

Full Length Research Paper

Dermatophytoses in rural school children associated with livestock keeping in Plateau State, Nigeria

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This article describes a study undertaken to evaluate the prevalence of dermatophytoses among one hundred and ten children between the ages of 3 to 14 years in rural primary school children of Barkin-Ladi Local Government Area, in association with the family livestock keeping, family hygiene level, environmental conditions of the schools and identify interventions to improve environmental health. Out of the number sampled, 108 (98.2%) were positive for fungal infections and 2 (1.8%) were negative was found to be highly significant at 5 and 10% level of probability at ($P = 0.01$ and $P = 0.05$). Of these 108 fungal isolates, 91(84.3%) were dermatophytes while 17 (15.7%) were non-dermatophytes. Among the pupils investigated, 56.5% fungal isolates were from males while 43.5% from females. From the site of fungal infections on the body of the pupils screened, 90 (83.4%) were from the head (hair) which is significant at 5 and 10% level of probability at ($P = 0.01$ and $P = 0.05$) compared to, 13 (12%) from the body trunks and 5 (4.6%) from the face. The dermatophytes isolates were; *Trichophyton mentagrophytes*, 26 (24%), *Trichophyton violaceum*, 11 (10.2%) *Microsporum audouinii* 10 (9.3%), *Trichophyton verrucosum* 8 (7.4%), *Microsporum ferrugineum* 8 (7.4%), *Microsporum canis* 7 (6%), *Trichophyton tonsurans* 6(5.5%), *Trichophyton concentricum* 4 (3.7%), *Trichophyton schoenleinii* 3 (2.8%) and *Trichophyton megninii* 2 (1.9%) and *Trichophyton rubrum* 6 (5.5%). The non-dermatophytes were; *Aspergillus fumigatus* 4 (3.7%), *Mucor* species 3 (2.8%), *Penicillium* species 2 (1.9%), *Aspergillus niger* 2(1.9%), *Aspergillus flavus* 2(1.9%), *Candida albicans* 2 (1.9%), *Trichoderma* species 1 (0.9%) and *Alternaria* species 1 (0.9%). The results showed the role of family hygiene standards and environmental sanitary quality in dermatophytoses among rural primary school children.

Key words: Dermatophytoses, school children, livestock, environmental hygiene.

INTRODUCTION

Human mycoses are infections of the skin or underlying tissues caused by fungi. These can be superficial, as in the case of athlete's foot, or progressive deep-seated infections such as invasive aspergillosis (Denning, 1998; Latge, 1999; Dutkiewicz and Hage, 2010). The disseminated infections may lead to high levels of

morbidity and mortality if not accurately diagnosed and treated. Dermatophytes are group of fungi which infect the skin, hair and nails. There are three specific genera which constitute dermatophytes. They are *Epidermophyton*, *Trichophyton* and *Microsporum* species. These three genera are the cause of dermatophytoses in both man and animals (Caffara and Scaligari, 1999). They also inhabit the soil (Caffara and Scaligari, 1999).

Dermatophytosis is however, not a reported or

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notifiable disease in Nigeria and other affected tropical countries because the disease is usually self limiting or produces bearable benign skin lesions (Adekeye et al., 1989). As a result actual prevalence figure for dermatophytosis is largely unknown in many endemic areas of Africa (Ayanwale and Alabi, 1988). However, zoophilic and anthropophilic strains of aetiological dermatophytosis agents often cause zoonotic infections (Even and Ranbitshek, 1960). The frequency of human mycoses caused by environmental fungi has increased dramatically over the past two decades (Pfaller et al., 2006).

Dermatophytosis occurs at any age, some are particularly prevalent in children (Julian and Michael, 2005; Mbata and Nwajagu, 2007). The age predilection is believed to result from the presence of *Pityrosporum orbiculare* which is a normal flora in the skin of children (Mandell et al., 1995). *Tinea capitis* which is the most common dermatophytosis in children under the age of ten (10) years usually varies with sex, depending on the causative fungus (Kao, 2005; Mbata and Nwajagu, 2007). Some other factors such as enlightenment, customs, and tradition of people, hygiene level and environmental sanitary conditions may influence the prevalence of dermatophytosis (Alabi, 1980). Children of primary school-age are usually between the ages of 3 to 14 years or above in rural areas, and thus, are more susceptible to various infections due to their close contact with each other, low immune status compared with adults.

