can be picked.

When present, tinea faciei and tinea corporis seem to be the usual co-existing dermatophyte infections.[1,10,33] We found either of them among 3.4% of our study participants. A similar prevalence of about 3.0% was documented in a study from Ogun State, Nigeria.[1] Conversely, only 0.1% of pupils in Osun State, Nigeria had other tinea infections.[2] Although not quite frequent, it seems rational to examine for other regional tinea infections while evaluating children with TC, as either can be a reservoir for recurring infections.

Tender cervical lymphadenopathy was noted in all but one of the six children with kerion or favus. This conforms with the notion that tender adenopathy is associated with inflammatory lesions.[30,34] The presence of adenopathy within the cervical group of lymph nodes is also consistent with one of the usually observed locations for TC related adenopathy (cervical, occipital and posterior auricular).[5,34,36]

The presence of more than one clinical type of tinea capitis in the same child is not entirely strange. Authors of a hospital-based study in Pakistan documented mixed clinical types of TC in up to 40 out of 100 children.[32] We had two similar cases; one child had favus and black dot, while the other had kerion and grey patch on different parts of the scalp. This combination of non-inflammatory and inflammatory lesions was also noted in studies from India and Ethiopia, in which children with combinations like a grey patch and diffuse pustules and favus plus grey patches were reported.[31, 37] A proposed explanation for this finding is that dermatophyte species can elicit varying degrees of inflammation on various parts of the scalp, hence presenting as different clinical types.[38]

Although hair loss with TC is classically transient, over 15 per cent of our participants had areas of scarring alopecia. This may have been a complication of inflammatory TC or the reported physical treatments like manual scrapping of lesions with a razor blade or topical application of corrosive agents. Therefore, this implies a risk of permanent

hair loss as long-term sequelae of TC in our region.

In many reports, the higher number of males having TC has been attributed to various reasons. They are generally more physically active while interacting with their peers, thus increasing the likelihood of manual transfer of infective fungal spores, either directly or through fomites.[6] Boys also usually lag behind girls in attaining puberty, which reduces the risk of developing TC.[34] Another factor that has been considered is the varying hair care practices between both sexes in our environment. Many boys in our environment patronize local barbers, who use contaminated, general-purpose instruments.[29] Girls, on the other hand, tend to plait or weave their hair using more personalized items.[5] The occupation of their parents suggests that many of our participants belong to families within the lower socioeconomic class. Some children hawk or sell foods and other items to augment their family earnings. The clustering of these children within our study population is because State Government-owned primary schools are much more affordable when compared to private schools of the same cadre.

Many children in our study had one or more previously identified socio-demographic detail that has been reported to be associated with TC. These include male sex, low socioeconomic status, contact with infected persons, carriage of objects like water buckets and hawking trays on the head, sharing hair care items and head garments and constant proximity to domestic animals.[1,5,9,13,31]

Over 80% of all studied children were insightful of their scalp lesions. More than half were embarrassed by it, and about a quarter had at least one physical symptom of TC. None of the children had received proper, hospital-based medical evaluation or treatment despite this. However, some form of largely unsuccessful care was offered in over two-thirds of cases. This affirms that TC is indeed a source of concern for affected children and, or their guardians. Probable reasons for not seeking standard care are ignorance and limited access to it, especially if it costs less to consider treatments passively suggested by unqualified persons.

Conclusion

TC requires more attention, especially in resource-poor settings within our environment. Its complications range from acute physical and psychosocial distress to the risk of permanent hairs loss, as highlighted in our study. *Trichophyton Tonsurans* is currently the prevailing aetiological agent of TC among primary school pupils in Ilorin. The clinical features and socio-demographic associations of TC have largely been consistent. However, the responsible dermatophyte species continue to vary. Public enlightenment on avoidance of unhelpful and potentially damaging treatments and training of local health workers on proper clinical identification and treatment of uncomplicated cases can help reduce the disease burden among affected children in our environment.

