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Prevalence of *Tinea capitis* in Schoolchildren in Three Villages of Woleu-Ntem Province Haut Ntem Department, Gabon

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Research Article

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Abstract

Introduction: Tinea capitis is a benign alopecising fungal infection mainly affecting schoolchildren with a tendency to spontaneous healing at puberty, and caused by dermatophytes.

Objective: to determine the prevalence of Tinea capitis in schoolchildren in the Haut Ntem department.

Materials and Methods: This was a descriptive cross-sectional study conducted from November 11, 2021 to April 7, 2022 in 3 villages in the Haut Ntem department. The ringworm lesions were taken from schoolchildren head using a scalpel and collected in a sterile Petri dish. Each sample was examined directly and cultured on Sabouraud Chloramphenicol Actidione medium. Tinea capitis was diagnosed if either direct examination or culture was positive.

Results: Among the 128 children, included, median age was 9 years, Tinea capitis with small plaques (66.4%) were more frequent than those with large plaques (33.6%). The frequency of Tinea capitis was higher on direct examination (23.6%) than on culture (9.4%). The age group most affected by both direct examination and culture was [6-9 years] ($p=0.27$). After culture, Tinea capitis of the scalp was more frequent in Gabon-Ville (41.7%); whereas its frequency (25.0%) was similar in Akok and Gabon-Ville on direct examination. Endothrix parasitism was significantly more frequent ($p<0.0001$). Tinea capitis was mainly due to the Trichophyton genus (100%, $p<0.0001$).

Conclusion: Tinea capitis are a public health problem in rural Gabon. They are dominated by small-plate ringworm caused by fungi of the Trichophyton genus.

Keywords: Prevalence; Ringworm; Haut Ntem; Trichophyton; Gabon

Abbreviations: KOH: Potassium Hydroxide; SCA: Sabouraud Chloramphenicol Actidione.

Introduction

Dermatophytes are a group of microscopic fungi that can affect the hair and cause *Tinea capitis* [1]. It is a benign, alopecising fungal infection that mainly affects school children, with a tendency to spontaneous recovery at puberty [2]. They are caused by zoophilic, telluric or anthropophilic species whose cosmopolitan geographical distribution may vary according to rural or urban areas [3]. The epidemiology and species involved in the occurrence of ringworm are constantly evolving worldwide [4].

In Africa, data on *Tinea capitis* are more extensive in North and West Africa than in Central Africa, with prevalence ranging from 11.3% to 76.4% [3,5-12]. In Central Africa, in Cameroon, scalp ringworm in school-age children has a prevalence ranging from 8.1%-21.48%, with anthropohilic species as the causative agents [13,14].

In Gabon, Afene NS, et al. [15] and Hogewoning AA, et al. [16] respectively in urban and semi-urban environments found that scalp ringworm was highly prevalent, with a predominance of *Trichophyton* species. These data are among the few found in Gabon. With the aim of contributing to our knowledge of the epidemiology of childhood scalp ringworm, we carried out this study to investigate the prevalence of scalp ringworm in rural areas.

Materials and Methods

Study Site and Population

A cross-sectional study was conducted from January to April 2022 among school-aged children from three village schools (Gabon-Ville, Akok, Mbounaville) in the Woleu-Ntem province of the Haut Ntem department, Gabon. Children clinically suspected of having scalp lesions were included after written informed consent and parental agreement. A questionnaire was submitted to all parents of included children to collect sociodemographic data and health status. Children under 3 years of age were not included in the study

Sample Collection and Handling

For each child included, hair was removed from the scalp using a scalpel blade, and cultured. Samples were inoculated on Sabouraud Chloramphenicol actidione for 7-14 days at 30-35°C.

Diagnosis of Fungal Species

Mycological diagnosis is carried out by two methods: direct examination and culture. Direct examination is performed on hair. It required 30% KOH (potassium hydroxide). A drop of potassium hydroxide is placed on a clean slide, then a fragment of the sample is placed on the slide, covered with a coverslip and observed with a x10 (tracing) and x40 (identification) objective. The type of parasitism (endothrix, Trichophytic hair and endo-ectothrix, microsporic hair) was revealed by microscopy. For fungal culture, samples were seeded in Sabouraud-chloramphenicol-actidione (SCA) medium contained in tubes and incubated at 27-30°C for 21 to 30 days. Identification was based on macroscopic and microscopic criteria for scalp dermatophytes.