Also, their inability to keep themselves clean always, and their frequent contact with soil and infected pets like dogs and cats at home. The study was carried out in order to determine the prevalence of dermatophytosis among primary school children and the impact of family hygiene, school environmental sanitation, sources of water supply and contact with pets. Therefore to compare the distribution of dermatophytosis agents among the school children in relation to sex and age groups, to evaluate the sanitary nature of the school's location and the pupils' parents standard of education and hygiene as well as the identification of the spectrum of dermatophytosis among the children in relation to their association with live stock or pets.

MATERIALS AND METHODS

Sampling

The three schools used for the study are situated in the central part of Barking Ladi Local Government Area of plateau State, Nigeria. There were no differences in climatic conditions or socioeconomic status of the schools. Health data was collected with self-administered questionnaire from the pupils (n= 110) schooling in those three schools. Also, demographic data and information on living habits such as type of beddings, source of water supply and other exposure situations such as keeping of animals and exposure at home or hobbies connected to exposure to dust (example playing with dogs or taking animals for grazing) were included. The children answered the questionnaires with the assistance of their

teachers.

Examination of samples for dermatophytosis

Children with suspected tinea lesions were randomly selected in visited schools. The lesions were cleaned with 70% alcohol and skin scrapings were collected into white envelopes using sterile surgical scalpel blade (one for each child). The skin scrapping samples were taken to the laboratory for direct microscopy and culture.

Direct microscopy

A part of the skin scrapings was examined by direct microscopy using 10% potassium hydroxide (KOH) to expose the fungal structures for microscopic identification under the 40x objective.

Culture

The remaining part of skin scrapings were cultured on Sabouraud Dextrose Agar (SDA) and incubated at room temperature (25°C) for 1 to 30 days. Fungal growth culture were identified and characterized based on macroscopic, microscopic and biochemical characteristics.

Identification and characterization

Fungal cultures on SDA plates were examined for identification macroscopically by observing the surface topography, colour, texture and edge of the fungus, while the reverse was examined for pigmentation, colour and growth of mycelia into the medium. The microscopic morphological examination, biochemical and physiological characteristics were observed according to (Gugnani, 1982).

A statistical comparison using chi-square test ($P > 0.05$) was used to determine the significant differences on the prevalence of dermatophytosis among children considering their sex, age, association with pets, source of water supply and their behavioural patterns were carried out.

RESULTS

Out of the 110 samples, 108 samples yielded fungal growth while 2 yielded no fungal growth. Out of the 108 samples that yielded fungal growth, 91 (84.3%) were dermatophytes, while 17 (15.7%) were non-dermatophytes. Among the three genera of dermatophytes, only epidermophyton was not isolated.

The distribution of fungi isolation is shown on (Table 1). The fungal isolates and distribution among the age groups are shown on (Table 1). The isolates were more within the age group of 7 to 10 years, was followed by the age group of 11 to 14 years (Table 1). The age group with the least fungi isolate was between 3 and 6 years (Table 2.) Table 3 shows the distribution of fungi isolates from the different body sites of the children. Table 4a shows the frequency of fungal infection in children. More of the non-dermatophyte fungi caused infection in children who had their bath once daily. Table 4b shows zoophilic

Table 1. Genus distribution of fungi isolates in children based on sex and age groups.

Genus	Age groups (Years)			Isolates	Frequency (%)
	3 – 6	7 – 10	11 – 14		
<i>Microsporum</i>	11	9	5	<i>M. audouinii</i>	9.3
				<i>M. canis</i>	6.5
				<i>M. ferrugineum</i>	7.4
				<i>T. violaceum</i>	10.2
				<i>T. mentagraphtes</i>	24.0
				<i>T. rubrum</i>	5.5
<i>Trichophyton</i>	10	32	24	<i>T. verrucosum</i>	5.5
				<i>T. concentricum</i>	7.4
				<i>T. schoenleinii</i>	3.7
				<i>T. tonsurrans</i>	2.8
				<i>T. megninii</i>	5.5
				<i>A. niger</i>	1.9
				<i>A. fumigatus</i>	3.7
<i>Aspergillus</i>	1	4	3	<i>A. flavus</i>	1.9
				<i>Penicillium</i>	1.9
<i>Penicillium</i> sp.				<i>Mucor</i>	2.8
<i>Mucor</i> sp.					
<i>Candidae</i>	-	-	2		
<i>Trichoderma</i>	-	-	1		
<i>Alternaria</i>	-	-	1		

Table 2. Frequency of isolation of dermatophytes in the population.

