

# Prevalence and risk factors of superficial fungal infections among primary school pupils in Ilorin, North Central Nigeria

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## Abstract

Superficial fungal infections are common in the tropics particularly in the rural areas where children are predisposed. The causative organisms include dermatophytes, yeasts and non-dermatophyte moulds. To determine the prevalence and risk factors of superficial fungal infections among primary school pupils aged 5-

16 years in Oke-Oyi, Kwara State. A cross-sectional survey was carried out from April through July 2017 among 602 pupils aged 5-16 years in Oke-Oyi, Ilorin East Local Government Area of Kwara State. Out of the 602 pupils screened during the study, 180 pupils were suspected clinically to have superficial fungal infection and a total of 180 skin specimens were collected from the pupils. The prevalence of clinically suspected fungal infection was 29.9% (180/602), dermatophytes accounted for 16.7% (30/180), while non-dermatophyte moulds accounted for about half of the isolates, 51.7% (93/180). Some of the factors that were significantly associated with the risk of acquisition of dermatophytic infections include age, past history of similar lesions, over-crowding, normal sweat pattern and unkempt socks worn by the pupils among others. This study has shown that superficial fungal infections are common among pupils in Oke-Oyi in Ilorin East Local Government Area of Kwara State and the risk factors include among others, young age, past history of skin infections, over-crowding and unkempt socks worn by pupils. Therefore socio-demographic and behavioural factors influence the occurrence of superficial fungal infections in the study area.

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## Introduction

Superficial fungal infections are caused by dermatophytes, yeasts and non-dermatophyte moulds, although dermatophytes are responsible for most of the superficial fungal infections.<sup>1</sup> The literature has identified several risk factors for fungal infections with predominance of one over the other based on peculiarities of the climate, human activity in the place studied and level of development of the people.<sup>2</sup>

In the tropics, the hot and humid weather predisposes to fungal infections by increased sweating and maceration of the skin. Other predisposing factors include poor socio-economic conditions prevalent in developing countries,<sup>3</sup> overcrowding, poor hygienic practices and lack of adequate water supply. Studies from Africa put the prevalence of superficial fungal infections in school children at 35.20% in Tanzania and 40.57% in Awka in Anambra State, Nigeria.<sup>4,5</sup> Poor personal hygiene, frequent body contact, poor environmental sanitation, over-crowding and low socio-economic status predispose pupils to fungal infections.<sup>6</sup> Superficial fungal infections in pupils cause morbidity and lower their quality of life leading to poor school attendance and its various consequences as well anxiety for their parents.<sup>7,8</sup> This is why this study is important because there is dearth of literature on the prevalence and risk factors for superficial fungal infections among pupils in the study area. The aim of this study was to determine the prevalence of superficial fungal infections and the associated risk factors among

primary school pupils in Oke-Oyi in Kwara State, so as to provide evidence based preventive measures and thus reducing the prevalence and associated morbidity of superficial fungal infections.

## Materials and Methods

This study was a cross-sectional survey, involving all primary school pupils aged 5 to 16 years in the two public primary schools in Oke-Oyi, a semi urban community in Ilorin East Local Government Area of Kwara State. A multistage random sampling was adopted in selecting the pupils who participated in the study. Stage 1 involved all the pupils in the 2 public primary schools in Oke-Oyi. In the stage 2 of the multistage random sampling, 2 Arms in each class of 4 Arms (A, B, C and D) in Primary One to Primary Six of the two public primary schools were randomly chosen by balloting. In Stage 3, all the pupils in the randomly selected 24 Arms of the primary schools were screened for eligibility and recruited into the study using their Class registers. This study was approved by the Ethics Review Committee of the University of Ilorin Teaching Hospital, Ilorin and consent to carry out the study was obtained from the Local Education Authority. Structured questionnaire was administered to clinically suspected, fungal infected pupils by interview. Those with skin lesions compatible with dermatophytosis had samples taken from the affected parts of the body after parental consent and pupil's verbal assent had been obtained. A portion of the obtained sample after a gentle scraping of the affected skin with a sterile size 11 surgical blade was placed on a clean blotting paper for microscopy and another portion inoculated directly on Sabouraud Dextrose Agar (SDA) for mycological examination using conventional technique.

