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Tinea capitis in schoolchildren in southern Ivory Coast

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Abstract

Objectives Fungal infections of the scalp commonly affect the pediatric population. These infections are caused by dermatophytes that are able to invade the keratinized structures of skin, hair, and nails. This study aimed to analyze the epidemiology of fungal scalp infections in southern Ivory Coast during 2008–2009.

Methods From October 2008 to July 2009, 17,745 children ranging in age from 4–16 years, attending urban and rural primary schools in seven towns in Ivory Coast, were examined clinically for tinea capitis. Hair stumps and scales were collected from children who showed symptoms suggestive of scalp ringworm. Samples were exposed to direct microscopic examination using 30% potassium hydroxide solution and cultivation on Sabouraud's dextrose agar with or without actidione.

Results Of the 17,745 children who were clinically examined, a total of 2645 exhibited symptoms suggestive of scalp ringworm. Positive cultures for fungi were found in 2458, yielding an overall prevalence of tinea capitis of 13.9%. The majority of infections occurred in males (74.0%). The most commonly affected age group involved children ranging from 9–12 years (n = 1335, 54.3%), followed by those in the range of 4–8 years (n = 936, 38.1%). *Trichophyton soudanense*, *Microsporum langeronii*, and *Trichophyton mentagrophytes* were the most prevalent etiologic agents (56.7%, 21.4% and 19.7%, respectively). Other species were occasionally isolated, including *Trichophyton violaceum* (1.4%) and *Trichophyton rubrum* (0.8%).

Conclusions Epidemiological surveys are an essential tool for developing strategies for infection control.

Introduction

Tinea capitis is a superficial fungal infection of the scalp and one of the most commonly seen dermatophyte infections in children. It is caused by anthropophilic, zoophilic, or geophilic species belonging to the genera *Microsporum* and *Trichophyton*.[1,2]

The distribution of dermatophytes varies according to country and geographical region and depends on several factors, such as lifestyle, type of population, migration of people, and climatic conditions.[3,4]

Prevalences of tinea capitis remain low in developed countries. By contrast, tinea capitis is endemic in many developing countries and represents a significant infectious dermatological disease. Many authors have pointed out that it is important to review the mycological flora of the skin in each region from time to time in order to detect changes.[5,6]

In sub-Saharan West Africa, *Microsporum audouinii* and *Trichophyton soudanense* are predominant.[7–10] In Western regions of the world, *Trichophyton tonsurans* has emerged as the predominant cause of tinea capitis.[9] *Microsporum canis* is the most common cause in central and southern Europe.[11] *Trichophyton violaceum* is the most common cause in North Africa[12,13] and Asia.[6] The present cross-sectional study performed among schoolchildren in southern Ivory Coast was designed to: (i) assess the overall prevalence of tinea capitis; (ii) describe its associated epidemiological determinants; and (iii) identify the causative agents.

Materials and methods

Study population

The study was carried out in the central and southern regions of Ivory Coast, which include the forest zone and the southern

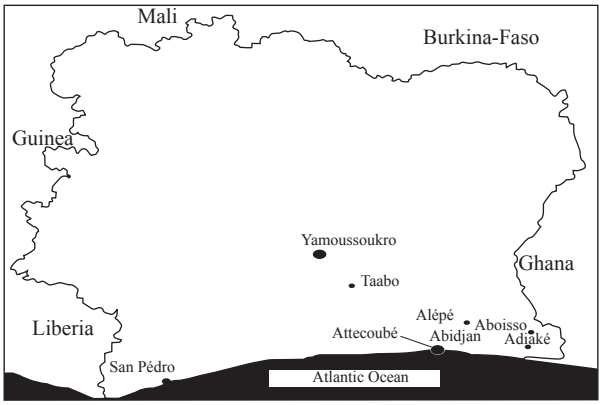

Figure 1 Map of ivory coast showing the towns included in this study

part of the savannas (Fig. 1). The climate is of wet, tropical type and includes four distinct seasons: (i) a short rainy season (March–May); (ii) a dry season (May–July); (iii) a longer rainy season (July–October); and (iv) a longer dry season (November–March).

Seven towns were chosen for this study. Yamoussoukro and Taabo are located in central Ivory Coast. Taabo is situated 37 km northwest of Yamoussoukro, the administrative capital of Ivory Coast. Aboisso, Adiaké, Alépé, Attecoubé, and San Pédro are located in southern Ivory Coast.