Genus	Isolates	Frequency
<i>Microsporum</i>	<i>M. audouinii</i>	10
	<i>M. canis</i>	7
	<i>M. ferrugineum</i>	8
<i>Trichophyton</i>	<i>T. violaceum</i>	11
	<i>T. mentagraphytes</i>	26
	<i>T. rubrum</i>	6
	<i>T. verrucosum</i>	8
	<i>T. concentricum</i>	8
	<i>T. schoenleinii</i>	4
	<i>T. tonsurrans</i>	3
	<i>T. megninii</i>	6
		2
		2
Others	<i>Penicillium</i>	2
	<i>A. niger</i>	2
	<i>A. fumigatus</i>	4
	<i>A. flavus</i>	2
	<i>Mucor</i> species.	3

dermatophytes in the sampled population.

The statistical analysis showed that the infections were more in male pupils as against their female counterparts. Also, the pupils (males) who had frequent contact with livestock were more infected with superficial mycoses

than those who had but had their bath regularly were significant at 5 and 10% levels of probability at ($P = 0.01$ and $P = 0.05$).

DISCUSSION

The association of environmental factors and public health are complex and pervasive especially among children. Dermatophytosis in children is mostly ignored. This is based on the assumption that such infections are self limiting. However, ring worm infections persist in children from rural areas, with poor hygiene, inadequate medical facility, poor water supply and poor environmental sanitation.

This study was carried out in a rural setting based on behavioural activities of the children. The results from this research showed a mixed isolates of dermatophytes and non-dermatophytes. The findings of this study have shown that the interaction of the school children with domesticated animals in their homes influenced the infection of superficial mycoses on them. The fungal lesions showed that *Tinea capitis* was most prevalent in children than *Tinea corporis* and *Tinea faciei*. This agrees with Niorimer et al. (2001) that *T. faciei* is rare in children. It was also observed that *T. capitis* was mostly caused by dermatophytes than non-dermatophytes, probably because dermatophytes are more keratinophilic in nature than non-dermatophytes.

This agrees with the work of Gugnani (1982), that

Table 3. Distribution of dermatophytes and non-dermatophytes isolates from the different sites of the body of the pupils.

Genus	Isolate	Face	Body (tunk)	Head (hair)
<i>Microsporum</i>	<i>M. audouinii</i>			10
	<i>M. canis</i>			7
	<i>M. ferrugineum</i>	1	2	5
<i>Trichophyton</i>	<i>T. mentagrophytes</i>	2		24
	<i>T. violaceum</i>	1		10
	<i>T. rubrum</i>	2		4
	<i>T. concentricum</i>	3	1	
	<i>T. verrucosum</i>			8
	<i>T. tonsurans</i>		1	5
	<i>T. schoenleinii</i>			3
	<i>T. megninii</i>			2
	Non-dermatophytes	<i>Penicillium species</i>	1	
<i>Mucor species</i>				2
<i>A. niger</i>		1		2
<i>A. fumigatus</i>		1		2
<i>A. flavus</i>				2
<i>Alternaria species</i>		1		
<i>Trichoderma species</i>				1
<i>C. albicans</i>				2
Total		13 (12%)	5 (4.6%)	90 (83.4%)

Table 4a. Distribution of fungi isolates on the children based on bathing activity.

Bathing periods	<i>Microsporum</i>	<i>Trichophyton</i>	Others
Once	<i>M. audouinii</i> (6)	<i>T. mentagrophytes</i> (21)	<i>A. niger</i> (2)
	<i>M. canis</i> (5)	<i>T. verrucosum</i> (6)	<i>A. fumigatus</i> (3)
	<i>M. ferrugineum</i> (6)	<i>T. schoenleinii</i> (2)	<i>A. flavus</i> (1)
		<i>T. concentricum</i> (2)	<i>Penicillium</i> (2)
		<i>T. rubrum</i> (4)	<i>Mucor</i> (3)
		<i>T. violaceum</i> (9)	<i>Aternaria</i> (1)
		<i>T. tonsurans</i> (5)	<i>Trichoderma</i> (1)
		<i>T. megninii</i> (2)	<i>C. albicans</i> (1)
	Twice	<i>M. audouinii</i> (4)	<i>T. violaceum</i> (21)
<i>M. canis</i> (2)		<i>T. mentagrophytes</i> (6)	
<i>M. ferrugineum</i> (2)		<i>T. verrucosum</i> (2)	
		<i>T. schoenleinii</i> (4)	
		<i>T. rubrum</i> (9)	
		<i>T. tonsurrans</i> (5)	
Thrice	<i>T. mentagrophytes</i> (2)	<i>A. fumigatus</i> (1)	
	<i>T. verrucosum</i> (1)		
Total	28	104	14

Table 4b. The different number of dermatophytes and non-dermatophytes infections among the pupils in relation to the various domesticated animals and environment.