All samples collected in the field were transferred to the Microbiology Laboratory of the University of Ilorin Teaching Hospital, Ilorin, where it was cultured and subjected to microscopy using 10% KOH (Potassium Hydroxide) and Sabouraud Dextrose Agar (SDA). The media were incubated at room temperature and at 37°C for a minimum period of three weeks. Positive cultures were examined macroscopically and microscopically for species identification. All data collected from the participants were entered into a database created specifically for this study using Epi-Info 6.04d. All data were kept confidential at all stages of the study. A p-value less than 0.05 was taken as statistically significant.

## Results

A total of 602 primary school pupils (398 males and 204 females) were screened, giving a male to female ratio of 2:1. One hundred and eighty respondents (123 males and 57 females) were suspected to have superficial fungal infection clinically. The overall mean age of the respondents was 8.99± 2.97 years.

Table 1, shows that the male sex was more infected clinically with dermatophytes than their female counterpart. The 9-12 years age-group was the most infected age-group with dermatophytes.

The prevalence of clinically suspected fungal infection was 29.9% (180/602), all of which were positive for hyphae on KOH microscopy, however 68.3% (123/180) were confirmed with SDA culture (Table 2). Dermatophytes accounted for 16.7% (30/180) while non-dermatophyte moulds accounted for 51.7% (93/180) of the isolates.

Out of the 180 pupils suspected to have dermatophytic infection clinically, 52 (28.9%) of the cases had a similar lesion in the past. The duration of the former lesion before it disappeared was

unknown to majority of the 29 (16.1%) respondents. Seventy four (41.1%) of the respondents said their current skin lesion started ≤3 months before the onset of the study.

A family history of infection was found in 70 (38.9%) of the clinically suspected cases. In 48 (26.7%) cases, blood brothers of the respondents were the family members that had a similar skin lesion. However, in 4 (2.3%) cases, their family members with similar lesions were adults.

Less than half of the 70 respondents with a family history of infection, 34(18.9%) said that their family members with a similar skin lesion were on one form of treatment or the other, but most of the respondents did not know the length of time for which they had been on treatment.

A habit of sharing materials was common among respondents. In 129 (71.7%) of the pupils, the hair comb or head brush was shared, while multiple materials including clothings were shared in the great majority. A total of 131 (72.8%) respondents had a history of profuse sweating during such episodes, 53 (40.5%) of the pupils did nothing to their sweat, while the rest pupils either changed their soaked clothes 33 (18.3%) or took a bath 45 (25.0%) and this opportunity was available to those from average homes with adequate supply of water.

A greater proportion of the respondents 119 (66.1%) reported not using socks. Of the remaining 61 (33.9%) pupils 11 (6.1%) noticed that their socks often smelt awful and another 50 (27.8%) denied such. In nearly all of the cases, the frequency of changing socks was 3 times per week or less 54 (30.0%). Different traditional treatments were being employed for the skin lesions in the community (Figure 1). Comparison of reported use of these medicaments previously and currently showed that there had been a considerable reduction in the use of these medicaments for present skin lesions.

The risk factors associated with fungal infections in the respondents among others include age, especially the age group 9-12 years as shown in Table 3, as this was statistically significant ( $p=0.008$ ). The male pupils had more cases of positive fungal infection than their female counterparts, but the difference was not statistically significant ( $p=0.409$ ).

The presence of a previous similar lesion in the respondents was significantly associated with acquisition of fungal infection ( $p=0.004$ ), whereas, the same cannot be said for similar lesions in a family member ( $p=0.903$ ). The greater the number of persons living in the same room, the greater was the likelihood of acquisition

**Table 1. Demographic characteristics of respondents suspected to have dermatophytoses clinically.**

Age groups (years)	Sex		Total (N=180) n (%)
	Male (123)	Female (57)	
5-8	61	20	81 (45.0)
5-8	45	27	72 (40.0)
13-16	17	10	27 (15.0)

**Table 2. Sex distribution of respondents who were positive for fungi on culture with Sabouraud Dextrose Agar.**

Type of fungi	Sex		Total (N=123)
	Male (123)	Female (57)	
Dermatophyte (D)	19	11	30 (16.7)
Non-Dermatophyte (ND)	67	26	93 (51.7)
Total	86	37	123 (68.3)

of fungal infection ( $p=0.054$ ). The sharing of materials among respondents' households did not seem to increase the likelihood of acquiring fungal infection ( $p=0.765$ ).

