

Dermatophytes and other fungi associated with hair-scalp of Primary school children in Visakhapatnam, India: A Case Study And Literature Review

Y Avasn Maruthi, K Aruna Lakshmi, S Ramakrishna Rao, K Hossain, D Apta Chaitanya, K Karuna

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Abstract

A total of 2804 primary section pupils aged 6-15 years of 12 schools located at different places in Visakhapatnam were physically screened for hair -scalp infection. Three hundred and thirty six (11.98%) of these children were positive for the dermatophytic infection. The majority of the isolated dermatophytes according to percentage of occurrence were *Microsporum audouinii* (18.88%), *Chrysosporium keratinophilum* (16.66%), *Trycophyton mentagrophytes* (13.33%) and *Trycophyton terrestre* (3.33%). *Microsporum audouinii*, *Chrysosporium keratinophilum*, *Trycophyton mentagrophytes* were the most frequently isolated dermatophytes. Other skin mycoses isolated include *Fusarium moniliforme* (6.66%), *Aspergillus flavus* (5.55%), *Fusarium oxysporum* (5.55%) and *Penicillium funiculosum* (4.44%). Infection was mainly due to *Microsporum audouinii*, *Chrysosporium keratinophilum* and *Trichophyton mentagrophytes*. Infected domestic animals constituted the apparent source of infection for most pupils. Playgrounds of children and animal fields were also source of infection for children and animals

Name of the Laboratory: Air pollution and Environmental Microbiology laboratory, Dept.of Environmental Studies, Institute of Science, GITAM University, Visakhapatnam-530045, A.P, India.

INTRODUCTION

Tinea capitis, most often seen in children, is a dermatophyte infection of hair and scalp. Both anthropophilic and Zoophilic dermatophytes can cause *Tinea capitis*. It is commonly caused by the anthropophilic dermatophyte *Trichophyton tonsurans*¹. Although this superficial disease is world wide in distribution, in tropical countries, a warm and humid climate, crowded living and poor sanitary conditions all promote the spread of this infection². However, Zoophilic and anthropophilic strains of etiological agents often cause zoonotic infections. Several reports indicated that domestic animals constitute important reservoir of Zoophilic dermatophytes³.

Children playgrounds represent a favorite environment for children's play and are therefore expected to play an important role in epidemiology of human and animal mycoses⁴. In India, only a few research studies are

available on prevalence and etiological agents of *Tinea capitis* in schools in different parts of the country⁵. This study was undertaken to determine the incidence of hair-scalp infection in primary school children in association with dermatophytes and other fungi.

MATERIALS AND METHODS

Visakhapatnam has approximately total number of 113 government schools (primary, upper primary and high schools) in and round it. Questionnaire was administered along with physical examination of volunteers for scalp, body and nail ringworms. Based on health data, both collected both from city schools and King George Hospital and some schools were selected as study areas, with respect to control (K. D. P. M. High School). The particulars of the study areas are given in Table-1.

Volunteers were randomly selected in visited schools and examined to confirm the causative agents of the infection. This was carried out by the "hair brush diagnosis" of scalp ringworm or microscopic demonstration of fungus⁶. The samples were divided into two portions: one for microscopic examination and one for culture. For Microscopic

observation, Potassium hydroxide preparation two to four fragments of scalp and broken hair samples were placed on a glass slide with KOH(30%), gently heated and then evaluated microscopically for the presence fungal elements. Each scraping was cultured into Sabaroud dextrose Chloramphenicol actidione agar₇. 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 Lodder₈.

RESULTS AND DISCUSSION

According to health Data, it was observed that dermatophytes affected 336 of 11.98% (N=2804) of sample population of children (Table-1) of infected pupil. It was observed that 82 (21.9%) pupil reported with incidence of Dermatophytic infections out of 375 total sampled pupil at Allipuram Model School. The collected health data revealed that the rate of prevalence of dermatophytes and related hair-scalp infection among pupil was low 8(2.28%) at K D P M School, which was chosen as control.