Statistical Analysis

Data from children with suspected scalp lesions were collected and password-protected. Data included age, sex, residence and type of suspected lesion. Data were entered into MS Excel® (Microsoft Corporation Seattle, USA). All statistical calculations were performed using SPSS version 20 (IBM SPSS, Chicago, USA) and Staview 05.

Ethical considerations: Participants gave written informed consent through their parents or legal guardians. Confidentiality was ensured by concealing the names of children suspected of having scalp ringworm through the use of identification numbers in the questionnaires. Participants diagnosed with various lesions of scalp ringworm were treated at their own health center, while others requiring further treatment were referred to the appropriate health services.

Results

Socio-Demographic and Clinical Characteristics of Children with Suspected Ringworm Lesions of the Scalp

The total number of children included in the study was 128. Table 1 shows that the study population consisted mainly of children aged [6-9] years with a median age of 9 years with q1: 5.2 years and q3: 10.0 years. The sex ratio was 0.7 in favor of males. Small plaque ringworm was more frequent than large plaque ringworm. Small-plate ringworm was twice as frequent as large-plate ringworm.

Age groups	Frequency (n)	Percentage (%)
[3-5]	32	25,0
[6-9]	50	39,1
[10-13]	46	35,9
Sex		
Male	74	57,8
Female	54	42,2
Locality		
Akok	48	37,5
Gabon-ville	36	28,1
Mbounaneville	44	34,4
Type of scalp ringworm		
Small plaque moth	85	66,4
Large plaque moth	43	33,6

Table 1: Distribution According to Socio-Demographic and Clinical Characteristics of Children with Suspected Ringworm Lesions of the Scalp.

Frequency of Scalp Ringworm in Rural Schoolchildren

Among 128 children with suspected scalp ringworm lesions examined, direct examination was positive in 30 (23.6%) children, while culture was positive in 12 (9.4%) children.

Socio-Demographic and Clinical Characteristics of Children with Positive Direct Examination and Culture Results

The socio-demographic, clinical and microscopic characteristics of the samples of children with scalp ringworm according to the results of direct examination and culture are given in Table 2.

Male were twice as affected by scalp ringworm as girls on culture (71.4% vs. 3.7%), while on direct examination both sexes were affected in almost equal proportions. Small plaque ringworm (n=21; 24.7%) was more common than large plaque ringworm (n=9; 20.9%), both on direct examination and after culture. The same was true for endothrix parasitism, which was significantly more frequent than endo-ectothrix parasitism (p<0.0001). Both on direct examination and culture. Other socio-demographic and clinical characteristics of the study population were not associated with either direct examination or culture positivity.

	Positive direct exam			Positive Culture		
	Frequency (n)	Pourcentage (%)	*p*	Frequency (n)	Pourcentage (%)	*p*
Age groups			0,17			0,27
[3-5]	5	15,6		3	4,3	
[6-9]	16	32,0		7	9,4	
[10-13]	9	19,6		2	4,3	
Sex			0,78			0,06
Male	18	24,3		10	71,4	
Female	12	22,2		2	3,7	
Locality			0,85			0,53
Akok	12	25,0		4	33,3	
Gabon-ville	9	25,0		5	41,7	
Mbounaneville	9	20,4		3	25,0	
Type of scalp ringworm			0,63			0,19
Small-plate moth	21	24,7		10	11,8	
Large-plate moth	9	20,9		2	4,6	
Type of hair parasitism			<0,0001			**<0,0001**
Endotrix	24	80,0		10	41,7	
Endo-ectothrix	6	20,0		2	33,3	

Table 2: Prevalence of Leather Moths on Direct Examination and Culture According to Socio-Demographic, Clinical and Microscopic Characteristics of Children.

Fungal Agents Responsible for *Tinea capitis* in the Study Population

Scalp ringworm was mainly due to the genus *Trichophyton* (n=12; 100%; p<0.0001). The species isolated were *Trichophyton soudanense* (n=10; 91.7%) and *Trichophyton tonsurans* (n=1; 8.3%).

One case of association between *T. soudanense* and *T. tonsurans* (8, 3%) was found. *T. soudanense* was significantly more isolated than *T. tonsurans* (p<0.0001). Significantly (p=0.03), *T. Soudanense* was more frequent in boys (n=9/12), than in girls (n=1/12). The [6-9] age group was the one in which *T. soudanense* was most frequently identified (n=6/12). As for its distribution between localities, it was not statistically different (Figure 1).