Conflicts of interest: None

Financial disclosures: Nil

References

1. Ayanlowo O, Akinkugbe A, Oladele R et al. Prevalence of tinea capitis infection among primary school children in a rural setting in South-West Nigeria. J Public Health Afr 2014; 5(1): 349.
2. Oke O O, Onayemi O, Olasode O A et al. The prevalence and pattern of superficial fungal infections among school children in Ile-Ife, South-Western Nigeria. Dermatol Res Pract. 2014; 2014: 842917.
3. Farooqi M, Tabassum S, Rizvi D A, Rahman A et al. Clinical types of tinea capitis and species identification in children: An experience from tertiary care centres of Karachi, Pakistan. JPMA 2014; 64(3): 304-8.
4. Hogewoning A, Adegnika A, Bouwes Bavinck J et al. Prevalence and causative fungal species of tinea capitis among schoolchildren in Gabon. Mycoses 2011; 54(5): e354-e9.
5. Akinboro AO, Olasode OA, Onayemi O. The pattern, risk factors and clinic-aetiological correlate of tinea capitis among the children in a tropical community setting of Osogbo, South-Western Nigeria. Afro-Egypt J Infect Endem 2011; 1(2): 53-64.
6. Enendu N, Ibe S. Prevalence of tinea capitis among primary school pupils in Uli, Anambra

State, Nigeria. Afr J of Appl Zool & Environ Biol 2008; 7(1): 1-4.

7. Adefemi S, Odeigah L, Alabi K. Prevalence of dermatophytosis among primary school children in Oke-oyi community of Kwara State. Niger J Clin Pract 2011; 14(1): 23-8.
8. Ajao A, Akintunde C. Studies on the prevalence of tinea capitis infection in Ile-Ife, Nigeria. Mycopathologia 1985; 89(1): 43-8.
9. Enweani I, Ozan C, Agbonlahor D et al. Dermatophytosis in schoolchildren in Ekpoma, Nigeria. Mycoses 1996; 39(7-8): 303-5.
10. Ogbu CC, Somadina Okwelogu I, Chinwe Umeh A. Prevalence of superficial fungal infections among primary school pupils in Awka South Local Government Area of Anambra State. JMR 2015; 2(1): 15-22.
11. Ogunbiyi A, Owoaje E, Ndahi A. Prevalence of skin disorders in school children in Ibadan, Nigeria. Pediatr Dermatol 2005; 22(1): 6-10.
12. Akinboro AO, Olasode OA, Onayemi O et al. The impacts of Tinea capitis on quality of life: A community-based cross-sectional study among Nigerian children. Clinical Medicine Insights: Dermatology 2013; 6: 9-17.
13. Adesiji YO, Omolade BF, Aderibigbe IA, Ogungbe OV, Adefioye OA, Adedokun SA, et al. Prevalence of tinea capitis among children in Osogbo, Nigeria, and the associated risk factors. Diseases 2019; 7(1): 13.
14. Afolabi OT, Oninla O, Fehintola F. Tinea capitis: A tropical disease of hygienic concern among primary school children in an urban community in Nigeria. JPHE 2018; 10(9): 313-9.
15. Aly R, Hay R, Del Palacio A, Galimberti R. Epidemiology of tinea capitis. Medical mycology 2000; 38(Supplement 1): 183-8.
16. Dogo J, Afegbua SL, Dung EC. Prevalence of Tinea capitis among schoolchildren in Nok community of Kaduna State, Nigeria. JPathog 2016; 2016.
17. Hogewoning A, Adegnika A, Bouwes Bavinck J, Yazdanbakhsh M, Kremsner P, van der Raaij-Helmer E, et al. Prevalence and causative fungal species of tinea capitis among schoolchildren in Gabon. Mycoses 2011;54(5): e354-e9.
18. Fuller L, Barton R, Mohd Mustapa M et al. British Association of Dermatologists' guidelines for the management of tinea capitis 2014. Br J Dermatol 2014; 171(3): 454-63.
19. Olsen EA, Hordinsky MK, Price VH, Roberts JL, Shapiro J, Canfield D, et al. Alopecia areata investigational assessment guidelines–Part II. J Am Acad Dermatol 2004; 51(3): 440-7.
20. Ayanbimpe GM, Taghir H, Diya A, Wapwera S. Tinea capitis among primary school children in some parts of central Nigeria. Mycoses 2008; 51(4): 336-40.
21. Fuller LC. Changing face of tinea capitis in Europe. Current opinion in infectious diseases 2009; 22(2): 115-8.
22. Foster KW, Ghannoum MA, Elewski BE. Epidemiologic surveillance of cutaneous fungal infection in the United States from 1999 to 2002. J Am Acad Dermatol 2004; 50(5): 748-52.
23. Mirmirani P, Tucker LY. Epidemiologic trends in pediatric tinea capitis: a population-based study from Kaiser Permanente Northern California. Journal of the American Academy of Dermatology 2013; 69(6): 916-21.
24. Wilmington M, Aly R, Frieden I. Trichophyton tonsurans tinea capitis in the San Francisco Bay area: increased infection demonstrated in a 20-year survey of fungal infections from 1974 to 1994. J Med Vet Mycol 1996; 34(4): 285-7.
25. Borman AM, Campbell CK, Fraser M, Johnson EM. Analysis of the dermatophyte species isolated in the British Isles between 1980 and 2005 and review of worldwide dermatophyte trends over the last three decades. Medical mycology 2007; 45(2):131-41.
26. Fulgence KK, Abibatou K, Vincent D, Henriette V, Etienne AK, Kiki-Barro PC, et al. Tinea capitis in schoolchildren in southern Ivory Coast. Int J Dermatol 2013; 52(4): 456-60.
27. Chen BK, Friedlander SF. Tinea capitis update: a continuing conflict with an old adversary. Current opinion in pediatrics 2001; 13(4): 331-5.
28. Kalla G, Begra B, Solanki A, Goyal A, Batra A. Clinicomycological study of tinea capitis in the