Those who reported that they did not sweat excessively were

more at risk of infection by dermatophytes. The use of socks and the cleanliness of it, was associated with an increased risk of acquisition of fungal infections as also the practice of barbing at the local barber shop. In addition, the poor personal hygiene of the

**Table 3. Risk factors associated with fungal infection in respondents.**

Variables	Microscopy		Total	$X^2$ , p-value
Positive	Negative (n = 109)	(N=180) (n = 71)		
Age groups (in years)				
5-8	39	42	81	$X^2 = 9.75, 0.008$
9-12	52	20	72	
13-16	18	9	27	
Sex				
Male	77	46	123	$X^2 = 0.68, 0.409$
Female	32	25	57	
Past similar lesion				
Yes	40	12	52	$X^2 = 8.20, 0.004$
No	69	59	128	
Similar lesion in family member				
Yes	42	28	70	$X^2 = 0.01, 0.903$
No	67	43	110	
No living in same room				
$\leq 2$	15	20	35	$X^2 = 5.70, 0.017$
$\geq 2$	94	51	145	
Sharing materials				
Yes	79	50	129	$X^2 = 0.09, 0.765$
No	30	21	51	
Frequency of baths				
1-2 times/week	2	2	4	$X^2 = 0.33, 0.847$
3-4 times/week	45	31	76	
Daily	62	38	100	
Sweating profusely				
Yes	68	63	131	$X^2 = 15.06, 0.001$
No	41	8	49	
Socks smelling badly				
Yes	10	1	11	$X^2 = 18.16, 0.001$
No	40	10	50	
Don't use	59	60	119	
Place of barbing hair				
Local barber	39	12	51	$X^2 = 10.25, 0.006$
Hair saloon	58	54	112	
Personal clipper	2	0	2	
Personal hygiene				
Hygienic	50	47	97	$X^2 = 7.15, 0.008$
Unhygienic	59	24	83	
Swam in communal bath				
Yes	36	6	42	$X^2 = 14.52, 0.000$
No	73	65	138	
Type of sports				
Swimming	8	2	10	$X^2 = 10.27, *0.006$
Athletics	26	34	60	
Football	54	26	80	
Keeping of pets				
Yes	87	64	151	$X^2 = 3.39, 0.066$
No	22	7	29	
Type of pets kept				
Cat	2	0	2	$X^2 = 10.82, *0.012$
Dog	9	3	12	
Cat + dog	14	2	16	
Birds + goat	62	59	121	
Playing with pets				
Yes	19	4	23	$X^2 = 5.37, *0.020$
No	90	67	157	

n = frequency of respondents in observations, N = total number of clinically suspected cases.

respondents was associated with an increased risk of acquisition of fungal infections. Swimming in the communal bath was also associated with an increased risk of acquiring fungal infections. Similarly, when the individual participated in swimming as a sport, the risk was further increased.

Though the proportion of those that kept pets had more cases of positive fungal elements on KOH examination, it was those who had no pets that had an increased risk of acquiring fungal infections, though this was not statistically significant.

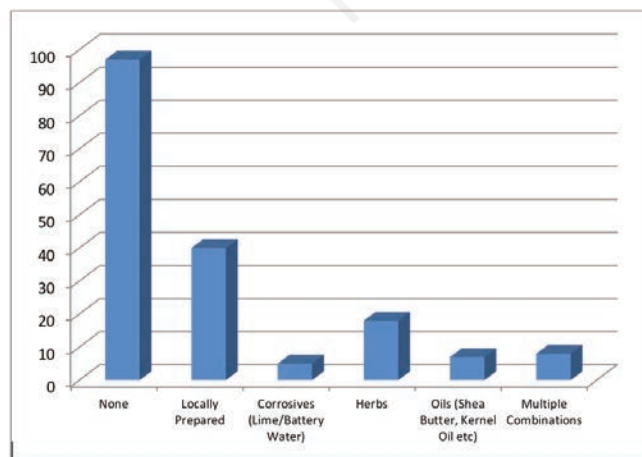
## Discussion and Conclusions

Knowledge of risk factors for fungal infections is important in its control. Risk factors known to predispose to fungal infections were computed as independent variables in this study.

