Dermatophytes and Other Fungi Associated with Hair-Scalp of Nursery and Primary School Children in Awka, Nigeria

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Citation

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Abstract

A total of 2,117 nursery and primary school children aged 1-13 years were surveyed for hair-scalp infection in Awka, Nigeria between January and March 2004. Specimens for mycological investigations were confirmed by microscopic examinations in 100 cases (4.7%) and the causative agents were isolated and cultured in 84 positive cases (3.9%). Zoophilic dermatophytes accounted for (42%) followed by geophilic (37%) and anthropophilic (21%) dermatophytes. Microsporum gypseum and Trichophyton mentagrophytes were the main etiologic agents. Other non-dermatophytic fungi species isolated were Alternaria alternata 14(17%), Aspergillus fumigatus 10 (12%) Fusarium solani 7 (8%), Penicillium sp 3 (4%) and Candida albicans 3 (4%).

INTRODUCTION

The superficial fungal infections or superficial mycoses affect the hair, nails and skin [1,2,3]. On the skin and scalp, the lesions are often roughly circular with raised border, but may coalesce to form confluent areas of dry, scaling skin, inducing itching and scratching which in severe cases may ulcerate [4]. The superficial mycoses include principally dermatophytes, pityriasis versicolar, tinea-nigra, black piedra, white piedra, cutaneous candidosis etc. Untold numbers of people world-wide suffer these infections. Sex, race and occupation have little recognized differential influence upon the frequency of these infections. Age, however influences susceptibility to dermatophytosis due to developed immunity[5]. Children are mostly affected by dermatophytic infection before and during puberty[6]. It is caused by a variety of zoophilic, anthropophilic and geophilic dermatophytes of the genera Microsporum and Trichophyton [2,6].

The prevalence of superficial mycoses (Tinea capitis) has been studied in different parts of the world [7,8,9,10]. The relative occurrence of the etiologic agents of these infections varies from country to country and from one climatic region to another [11,12,13]. In tropical countries, a warm and humid climate, crowded living and poor sanitary conditions all promote the spread of these infections [14]. In Nigeria, only a few research studies are available on prevalence and etiological agents of Tinea capitis in schools in different parts of the country [15,16,17,18,19].

The present study is aimed at detecting the presence of dermatophytes and other fungi associated with hair-scalp of nursery and primary school children in Awka, Nigeria.

MATERIALS AND METHODS

SAMPLE SELECTION

The selection was carried out using the method described by Ellabid[20]. A total of 2117 children with an age range of 1-13 years suspected to have superficial hair-scalp infections were randomly selected from 4 primary schools in Awka, Nigeria between January and March 2004. Questionnaires and physical observations were used to obtain information on duration of the lesion, clinical picture, prior therapy as well as demographic data such as age, sex, nationality and family status of the respondents. The final selected culture positive children for this study consisted of 51 males and 33 females, including nursery children.

SAMPLE COLLECTION

Two sample collection methods were used in this study: In one method, samples consisting of epidermal scales and infected hairs were scraped from the scalp/rim of lesions using a sterile scalpel blade following cleaning of the affected sites with $70^{v}/_{v}$ isopropyl alcohol. The scrapings were collected on a piece of sterile brown paper[21]. Moist

cotton swabs were used to collect pus from inflammatory lesions. The samples were divided into two portions: one for microscopic examination and one for culture. The collected samples were transported to the laboratory within 2 hours for microscopic and cultural analysis. A second method was a brush culture collection technique described by Mackenzie.[22]

SAMPLE PROCESSING

DIRECT MICROSCOPIC EXAMINATION

Direct microscopic examination of scales and broken-off hairs placed on a microscope slide with one or two drop of 20% potassium hydroxide (KOH) and a cover slip was performed. The sample was warmed for 5 minutes over a flame as described by Hainer[4]. Each treated slide was then carefully examined under low (X10) and high (X40) power objective for the presence of hyphae and/or arthroconidia.