desert district of Rajasthan Indian J Dermatol Venereol Leprol 1995; 61(6): 342.

29. David D, Edward A, Zaruwa M, Addass P. Barbing saloon associated fungal disease infection in Mubi, Adamawa State-Nigeria. World J Med Sci 2010; 5(1): 17-21.
30. Gupta A, Summerbell R. Tinea capitis. Medical Mycology. 2000; 38(4): 255-87.
31. Puri N, Puri A. A study on tinea capitis in preschool and school-going children. Our Dermatology Online 2013; 4: 157-60.
32. Jahangir M, Hussain I, Khurshid K, Haroon T. A clinico-etiologic correlation in tinea capitis. Int J Dermatol 1999; 38(4): 275-8.
33. Jha BN, Garg VK, Agrawal S, Khanal B, Agarwalla A. Tinea capitis in eastern Nepal. Int J Dermatol 2006; 45(2): 100-2.
34. Zaraa I, Hawilo A, Aounallah A, Trojjet S, El Euch D, Mokni M, et al. Inflammatory tinea capitis: a 12-year study and a review of the literature. Mycoses 2013; 56(2): 110-6.
35. Isa-Isa R, Arenas R, Isa M. Inflammatory tinea capitis: kerion, dermatophytic granuloma, and mycetoma. Clinics in dermatology 2010; 28(2): 133-6.
36. Hubbard TW. The predictive value of symptoms in diagnosing childhood tinea capitis. Archives of pediatrics & adolescent medicine 1999; 153(11): 1150-3.
37. Lulekal S, Abera S, Misganaw S, Urgie S, Asfaw S. Assessment on Prevalence of Tinea Capitis and Its Associated Factors among School Children in Addis Zemen, Northwest Ethiopia, 2016. Central African Journal of Public Health 2019; 5(4): 172.
38. Elghblawi E. Tinea capitis in children: A report of