From October 2008 to July 2009, 17,745 children attending urban and rural primary schools in these seven towns were clinically examined. No exclusion criteria were defined. The protocol for the study was presented to the chiefs and elders of the villages concerned and to the headteachers of primary schools. Informed consent was obtained before enrollment and participation in the study. Written informed consent was obtained from parents or legal guardians prior to the children's inclusion in the study.

All children were submitted to a careful examination of the scalp conducted by a team of physicians. Children with lesions that were clinically indicative of possible tinea capitis were enrolled for further participation. Samples for mycological examination were taken from these children.

Laboratory methods

Before sampling, lesions were disinfected with ether in aseptic conditions.

Hair stumps, skin scrapings, and scales were taken asceptically using sterile scalpel blades. All samples were then transported to the Mycology Laboratory, Center for Diagnosis and Research on AIDS and Opportunist Diseases, Abidjan, for mycological examination. Each sample was subjected to direct microscopic examination using 30% potassium hydroxide (KOH) solution and cultivation on Sabouraud's dextrose agar supplemented with 0.5 g/l chloramphenicol and 0.4 g/l cycloheximide. Cultures were incubated at 27 °C for 4–6 weeks and observed weekly for evidence of growth. Dermatophyte identification was based on the macroscopic and microscopic characteristics of colonies.[14]

Statistical analysis

Data were analyzed using the chi-squared test as appropriate. The level of statistical significance was set at $P < 0.05$. Statistical analysis was carried out using SPSS Version 11 (SPSS, Inc., Chicago, IL, USA).

Results

Of the 17,745 pupils examined, 2645 (14.9%) were found to have scalp lesions, and 2458 (92.9%) of these were found to be mycologically positive by direct microscopy and/or culture. There were significant differences in the occurrence of tinea capitis with respect to locality (Table 1). The frequency of tinea capitis was twice as high in Taabo (18.1%) as it was in Aboisso (9.2%).

Table 2 shows occurrences of tinea capitis with respect to age group and sex. Of 2458 children with

Table 1 Occurrences of tinea capitis in schoolchildren in seven towns in Ivory Coast

Location	Children examined, *n*	Children with lesions, *n*	Children found positive, *n*	Examinees positive, %
Aboisso	2524	243	233	9.2
Adiaké	2421	277	243	10.0
Alépé	2739	477	457	16.7
Attecoubé	2660	403	387	14.5
San Pédro	2562	377	363	14.1
Taabo	2419	525	438	18.1
Yamoussoukro	2420	343	337	13.9
Total	17 745	2645	2458	13.9

[a]$P < 0.001$.

Table 2 Age and sex distribution of schoolchildren found to be infected with tinea capitis

Age group	Children examined, *n*	Boys infected, *n* (%)	Girls infected, *n* (%)	Total infected, *n* (%)
4–8 years	5869	649 (69.4)	287 (30.6)	936 (38.1)
9–12 years	9513	1006 (75.3)	329 (24.7)	1335 (54.3)
13–16 years	2363	164 (87.7)	23 (12.3)	187 (7.6)
Total	17 745	1819 (74.0)	639 (26.0)	2458 (13.9)

[a]$P < 0.001$.

dermatophytosis, 74.0% and 26.0% were, respectively, male and female.

The highest and lowest frequencies of dermatophytosis were seen in patients ranging in age from 9–12 years (54.3%) and 13–16 years (7.6%), respectively. There were statistically significant differences in prevalence between age and sex groups ($P < 0.001$). Tinea capitis was rarely observed in persons > 12 years (7.6%) of age.

The majority of isolated dermatophytes were anthropophilic (80.3%). The remainder were zoophilic dermatophytes (19.7%).

Trichophyton soudanense was the most frequently isolated (56.7%), followed by *Microsporum langeronii* (21.4%), *Trichophyton mentagrophytes* (19.7%), *T. violaceum* (1.4%), and *Trichophyton rubrum* (0.8%) (Table 3).

Discussion

In Ivory Coast, tinea capitis is estimated to affect 11–12% of the pediatric population.[8]

In the present study, 2458 (92.9%) of the 2645 samples obtained from children who presented lesions suspicious for tinea capitis enabled the isolation of fungi after culture.

Furthermore, of 2458 positive cultures, only 329 (13.4%) direct examinations appeared to be negative, which suggests that this routine test has high sensitivity compared with culture. These culture negative results may reflect the administration of an antifungal treatment initiated before sampling because some patients may have given incorrect information on their receipt of antifungal treatment.