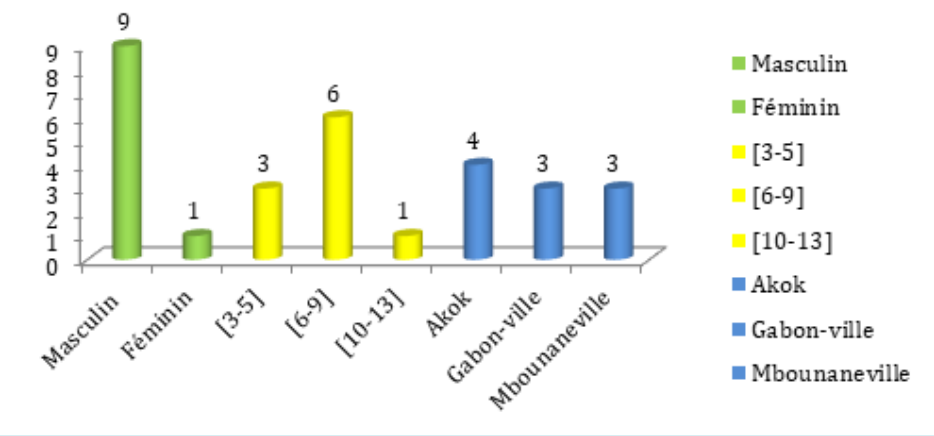

Figure 1: Distribution of *T. soudanense* by Sex, Age Group and Locality in the Study Population.

The distribution of etiological agents of scalp ringworm by locality is shown in Figure 2. Scalp ringworm caused by *T. soudanense* was more frequent in the different localities.

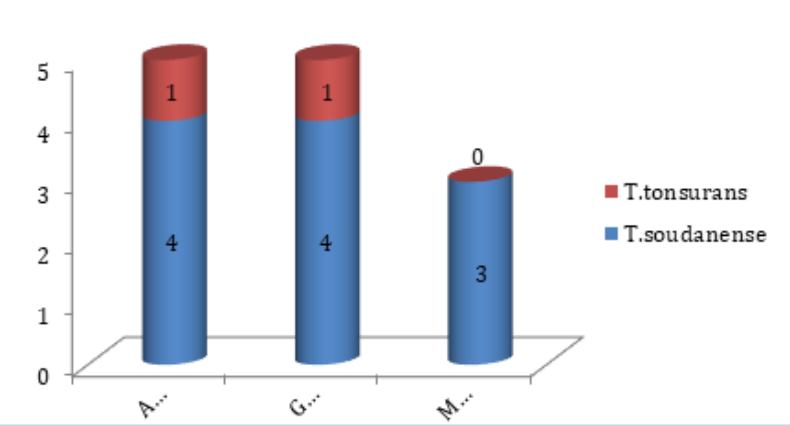

Figure 2: Distribution of *Trichophyton* Species Responsible for Scalp Ringworm, by Locality.

Discussion

School children with suspected enrolled scalp ringworm lesions were predominantly male. This gender distribution was also observed in (Gabon, Marocco Cameroon and Benin), by Hogewoning AA, et al. [16] in Lambarene, Gabon, Kechia FA, et al. [13] in Meiganga, Cameroon, Elmaataoui A, et al. [17] in Rabat, Morocco, Degboe B, et al. [18] in Cotonou, Benin, where the number of male with suspected scalp ringworm was higher than that of female. On the other hand, some authors Coulibaly O, et al. [7] in Mali, Oussou MA, et al. [8] in Bouke, Cote d'Ivoire, Sidat MM, et al. [19] in Mozambique had a predominance of female over male. Others, Afene NS, et al. [15] in Libreville, Gabon, obtained as many female as male in their studies.

The higher incidence of suspicious lesions in male than in female can be explained by the fact that female generally have longer hair than males. This means that the visible destruction of the hair takes place more slowly than in males, whose hair is shorter. Male hair is more rapidly broken by dermatophyte contamination. Since dermatophytes are keratinophilic, they eat away at the hair bulb, altering the structure of the hair and causing it to break faster. In addition, hair care for female may explain the greater number of suspicious lesions observed in female [15].

