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AETIOLOGY OF TINEA CAPITIS IN SCHOOL CHILDREN

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ABSTRACT

Background: Tinea capitis is a superficial fungal infection of the scalp and hair of the head which is common in children aged between two and eleven years. An endothrix infection is best treated using parenteral antifungal drugs while an ectothrix one may be treated by parenteral or topical antifungal drugs. The organism that commonly causes tinea capitis in the Western world is *Trichophyton tonsurans* while there is inadequate information on the actual causative agent in Kenya.

Objectives: To determine the prevalence and the aetiology of tinea capitis and the fungal agents responsible for it and; to recommend the correct mode of treatment in school children attending a primary school near Eldoret.

Design: Prospective and descriptive study.

Setting: Private primary school near Eldoret town.

Subjects: Sixty eight primary school children aged between six and 14 years in classes 1 to 5.

Results: Of the 68 pupils included in the study, 60.9% and 39.1% were males and females, respectively. Prevalence of tinea capitis in the school was 33.3%. Peak age of infection was 10 years. Ratio of infected males to females was 2:1. There was a growth on culture in 76.1% of the cases all of which were endothrix. *T. tonsurans* was isolated in 77.8%, *T. rubrum* in four per cent of the cases.

Conclusion: The prevalence of tinea capitis in this school was high. The most common cause of tinea capitis was *T. tonsurans*. Males were more infected than the females.

Recommendations: Oral antifungal drugs with griseofulvin being the first line of treatment should be adopted. Health education on the aetiology, treatment and prevention of tinea capitis should be given.

INTRODUCTION

Dermatophytes are superficial fungal infections of the skin. They are classified by genera, patterns of infection and by ecology. The genera include *Trichophyton*, *Epidermophyton* and *Microspora*. The pattern classification includes tinea capitis, tinea pedis, tinea cruris and tinea corporis. Ecological classification has anthropophilic and zoophilic dermatophytes. Examples of anthropophilic dermatophytes are *T. tonsurans* and *M. aoudounii* and zoophilic dermatophytes are *M. canis* and *T. verrucosum* (1- 8).

Tinea capitis is a superficial fungal infection of the scalp and hair(1,2). The infection is common in children aged two to eleven years and males are affected more than females(1-8). The predisposing factors include: poor hygiene, sharing of fomites, overcrowding and low socio-economic status. It is therefore more common in the developing than in the developed world(1). It is known that the most common causative agent in the Western world is *T. tonsurans*. While in the case of Africa and Kenya, no extensive studies have been done to determine the causative agents, though there are scattered reports...

The mode of treatment depends on whether the infection is endothrix or ectothrix. The endothrix infection requires oral medication while the ectothrix may be treated with topical drugs. Topical antifungals are cheaper and are used more frequently in Kenya.

Ethical consideration: Permission was sought from and granted by the school administration for the study. The parents and guardians were informed and requested by the school administration to give permission which they did. The researchers could not meet the parents because it was a boarding school. All the children found to have clinical features of tinea capitis, were included in the study and given griseofulvin for the treatment of tinea capitis at the recommended dosages.

MATERIALS AND METHODS

Study area: A pilot study was carried out at a mixed boarding primary school in Ndalat division of Nandi District, Kenya. The school is located 19 km west of Eldoret town along the Kipkarren road. The school was started in 1998 and has pupils in nursery and upto standard five classes. There were 78 male and 86 female pupils.

Study population: The researchers were requested to study the children in this school by the proprietor who had noted that a lot of pupils had "ring worm" lesions. Thus, this group was convenient for cross-sectional sampling. All the children in the school were screened for clinical signs of tinea capitis. Therefore, the study population comprised all the children in the school with such clinical features as, scaling scalp lesions, alopecia, black dots and/or kerion. These pupils were aged between six to 14 years. Of these, 42 (60.9%) and 26 (39.1%) were males and females, respectively.

Study design: The study was prospective.

Materials: The materials used in this study were: surgical blades (No. 15), glass slides, microscope, cover slips, Sabouraud dextrose agar, potassium hydroxide (KOH) and tweezers.

Collection of specimen: All the students in the school were clinically assessed for tinea capitis. Those found to have had clinical evidence of tinea capitis were enrolled in the study. A questionnaire was used to collect information from them regarding age, sex, class, sharing of fomites, their households and keeping of animals.