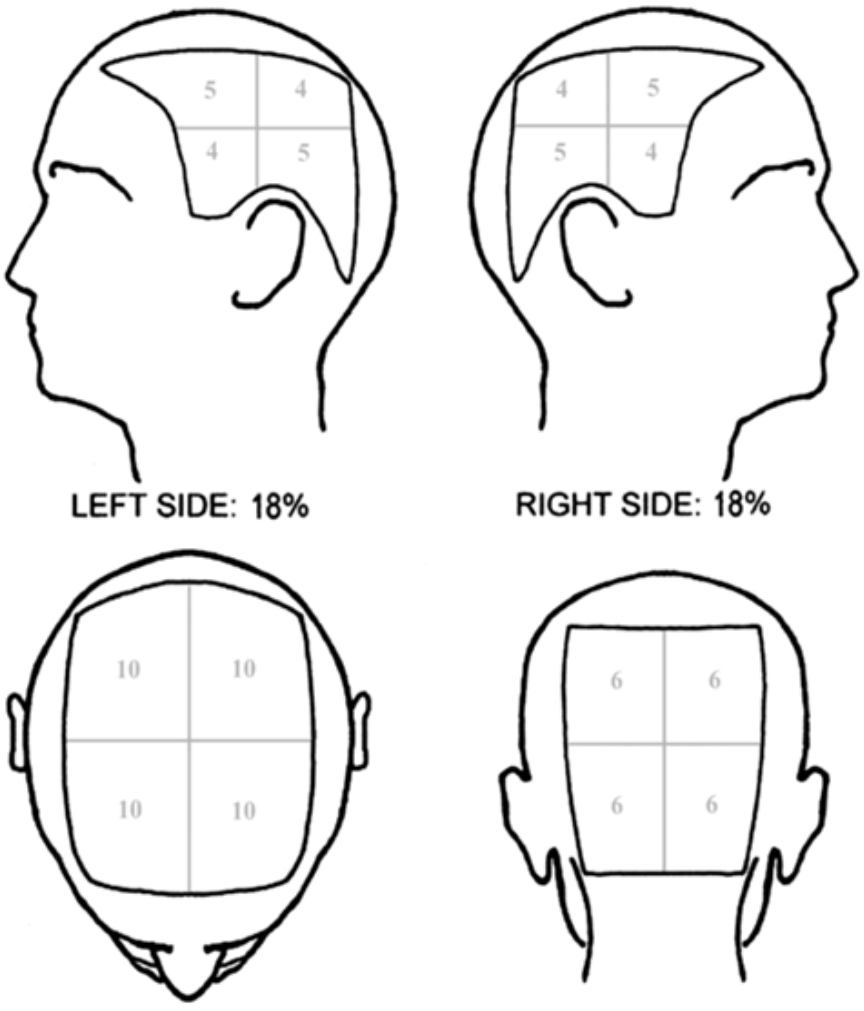


Figure 1. Reference for estimating the percentage of scalp involvement

TABLE 1: CLINICAL FEATURES OF CHILDREN WITH TINEA CAPITIS

VARIABLE	FREQUENCY	PERCENTAGE (%)	Mean (SD)
Age distribution			
⩽ 5	21	10.3	9.4 (± 2.7)
6-10	103	50.5	
11- 15	78	38.2	
> 15	2	1.0	
Total	204		
Sex distribution			
Male	176	86.3	
Female	28	13.7	
Associated scarring alopecia	32	15.7	
Scalp regions affected			
Frontal area	183	89.7	
Vertex	161	78.1	
Occipital area	149	73.0	
Temporal area	110	53.9	
Extent of scalp involvement			21.3 (±14.3)
Number of scalp areas affected			
One site	42	20.9	
Two sites	52	25.5	
Three sites	51	25.0	
Four sites	53	25.9	
Five sites	4	2.0	
Six sites	2	1.0	
Associated physical symptoms			
Pruritus	51	25.1	
Pain	23	11.3	
Burning sensation	5	2.5	
Awareness of scalp lesions			
Yes	166	81.4	
No	38	18.6	
Past history of similar scalp lesions			
Yes	70	34.3	
No	134	65.7	
Extra -scalp involvement			
Tinea faciei	2	1.0	
Tinea corporis	5	2.5	
Dermatophytid reactions	2	1.0	
Cervical lymphadenopathy	10	5.0	
Feeling of embarrassment			
Yes	105	51.5	
No	99	48.5	