FUNGAL CULTURE

Each scraping was cultured into sabouraud dextrose chloramphenicol actidione agar[23]. A duplicate inoculation of the specimen was also cultured on sabouraud's dextrose cycloheximide agar. The plates were incubated at 28°C for up to 4 weeks and examined at 2 to 3 day intervals for fungal growth. Fungal isolates were subcultured onto plates of sabouraud's agar, potato glucose agar and corn meal agar. The isolates were examined visually and microscopically for morphology of fungi using lactophenol cotton blue by slide culture technique. Yeasts were identified with the taxonomic criteria outlined by Lodder[24]. Each isolate was tested for the ability to ferment and/or assimilate different carbon sources. They were also tested for their ability to produce Urease, utilize HNO3 as the sole nitrogen source and grow at 37°C. The dermatophytes species were identified by gross and microscopic morphology and by in-vitro tests, if required based on the criteria enumerated by Rebell and Taplin[25] and Frey et al. [26]

RESULTS

Samples were obtained 2117 children presenting with suspected superficial mycoses during the course of this study. Diagnosis was confirmed by microscopic examination in 100 cases (4.7%) and the causative agents were isolated in 84 cases (3.9%). From the total number of isolates identified, dermatophytes were the most prevalent.

Table 1 lists the species isolated, their frequencies and the sites where they were found. Many fungi belonging to 7 different genera were recovered from the hair-scalp of 84 of the 2117 children. The majority of the isolated dermatophytes were zoophilic (42%) followed by geophilic (37%) and anthropophilic (21%) dermatophytes. Microsporum gypseum and Trichophyton mentagrophytes were the most frequently isolated dermatophytes. Other skin mycoses isolated include Alternaria alternata 14 (17%), Aspergillus fumigatus 10 (12%), Fusarium solani 7 (8%), Penicillium sp 3(4%) and Candida albicans 3(4%).

Table 2 shows the pattern of distribution of infection by age. Analysis of the data showed that 47 children examined representing (47%) of the 100 children were between the ages of 5-9 years, while 23 (23%) were between 10-13 years and 30 (30%) were between 1-4 years.

Table 3 shows the distribution of fungal positive cases by sex. Among 84 culture positive children examined, 56 (66.7%) were male, while 28 (33.3%) were female.

Table 4 list the species isolates (etiological agents) from inflammatory lesions. The children's clinical picture varied: 64 children (76.2%) presented gray patches with broken-off hair near the follicle and 10 children (11.9%) presented diffuse scaling with hairs broken off at the follicle with or without black dots. In 9 children (10.7%) the infection was inflammatory with follicular pustules and kerion. Finally, one child (1.2%) had an atypical presentation as amiantacea and atrophic patches with clinically apparent alopecia.

The majority of the inflammatory disorders were mainly recovered in cases of M.gypseum 33.3%) and T. mentagrophytes (22.2%) infections. Out of 9 children, (Table 4) boys were affected more than girls with a ratio of 2:1

Figure 1

Table 1: Frequency of Fungi found in hair scalp of 84 Positive Samples Positive Sample

Fungus	n	%
Microsporum audouinii	9	11
M. gypseum	31	37
Trichophyton tonsurans	3	4
T. rubrum	5	6
T. mentagrophytes	21	25
T. verrucosum	14	17
Alternaria alternata	14	17
Aspergillus fumigatus	10	12
Fusarium solani	7	8
Penicililum sp	3	4
Candida albicans	3	4

Figure 2

Table 2: Percentage distribution of infection by age

			Age (years)		
Location of school	No. Examined	School enrollment	1-4	5-9	10-13
Iyiagu district	24	521	5(16.7%)	14(29.8%)	5(21.7)
St. Mary's layout	33	503	7(23.39)	17(36.2%)	9(39.1%)
Okpuno	30	786	8(26.7%)	16(34.0%)	6(26.1%)
Achalla layout	13	307	10(33.3%0	-	3(13.0%)
Total	**100**	**2117**	**30(30%)**	**47(47%)**	**23(23%)**

Figure 3

Table 3: Percentage distribution by sex

Location of school	Enrollment	No. of (culture) positive case	Male	Female
Iyiagu district	521	19	18(32%)	1(4%)
St. Mary layout	503	33	20(36%)	13(46%)
Okpuno	786	24	12(21%)	12(43%)
Achalla layout	307	8	6(11%)	2(7%)
Total	**2117**	**84**	**56(66.7%)**	**28(33.3%)**

Figure 4

Table 4: Inflammatory infections and etiological agents

Dermatophyte	Boys	Girls
Microsporum gypseum	2	1
M. audiouinii	1	-
Trichophyton mentagrophytes	1	1
T. verrucosum	1	-
Aspergillus fumigatus	1	-
Candida albicans	-	1
Total	**6**	**3**

DISCUSSION

During the period of this study, samples were collected from 2117 children from 4 primary school districts and diagnosed as having a superficial fungal infection. Microscopic identification was performed in 100 cases and the causative agent was identified by culture in 84 cases.