The affected area was cleaned with 70% ethanol, pieces of hair collected by scrapping the lesion edges with a sterile number 15 scapel blade and placed on a clean piece of paper. The paper was folded on the edges to form a flat packet and labelled with the pupil's code number. The specimens were sent to the Department of Medical Microbiology and Parasitology Laboratory at the Faculty of Health Sciences, Moi University for processing.

Laboratory procedures: Direct microscopy: A drop of potassium hydroxide (KOH) was placed on a glass slide. A few pieces of the specimen were transferred to the drop of KOH and covered with a cover slip. This was warmed for one minute and then examined for spore and hyphae within five minutes with a light microscope.

Culture: Using sterile tweezers, a few pieces of hair were inoculated onto the surface of Sabourauds dextrose agar plates and incubated at room temperature (22-26°C) for one week. Fungal growth was identified using colonial morphology followed by wet preparation microscopy in saline at x40 magnification. The features used for identification were hyphal characteristics, presence or absence of spores and morphology of spores.

Data management: The data were collected using a questionnaire and entered into a computer on SPSS (Statistical Package for Social Sciences). Pearson's Chi-square test was used to test for statistical significance of the difference in the rate of isolation of organisms among the sexes and the age groups.

RESULTS

Population: There was a total of 164 children in the school of whom 46% were males and 54% females. Sixty eight children formed the study group. Of these, forty two (61.8%) and twenty six (38.2%) were males and females, respectively. The age range of the study group was six to 14 years with a mean of 9.6 years. The number of rooms in the households where the pupils came from ranged from one to twelve with a mean of 5.5 rooms per household. The family size ranged from 3-14 with a mean of 6.9.

Sharing of fomites: Combs and beddings were the most shared fomites while headgear and clothing were rarely shared as illustrated in Table 2.

Table 1

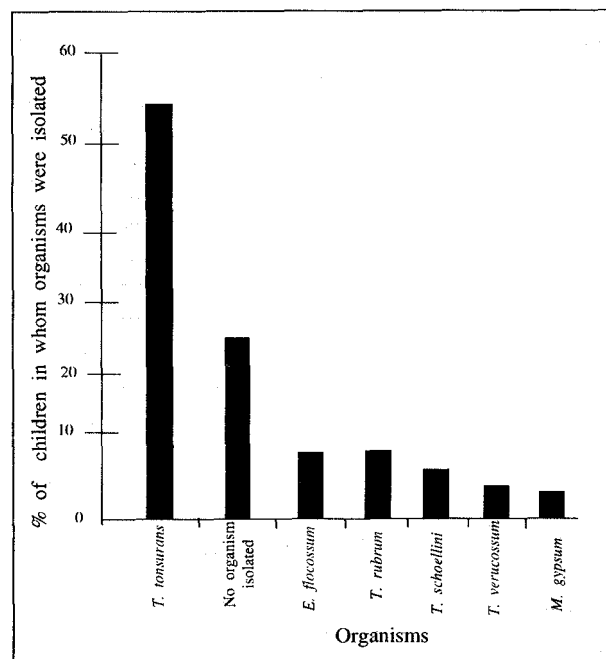
Distribution of children per class			
Class	Males	Females	Total (%)
I	13	8	21 (14.00)
II	13	14	27 (18.00)
III	14	15	29 (19.30)
IV	15	23	38 (25.30)
V	14	21	35 (23.50)
Totals	69 (46%)	81 (54%)	150 (100)

Table 2

Sharing of fomites by the children	
Fomites	Frequency (%)
Bedding	51 (18.8%)
Washing basin	48 (17.7%)
Soap	46 (17%)
Comb	46 (17%)
Razor blade	45 (16.6%)
Towel	23 (8.5%)
Clothing	7 (2.6%)
Head-gear	5 (1.8%)
Total	271 (100)

Figure 1

Organisms isolated



When pupils were interviewed, 61 (89.7%) knew the word ringworm or *mashilingi*. Of these, 56 (88.9%) said ringworms affected the head, six (9.5%) said ringworms affected the limbs while one (1.6%) said ringworms affected the trunk. Thus, most of them were aware of tinea capitis but not of tinea corporis, tinea pedis or tinea manuum.