Domestic animals	Number of children infected	Microsporium species	Trichophyton species	Others
Cats	17	<i>M. audouinii</i> (1)	<i>T. mentagrophytes</i> (7)	<i>A. flavus</i> (1)
		<i>M. canis</i> (5)		<i>Mucor spp</i> (1)
		<i>M. ferrugineum</i> (1)		<i>Aternaria</i> (1)
Dogs	35			<i>Trichoderma</i> (1)
		<i>M. audouinii</i> (3)	<i>T. verrucosum</i> (1)	<i>A. flavus</i> (1)
		<i>M. canis</i> (2)	<i>T. mentagrophytes</i> (11)	<i>A. niger</i> (1)
		<i>M. ferrugineum</i> (2)	<i>T. schoenleinii</i> (1)	<i>C. albicans</i> (1)
			<i>T. megninii</i> (2)	<i>Trichoderma</i> (1)
			<i>T. tonsurans</i> (3)	<i>Aternaria</i> (1)
			<i>T. concentricum</i> (1)	
Pigs	29		<i>T. ventagrophytes</i> (2)	
			<i>T. verrucosum</i> (1)	
Goats	23		<i>T. verrucosum</i> (5)	
No animals involved	11	<i>M. audouinii</i> (6)	<i>T. concentricum</i> (1)	<i>A. niger</i> (1)
		<i>M. ferrugineum</i> (5)	<i>T. mentagrophytes</i> (8)	<i>Mucor spp</i> (2)
			<i>T. violaceum</i> (6)	<i>penicillium</i> (2)
			<i>T. rubrum</i> (4)	<i>A. fumigatus</i> (4)
			<i>T. schoenleinii</i> (2)	<i>C. albicans</i> (1)
		<i>T. tonsurans</i> (3)		

superficial fungal infections are among the commonest infections diseases and constitutes the bulk of mycotic infections. Also the our findings are similar to the works of Mbata and Nwajagu (2007), who reported the dermatophytes and other fungi associated with hair-scalp of nursery and primary school children in Awka, Nigeria.

Dermatophytosis with dermatophytes species was most prevalent in children between ages 7 and 10. This agrees with the findings of Gugnani (1982) who observed a prevalence of infection in children between 6 and 10 years of age which may be due to the fact that, at this age, children play more. They are not hygiene conscious and are still trying to build up their immunity against infections, since immunity in children builds up with age (Gugnani, 1982). In most cases, parents pay less attention to children at these ages and focus more on their sibblings ages 0 to 5 years.

For non-dermatophyte fungi, their prevalence was least in children between 3 and 4 years followed by children between 11 and 14 of years of age. This can be attributed to the fact that between 11 and 14 years of age, children are more involved in farming than younger ones. For instance, isolates like *Alternaria* and *Trichoderma* which are mostly found in soil, are known to

infect farmers. From this study, it was also observed that *T. capitis* was more in males than in females and this agrees with Kao (2005) that infection in males was five times higher than infections in females.

Among all the dermatophytes obtained from this work, *Trichoderma mentagrophytes* was the most prevalent and this agrees with the report of Beneke and Rogers (1996), who stated that *T. mentagrophytes* is distributed worldwide and that it is both zoophilic and anthropophilic. Isolates based on children's relationship with house hold animals which are usually carriers or infected, suggests that, house hold animals should be bathed with disinfectant at least once a week to reduce the spread of spores.

This work also agrees with Chineme et al. (1980) that *Trichophyton verrucosum* is common in individuals who keep animals such as cows, sheep and goats. The saprotrophic nature of these fungal isolates may have also, contributed to the infections of pupils in their school playground environment. This is because the fungi utilize a wide range of substrates in the natural environment and thus, are common microbial components of soil, compost, sewage, decaying plant/vegetable materials, polluted water and eutrophic habitats.

Opportunistic superficial mycoses represent formidable diagnostic challenges. It was observed in this study, that if public health education on the improvement in personal and environmental hygiene and treatment of infected pets and children is given, the prevalence of dermatophytosis will reduce or be eliminated in the community. In conclusion, it is therefore, imperative that diagnosis is made timely on the pupils, since prognosis worsens significantly in the absence of accurate fungal identification and intervention with antifungal agents.

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