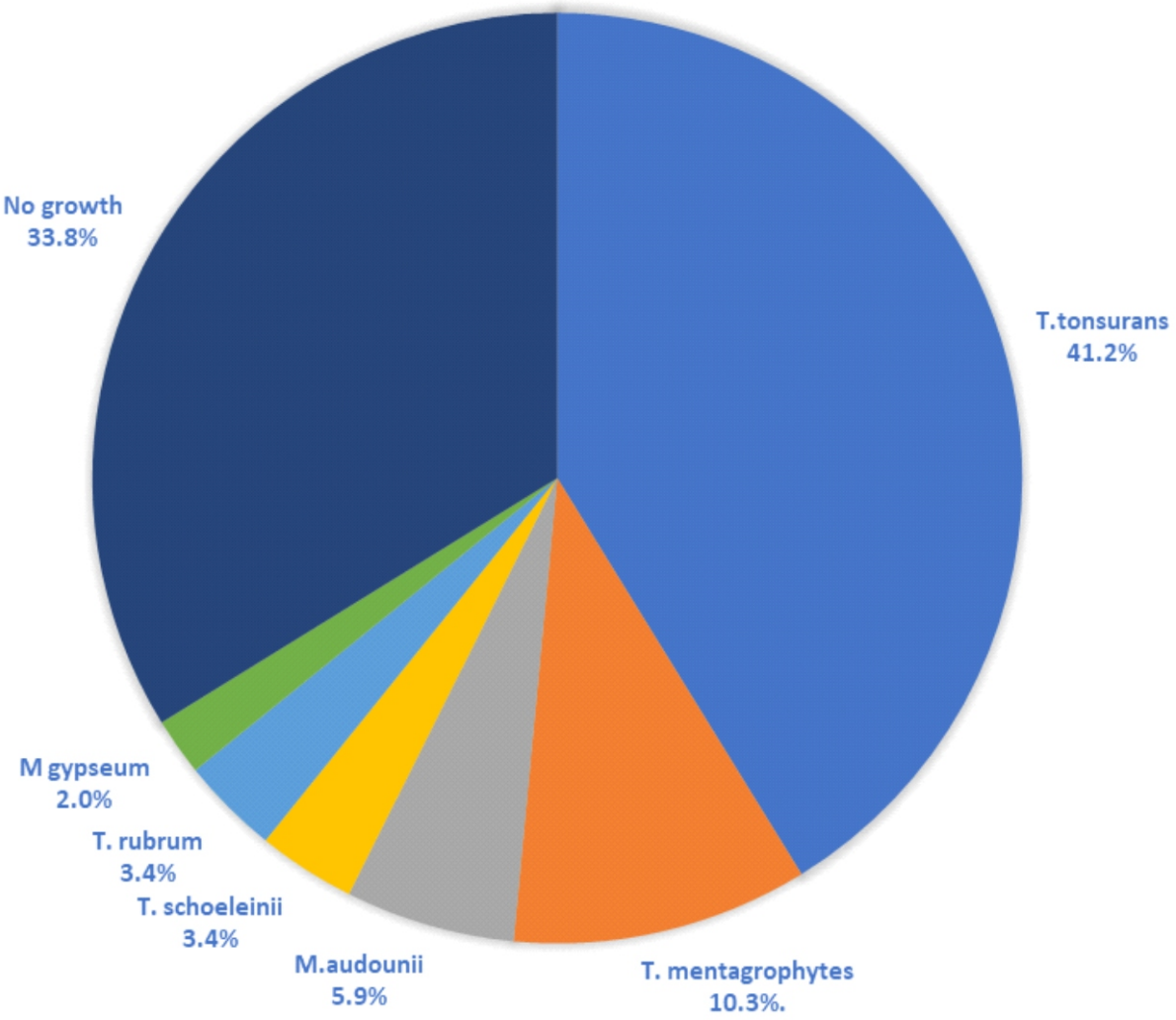


Figure 2: Distribution of the aetiological agents of Tinea capitis

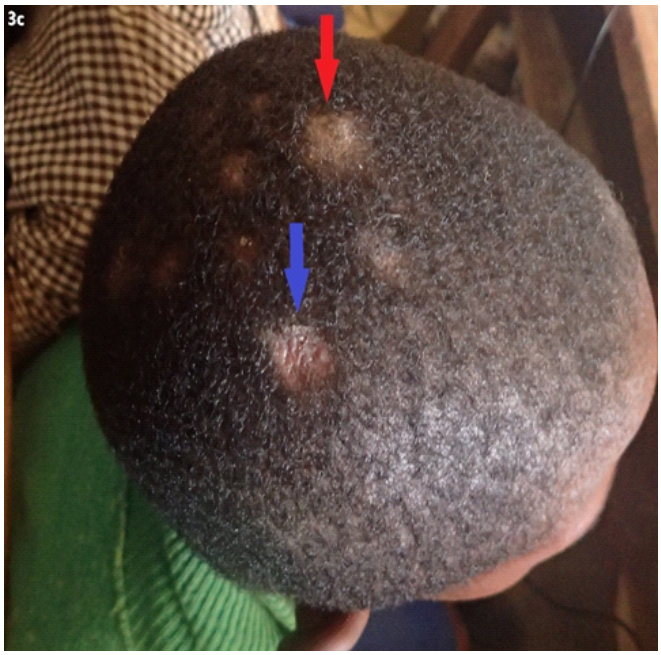
TABLE 2: Relationship Between Clinical Types Of Tinea Capitis And Culture Results

CLINICAL TYPE	FREQUENCY	POSITIVE CULTURE	NEGATIVE CULTURE	P-Val
Black Dot	70	61 (87.1%)	9 (12.9%)	0.001
Grey Patch	92	51 (55.4%)	41 (44.6%)	0.070
Diffuse Scaling	38	22 (57.9%)	16 (42.1%)	0.021
Favus	4	1 (25.0%)	3 (75.0%)	-
Kerion	2	2 (100%)	-	-

Figure 3: Clinical types of Tinea capitis.