Figure 1

Table 1: Prevalence of infections related to Dermatophytes among school children based on health data.

Name of the school investigated	No. of students are examined	No. of infected	Percentage of infection
Government fisheries Elementary School	130	25	19.23
M V P Handicap School	70	12	17.14
Jodugullapalem Mandal Parishad Primary School	75	10	13.33
Pedda Jalaripeta M C Primary School	127	19	14.96
K D P M high School	350	8	2.28
M C Primary School	150	11	7.33
A U English Medium School	245	28	11.42
R C M Kratadei Alded U P School	255	26	10.19
M V D M C High School	330	47	14.2
Queen Mary's School	370	36	9.7
Allipuram Model School	375	82	21.9
M G N School	327	32	9.8

Figure 2

Table 2: Percentage Distribution of hair-scalp Infection by Sex

Name of the school investigated	No. of students are examined	No. of infected	Percentage of infection	Boys	%	Girls	%
Government fisheries Elementary School	130	25	19.23	15	60	10	40
M V P Handicap School	70	12	17.14	8	66.66	4	33.34
Jodugullapalem Mandal Parishad Primary School	75	10	13.33	6	60	4	40
Pedda Jalaripeta M C Primary School	127	19	14.96	11	57.89	8	42.11
K D P M high School	350	8	2.28	6	75	2	25
M C Primary School	150	11	7.33	6	54.54	5	45.45
A U English Medium School	245	28	11.42	18	64.28	10	35.71
R C M Kratadei Alded U P School	255	26	10.19	15	57.69	11	42.30
M V D M C High School	330	47	14.2	31	65.95	16	34.04
Queen Mary's School	370	36	9.7	20	55.55	16	44.44
Allipuram Model School	375	82	21.9	53	64.63	29	35.36
M G N School	327	32	9.8	18	56.25	14	43.75
TOTAL		336	--	207	61.607	129	38.39

The collected health data elucidates that the occurrence of hair-scalp infection was more in boys (61.60%) on comparison with girls (38.39%) (Table-2). After analyzing the health data of prevalence of hair-scalp infection in pupil with respect to age group, it was conspicuous that the number of pupils of age group 5-8 years was suffering with infection (34.82%) (Table-3). But age group of 12-15 reported with less number of infections both in boys and girls, when compared with other age groups of selected pupil (Table-3).

Figure 3

Table 3 : Percentage distribution of hair-scalp Infection by Age Group

Name of the school investigated	No. of students are examined	No. of infected pupil	Percentage of infection	Age 5-8	%	Age 9-12	%	Age 12-15	%
Government fisheries Elementary School	130	25	19.23	7	28	10	40	8	32
M V P Handicap School,	70	12	17.14	3	25	7	58.33	2	16.66
Jodugullapalem Mandal Parishad Primary School	75	10	13.33	2	20	4	40	4	40
Pedda Jalaripeta M C Primary School	127	19	14.96	4	21.05	9	47.36	6	31.57
K D P M High School	350	8	2.28	3	37.5	3	37.5	2	25
M C Primary School	150	11	7.33	3	27.27	4	36.36	4	36.36
A U English Medium School	245	28	11.42	9	32.14	12	42.85	7	25
R C M Kratadrel Aided U P School	255	26	10.19	8	30.76	11	42.30	7	26.92
M V D M C High School	330	47	14.2	12	27.65	20	42.55	14	29.78
Queen Mary's School	370	36	9.7	11	30.55	14	38.88	11	30.55
Allipuram Model School	375	82	21.9	37	45.12	13	15.85	32	39.02
M G N School	327	32	9.8	17	53.13	8	25	7	21.87
TOTAL		336		117	34.82	115	34.22	104	30.95

Many fungi belonging to 11 genera were recovered from hair scalp of 90 of 2804 children. The majority of the isolated dermatophytes according to percentage of occurrence were *Microsporum audouinii* (18.88%), *Chrysosporium keratinophilum* (16.66%), *Trichophyton mentagrophytes* (13.33%) and *Trichophyton terrestris* (3.33%). *Microsporum audouinii*, *Chrysosporium keratinophilum*, *Trichophyton mentagrophytes* were the most frequently isolated dermatophytes. Other skin mycoses isolated include *Fusarium moniliforme* (6.66%), *Aspergillus flavus* (5.55%), *Fusarium oxysporum* (5.55%) and *Penicillium funiculosum* (4.44%) (Table-4).