As for the greater presence of suspicious lesions with small plaques compared to those with large plaques. All these could be due to the rarity of proximity between humans and animals, as in northern African countries, and the fact that we are in a rainy rather than a dry zone.

Mycological examination of our samples showed that the frequency of scalp ringworm was higher on direct examination than on culture. This observation is also mixed in the literature, with some authors reporting results with trends similar to our own Oussou MA, et al. [8] and Olarinoye GM, et al. [9] while others have observed that culture increases the frequency of scalp ringworm [6,11], and that culture results overlap well with those of direct examination [3].

The role of culture and direct examination in mycological procedures remains irrefutable. However, their sensitivity depends on a number of factors, such as the quality of the reagents used for culture and direct examination. But also, the performance of technicians in reading samples on direct examination and after culture. It may also be considered that patients may have used fungistatic or fungicidal substances that have the capacity to inhibit the growth of fungi in culture [5].

The prevalence of scalp ringworm based on culture results was 9.4% in our study. These results are lower than those of Sy O, et al. [20] who found a prevalence of 10.4% in rural Mauritania, and Ngwogu AC, et al. [10]. Adesiji YO, et al. [21] found a prevalence of 91% in the rural community of Osogbo in Nigeria. However, other authors, such as Testa J, et al. [22] in Bangui found lower prevalences than ours [13,18,23].

The prevalence of scalp ringworm varies from region to region, country to country. This variation in frequency is also observed within the same country, from one locality to another. This has been attributed to geographical, ecological, climatic, socio-economic and even genetic differences. Even differences between urban and rural areas have been reported [7,8,19]. This could explain the difference in results between the studies by Afene NS, et al. [15] carried out in urban areas and our own study carried out in rural areas.

Our results showed that scalp ringworm most affected children aged [6-9 years]. Males showed small-plate ringworm with Endotrix parasitism. Data on the profile of scalp ringworm are just as variable as prevalence. Indeed, some authors find identical data to ours concerning age and sex [10,15,16,24]. Others, such as Kechia, et al. [13], found a predominance of males, with an average age of 10 years.

With regard to the type of ringworm, our results are contrary to those of Kallel in Tunis [25], which showed ringworm with a large ectothrix plate. As for the type of parasitism, the literature has shown that it depends on the species responsible for the ringworm. Mezouari EE, et al. [26] found a predominance of Endotrix parasitism, as we did, whereas other teams found ectothrix parasitism [26].

The type of Endotrix parasitism found in this study was linked to the exclusive existence of the *Trichophyton* genus. Among *Trichophyton* species, only two were isolated. These were *T. soudanense* (91.7%) and *T. tonsurans* (8.3%). These are the species most frequently found by Hogewoning AA, et al. [16] in rural Gabon, while Afene NS, et al. [15] found a prevalence of *T. soudanense* and *T. gourvilii* in urban areas.

These two studies, although small in number, help to demonstrate the place occupied by *T. soudanense* in the ecology of scalp ringworms in Gabon. In Mauritania, *T. soudanense* and *T. rubrum* were the species most frequently found by Sy O, et al. [21]. In Nairobi, *T. tonsurans* was the species most frequently found along with *T. rubrum* [27].

The exclusive detection of *Trichophyton* can be explained by the fact that these are mostly anthropophilic species. The rarity or even absence of co-habitation with animal species would explain the absence of zoophilic species such as *Microsporum*. In addition, factors such as family poverty, contact and shared use of certain toiletries, combined with the neglected nature of *Tinea capitis* [22] could explain our results.

The species we isolated in our study are among those most frequently found in sub-Saharan Africa [28]. Similar results were obtained by Hogewoning AA, et al. [16] and Afene SN, et al. [15], except that in Afene N's study, the second species was *T. gourvilii*.

These results are in contrast to those found in North Africa (Tunisia, Morocco, Algeria), where zoophilic species are the most isolated [25,29,30]. However, the change in lifestyle with proximity to animals has begun to be noticed in some studies, where the genus *Microsporum* is gaining prominence in the ecology of scalp dermatophytes [31].

Conclusion

Scalp ringworm is still a public health problem in rural Gabon. They are dominated by small plaque ringworm. The anthropophilic species *T. soudanense* and *T. tonsurans* are the only species responsible for this pathology. Rapid diagnosis and management of these diseases in rural areas could help reduce their prevalence and human-to-human contamination.

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