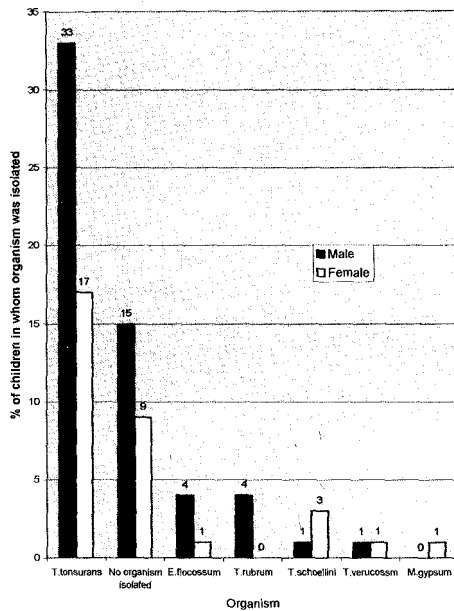
Of the children interviewed, 46 (67.6%) had suffered from tinea capitis before. Of these, twenty two (48%) had

received treatment for the previous infection and eleven (50%) of these had been given topical treatment. The other eleven did not know the type of treatment they were given. None could recall having been given oral medication.

When asked about infection among the family members, forty (58.8%) of the children said there were others with similar infection. Of these, twenty six (61.9%) and sixteen (38.1%) were brothers and sisters, respectively.

Figure 2

Organisms isolated by age

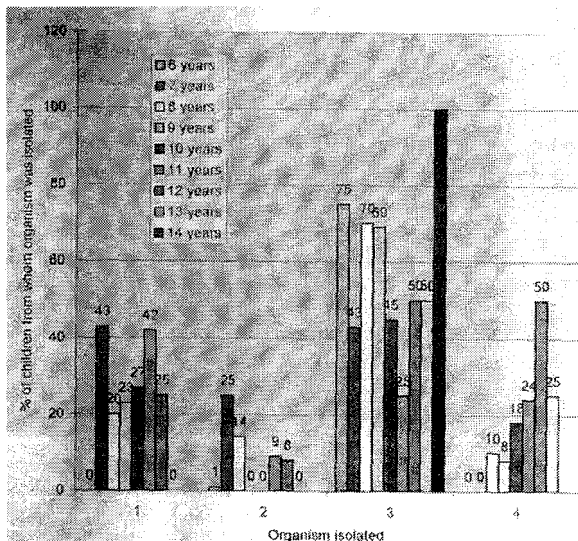


Pearson's Chi-square, P=0.740

- Key:
1. No organism isolated
 2. *E. floccosum*
 3. *T. tonsurans*
 4. Other organisms

Figure 3

Organism isolated by sex



On the animals kept in their homesteads, 52 (76.5%) said there were sheep and goats kept. Out of these, five (9.4%) had the animals staying outside, six (11.3%) had the animals staying in the same house and 42 (79.2%) had the animals staying in separate pens. There were 52 (76.5%) of the children with fungal growth while 16 (23.5%) had no growth on culture. All the growths were endothrix.

DISCUSSION

Dermatophyte skin infections are some of the most common human infections in the world. Their prevalence has been increasing because of new drug resistant organisms, increased use of immunosuppressive therapy, chemotherapy, antibiotics, HIV/AIDS, poverty, overcrowding, sharing of combs or hats and poor hygienic practises(1,2). The infections are therefore more common in the developing than in the developed world. Despite this fact, epidemiological data on dermatophyte skin infections in sub-Saharan Africa are scanty.

Tinea capitis is the most common dermatophyte infection in children. It is five times as common in boys as in girls(2,8). It usually affects children aged two to eleven years though in Nigeria, it was most prevalent in the age group ten to twelve years(2,7,8,9). The prevalence rate of tinea capitis in Africa varies between 5.1% and 20.6%. The prevalence rate in this study was higher than this but the peak age of ten years and the male to female ratio of 2:1 was similar to the findings elsewhere in Africa and the world(2,7-10). Though we did not assess the children for other skin infections, an interview of the children revealed that 89.5% were familiar with the word "ringworm" (*mashilingi*), of these 88.9% said that ring worms affected the head, 9.5% said they affected the limbs, and 1.6% said that they affected the body. This implied that they were most familiar with tinea capitis probably because it was the most common.(2,7-10).