Fungi are everywhere and no geographical area or any group of people is spared by these organisms. In Nigeria, superficial mycoses are among the commonest of infectious diseases and constitute the bulk of mycotic infections [15,16,17,27]. However, accurate assessment of the prevalence of etiologic agents is useful to estimate the size of the problem and to prevent transmission.

The incidence of hair-scalp infections among nursery and primary school children in Nigeria found that dermatophytes were the most common cause of all culture positive fungal infections involving the hair-scalp observed during the period of this study. Of the isolated species Microsporum gypseum and Trichophyton mentagrophytes are the most prevalent isolates. The increased incidence of these organisms as the major cause of most superficial mycoses in Nigeria is reported. [28,29]

In this study children could have contracted the infection either by direct contact with infected children at school or indirectly by sharing infected facilities, including combs, towels, etc[4]. Other factors contributing to the transmission of infections include over crowding and poor sanitary environment[4]. This is a common practice in most primary schools in Nigeria and this may facilitate transmission.

Three anthropophilic species of dermatophytes T. rubrum, T. tonsurans and M. audouinii. which are mainly human pathogens but occasionally infect animals, [4]were isolated from a number of children with hair-scalp lesions. Two zoophilic species of dermatophytes, T. mentagrophytes and T. verrucosum, which are fundamentally pathogens but sometimes cause disease in man,[4] were also isolated. Other mainly geophilic species (T. gypseum) were also isolated. Dermatophytes isolated by Rippon, [30] suggest that prevailing endemic pathogens vary among different regions and change with time in accordance with the existing living and hygiene conditions.

The role of pets (dogs) as reservoirs in transmitting dermatomycosis to children has been amply documented [31]. In this study only 2 children (2%) had contacts with pets and were not aware of the danger of contracting dermatophytosis.

Certain factors may influence the distribution of dermatophytosis. Srejaard [32] suggested infection is influenced by environment and also by age and sex. We found that the highest incidence of infection occurred in younger children (47%) aged 5-9 years and (30%) in children aged 1-4 years rather than in older children > 10 years (23%).

According to Ekenem,[5] age influences susceptibility to dermatophytosis because of the changes in immunity. In this

study the children may have been immunosuppressed due to the high incidence of infection recorded. These results are in agreement with the work of Hainer4 that children with dermatophytes are usually otherwise healthy. However, chronic and extensive infections are common in children who are immunosupressed or with depressed cell-mediated immunity. In Nigeria, malnutrition is a predisposal factor and influences the prevalence of skin diseases (Tinea capitis). This usually results in lower immunity especially in children. These children with Tinea capitis may get bitter spontaneously at puberty.

Most infected children on physical examination reveal a characteristics pattern of inflammation characterized by a greater degree of redness and scaling at the edge of the lesion or occasionally blister formation as in the case of most dermatophytes identified(Table 1). Mucosal involvement with an adjacent red, scaly skin rash was seen in Candida infection. Candida albicans, an opportunistic pathogen, was isolated in 3(4%) of children with non-dermatophytic mycoses, and was particularly common among female children. This finding also agrees with other studies that suggest that cutaneous candidiasis may be as important as dermatophytes, particularly in women [12,13,33,34].

The presence of other non-dermatophytes (particularly Aspergillus and Penicillium species) may be due to the ubiquitous nature of their spores in our environment, carried transiently on healthy skin.[35] Fusarium solani was isolated from scrapings from skin lesions [36]. In our study this organism was recovered mixed with other pathogens and its recovery from hair-scalp should be considered significant.

Alternaria alternata is a soil saprophytes and common pathogen. Cutaneous infections caused by Alternaria species are often associated with debilitating diseases or conditions.[37]. During the past decade there has been a significant increase in the number of phaeohyphomycotic infections recognized in humans[38,39]. Isolation of this fungus from hair-scalp may result from frequent outdoor playing habits of children and constant contact with contaminated soil which aids in the transmission of infection.

The study showed that dermatophytes were the most common cause of all culture positive fungal infections involving the hair-scalp among children. However, there were no children with HIV-AIDS, and there is a need for children who are generally at risk to be aware of the dangers of contracting dermatophytes. The government should create greater awareness of environment and personal hygiene to help to curb the incidence.

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