Figure 4

Table 4: Frequency of Occurrence of Fungi in hair scalp of 90 positive samples

Isolated fungal Species	Occurrence in samples	
	n	%
<i>Microsporum audouinii</i>	17	18.88
<i>Microsporum gypseum</i>	7	7.77
<i>Microsporum nanum</i>	5	5.55
<i>Chrysosporium keratinophilum</i>	15	16.66
<i>Chrysosporium tropicum</i>	9	10.00
<i>Trichophyton mentagrophytes</i>	12	13.33
<i>Trichophyton terrestris</i>	3	3.33
<i>Aspergillus flavus</i>	5	5.55
<i>Fusarium moniliforme</i>	6	6.66
<i>Fusarium oxysporum</i>	5	5.55
<i>Penicillium funiculosum</i>	4	4.44

Most infected children on physical examination revealed a characteristic 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 identified⁹. Mucosal involvement with an adjacent red, scaly skin rash was seen in *Chrysosporium keratinophilum*. *Chrysosporium tropicum*, an opportunistic pathogen, was common among female children.

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. *Fusarium oxysporum* was isolated from scrapings from skin lesions¹⁰. In our study this organism was recovered mixed with other pathogens and its recovery from play ground soil should be considered significant.

Transmission between hosts usually occurs by direct contact with a symptomatic or asymptomatic host, or direct air borne contact with its hairs or skin scales. Infective spores in hair and dermal scales can remain viable for several months to years in the environment. It is necessary to replace the soil of school playgrounds periodically. Dermatophytic fungal spores are susceptible to common disinfectants such as Benzalkonium Chloride, dilute (1:10) chlorine bleach or strong detergents. The mechanical removal of any material containing keratin, such as shed skin and hairs, facilitates disinfection. Vacuuming is considered to be the best method to make soil free of dermatophytes¹¹.

Treatment of Dermatophytosis is often dependant on the clinical setting. For instance uncomplicated single cutaneous lesions can be adequately treated with a topical antifungal agent, however topical treatment of scalp and nail infections is often ineffective and systemic therapy is usually needed to cure these conditions¹².

In contrast, anthropophilic dermatophytes are readily spread between people. Control of disease in human beings can be prevented by adopting the good sanitation strategies.

Most dermatophytic infections are more common in children than adults. In view of these findings it may be concluded that the unclean soil of Schools may be considered as a health risk to children. The study showed that dermatophytes were the most common cause of all culture positive fungal infections involving the hair-scalp among children. However, 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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CORRESPONDENCE TO

DR (Mrs).Y.AVASN MARUTHI, Associate Professor, W/o V.B.K Srinivas,D.No:4-60-5/3(First floor), LIG-21, Lawsons bay colony,Visakhapatnam-530017-,A.P ,India. e-mail: ymjournal03@yahoo.co.in

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Author Information

Y. Avasn Maruthi, Ph.D.

Associate Professor, Dept.of Environmental Studies, Institute of Science, GITAM University

K. Aruna Lakshmi, Ph.D.

Associate Professor, Dept.of Engineering Biotechnology, GITAM University

S. Ramakrishna Rao, Ph.D.

Professor, Dept. of Civil Engineering, Andhra University

Kaizar Hossain, M.Sc.

M.Sc Student, Dept. of Environmental Studies, GITAM University

D. Apta Chaitanya, M.Sc.

Research Scholars, Dept. of Environmental Studies, GITAM University

K. Karuna, M.Sc.

Research Scholars, Dept. of Environmental Studies, GITAM University