Tinea capitis clinically presents with broken hairs, partial alopecia and rarely kerion. *Microspora fluorescence* under the Woods' light but *Trichophyton*s do not. The diagnosis is based on clinical findings and confirmed using the laboratory(1,11,12). In North America, Western Europe and Mexico *T. tonsurans* is the most common causative organism(1,8,13). *T. violeceum* is the most common cause in Ethiopia, South Africa, India, Jordan and the Far East. It is endemic in Eastern parts of Europe, Africa, Asia, and South America(12,13). *T. soudanense* is commonly found in northwestern tropical Africa, while in Kisumu district of Western Kenya, the major aetiological agents were *T. violeceum*, *M. audounii* and *M. canis* which were zoophilic organisms(1,6,9,15,16). In our study, there were 68 children with the clinical features of tinea capitis. Out of these, 52 (76.5%) had growth on culture. *T. tonsurans* was the most commonly isolated organism in this study and this is similar to the findings in the West(1). *T. rubrum* was isolated only from the males while *M. gypsum* was only isolated from the females. All the 14-year old pupils

had *T. tonsurans* only. The prevalence of zoophilic organisms in this study was lower than in Kisumu perhaps because there was no close contact with animals(16). All the organisms isolated were reported as endothrix in our study.

Oral antifungal drugs are required for children with tinea capitis, tinea unguium, and those who are immunosuppressed either from disease or therapy(17,18). The treatment of tinea capitis aims at removing the organism from the hair follicle and to eradicate it from the hair shaft. Topical antifungals cannot achieve these aims because they cannot penetrate into the hair shaft, hence the treatment of endothrix infections with oral drugs(20). Topical antifungals are however effective in ectothrix infections(1). Griseofulvin is the mainstay of the treatment of tinea capitis in children(10,16-22). There are newer oral antifungal drugs such as terbinafine, itraconazole, fluconazole which possess pharmacological and pharmacokinetic properties that theoretically would make them ideal for treatment of tinea capitis(22). These drugs have not been approved by the FDA for use in tinea capitis in children except terbinafine whose oral formulation was approved recently(22). There have been few published randomised case control studies of these drugs(22). However, they are expected to have an advantage over griseofulvin because of shorter duration of use, better safety profile, longer duration of action even after the patient has stopped taking the drug and better compliance(20). The oral antifungal drugs have the disadvantage of being prescription drugs and more expensive than the topicals(1).

During the interviews, we found that 66.7% of the children had suffered from tinea capitis before, of whom 50% had sought and received treatment for their infections. Only 48% could tell that they had received topical treatment. None of these pupils could recall having been given oral treatment. This shows that many of the children did not seek treatment probably because they didn't consider the condition severe enough since a lot of other pupils had it. Those who sought treatment were given topical treatment which was unlikely to work since the infecting organism was an endothrix. This shows that the health workers treating these pupils did not consider the possibility of an endothrix infection or they were not aware of the appropriate management of an endothrix infection. It is possible that the prescriptions were influenced by the lower cost of topical antifungal drugs or there was self medication. There is need not only for seeking treatment but also health education on the aetiology and management of tinea capitis. Sources at the school indicated that some parents complained that the children had the scalp lesions because the school did not provide them with milk. Others including some teachers associated this infection with intestinal worms. Health education could be provided through primary health care system using community health workers or the Kenya Medical Association's school health programme(16).

It is our observation that most health workers in this region use topical antifungal drugs for the treatment of tinea capitis which have been found to be ineffective in Eldoret town. The results in this study have shown that the reason is that the causative organisms are endothrix. This is different from the observations made in Kisumu district where some ectothrix infections were found and indeed the prevalence of infection went down after the use of Whitfield ointment(16). In Eldoret as well as in the rest of Kenya, Whitfield is very commonly used for tinea capitis because it is much cheaper than the newer topical antifungal drugs such as ketoconazole and terbinafine, and oral antifungal drugs and it can be bought over the counter. Though the newer antifungal drugs have several advantages over griseofulvin, they are much more expensive than griseofulvin. For example, an eight week course of griseofulvin may cost Ksh 250 compared to Ksh 5,000 for terbinafine for four weeks in the treatment of tinea capitis. This is out of reach for most Kenyans. Use of griseofulvin should therefore be recommended in the treatment of tinea capitis.

In conclusion, prevalence of tinea capitis in the school was high and comparable to that reported in other parts of Africa. The commonest organism isolated was *Trichophyton tonsurans*. This finding is in agreement with what has been seen in North America and Western Europe. Most pupils in the school did not seek treatment for the tinea capitis. Topical treatment was the only treatment of tinea capitis known to have been used in the school. The peak age and sex distribution were quite similar to what had found elsewhere. Oral antifungal drugs should be used in the treatment of tinea capitis with griseofulvin being the first line of treatment in the region and Africa. Health education on the aetiology, treatment and prevention of tinea capitis should be given to the population in Kenya. A study involving more schools and school children randomly selected should be carried out to confirm these results.

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