(a) Grey patch,

(b) Black dot,



(c) Favus (red arrow) and scaring (blue arrow)

(d) Extensive scaring alopecia in child with TC.

Figure 4: Dermatophytid (Pruritic, scaly erythematous rash on superior helix of the right the ear) and tinea corporis on the neck

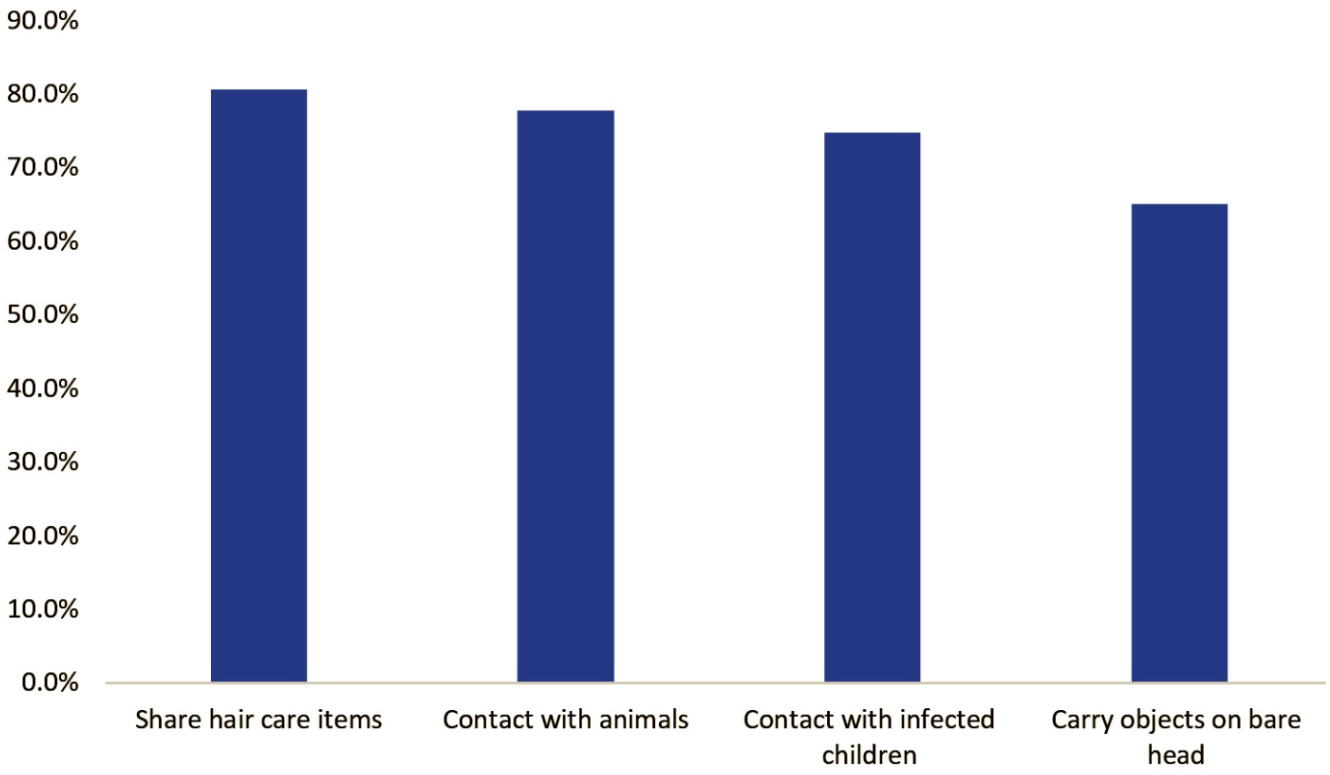


Figure 5: Bar chart showing proportion of pupils exposed to known risk factors for tinea capitis