This study corroborates reports from various parts of the world on high incidences of tinea capitis among primary schoolchildren.[7,12]

The present prevalence of 13.9% is comparable with those previously documented among schoolchildren in other countries, such as Ethiopia (16.0%),[15] Mozambique (11.6%),[16] and Nigeria (11.3%).[17]

This prevalence is also clearly higher than those found among infants in developed countries, such as the 3–8% reported in Ohio, USA.[18]

In the present study, 2458 of the 2645 (92.9%) samples obtained allowed for the isolation of fungi after culture. It should be noted that samples were obtained only from symptomatic children. The prevalence rate mentioned in this survey may reflect an underestimation because it does not take into account asymptomatic carriers, who may represent a significant reservoir of infection.[19] This study found a significant relationship between male gender and tinea capitis, as previously documented in other surveys.[8,11,12,15] Dermatophyte infection of the scalp was more common in males than females. The higher susceptibility of boys may be explained by the fact that boys normally reach puberty later than girls, and sebum acidity may prevent the development of dermatophytes.[20]

Tinea capitis was most prevalent in children ranging in age from 9–12 years (54.3%), followed by those in the range of 4–8 years (38.1%). These age groups have been prominent in earlier reports.[12] Children in these age groups constitute the most active in the population, especially in playgrounds, and thus are more likely to be in closer contact with sources of fungal pathogens.

The present study has confirmed that anthropophilic dermatophytes represent the most common (80.3%) dermatophyte species isolated in tinea capitis and that *T. soudanense* (56.7%) is the main cause of scalp ringworm in the study region.

Thus, in Ivory Coast, the predominant etiological agent of tinea capitis seems to be *T. soudanense*,[8,9] as it is in

Table 3 Prevalences of dermatophytes identified by culture as agents of tinea capitis in schoolchildren, by locality

	Positive for infection, *n* (%)					
Location	***Trichophyton soudanense***	***Microsporum langeronii***	***Trichophyton mentagrophytes***	***Trichophyton violaceum***	***Trichophyton rubrum***	**Total**
Aboisso	142 (61.9)	29 (14.3)	18 (9.5)	1 (2.4)	0	190 (9.2)
Adiaké	80 (33.7)	56 (22.9)	100 (42.6)	1 (0.8)	0	237 (10.0)
Alépé	220 (60.1)	48 (12.0)	41 (21.7)	5 (3.8)	8 (2.3)	322 (16.7)
Attecoubé	163 (44.5)	79 (21.4)	101 (27.8)	20 (5.6)	2 (0.5)	365 (14.5)
San Pédro	223 (64.3)	49 (16.6)	47 (18.1)	0	4 (0.9)	323 (14.1)
Taabo	134 (42.5)	104 (30.7)	77 (25.4)	3 (0.8)	2 (0.5)	320 (18.1)
Yamoussoukro	201 (66.7)	75 (26.4)	20 (6.8)	0	0	296 (13.9)
Total	1163 (56.7)	440 (21.4)	404 (19.7)	30 (1.4)	16 (0.8)	2053 (100)

[a]$P < 0.001$.

Nigeria,[17] Guinea,[10] Senegal,[21] Gabon,[22] and sub-Saharan West Africa (Ethiopia).[23] In the present study, the etiological agents of tinea capitis varied across the towns studied, but *T. soudanense* was reported to predominate in almost all locations. *Microsporum langeronii* (21.4%) and *T. mentagrophytes* (19.7%) were the next most common etiological agents. These data are in agreement with the findings of other Ivorian authors.[8,9]

This is the second study to identify *T. violaceum* as a secondary causative agent of tinea capitis in Ivory Coast, a finding that is probably related to increasing population migration. Changes in the causative fungi of tinea capitis have been observed over the past five decades, such as in the USA[18] (from *M. audouinii* to *T. tonsurans*), in Sarajevo[24] (from *T. violaceum* to *M. canis*), and in northwest Europe[11] (from *Trichophyton schoenleinii* to *T. violaceum*).

The present findings indicate a need for further prospective epidemiological studies to confirm the apparent emergence of *T. violaceum* in Ivory Coast. In fact, *T. violaceum* has been detected as the most prevalent species in several African and Asian countries, including Ethiopia[15] (81.6%), Libya[25] (50.0%), Egypt[13] (71.1%), Morocco[26] (46.0%), and Tunisia[27] (66.7%).

Conclusions

The present study shows that the most commonly isolated agent from superficial tinea capitis infections in Ivory Coast was *T. soudanense*. Well-rounded epidemiological research is needed in this area and should cover both rural and urban regions.

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