Age as opposed to gender was a significant risk factor for acquiring fungal infections. This is similar to the findings in Egypt where older age was found to significantly influence acquisition of dermatophytosis.<sup>9</sup> The 9-12 year age group may be more predisposed because children in this age-group might be expected to personally clean themselves compared to the 5-8 years old who rely more on their parents or elderly persons to clean or bath them, while the 13-16 year age group may be expected to become more aware of themselves and their cleanliness and thus personally cleaning themselves properly. In addition, the 9-12 year age group may be predisposed to fungal dermatosis because they shared materials that otherwise should be personal, such as their combs, head brushes, clothes, hats and caps, in spite of the fact that the sharing of these materials was not found to be significantly related to infection by dermatophytes.

Previous fungal lesions in the respondents as compared to similar lesions in a family member, was a significant risk factor for the acquisition of fungal infection. This finding suggests that previous lesions were not cured by the treatment employed or they had new infection on previous sites. This is against the backdrop that some of the respondents had used traditional medicaments for their past fungal lesions and also had attempted doing the same with the current lesions.

Dermatophytic infections were also linked to overcrowd-



**Figure 1. Traditional treatments employed for skin lesions by the pupils.**

ing.<sup>10,11</sup> The pupils of the community primary schools surveyed were characterized by families with 3 or more members. This link between crowded living conditions and the increased prevalence of dermatophytic infections has been observed by researchers who noticed that *Tinea capitis* was commoner in school children from families with 3 or more members sharing a room.<sup>11,12</sup> In addition, the association of dermatophytic infections with overcrowding probably stems from the likelihood of the sharing of personal materials like towels, combs or hats, among others, which was a common finding in this study, although it was not statistically significant.<sup>9,13</sup>

An unkempt pair of socks presented an increased risk of acquisition of fungal infection in the study. This is against the backdrop that only 11.5% of those who used socks changed them on a daily basis. The remaining pupils changed socks from thrice weekly to a month. This is an additional evidence to support the state of poor personal hygiene of the pupils surveyed.

The place of barbing also presented an increased risk in our study, as noted in previous studies.<sup>10</sup> Those who patronized local barbers were significantly infected compared with those who barbed at the saloon or used their personal clippers.<sup>11</sup> This may account for the higher prevalence of *Tinea capitis* in the study and may explain the higher prevalence in boys.<sup>12</sup>

The frequency and severity of dermatophytic infections have been linked to personal cleanliness. Since 71.1% of cases of unhygienic children as at the time of clinical examination had positive microscopy compared to 52.5% of hygienic children, it appeared that unclean children were predisposed to dermatophytic infection and also served as agents of transmission.

In 44% of the pupils, the bath frequency was  $\leq 3-4$  times per week. In the same manner, the respondents did nothing when they were sweating 53 (29.4%) and only 7/61 (3.9%) of those who used socks changed them on a daily basis. The link between poor personal hygiene and increased prevalence of dermatophyte infections and other parasitic infestations have been confirmed in several studies.<sup>3,10,11,14</sup>

Swimming in communal baths as well as swimming as a form of sporting activity is statistically associated with the increased risk of acquiring fungal infection. In addition, there was a significant risk of dermatophytosis in both swimmers and non-swimmers who used the swimming pool.

Dermatophyte infection can also be acquired directly by transmission through fomites such as upholstery, hair brushes and combs. In spite of the fact that sharing of materials like combs, hair brushes, clothing and hats/caps was not statistically significant for acquisition of fungal infection in this study, there was a high proportion of sharing of materials in the community surveyed.

Contact with animals is considered a risk factor for dermatophytosis.<sup>9,13</sup> This study found a high level of contact with animals in 151 (83.9%) of the clinically suspected cases. There was evidence of contact with dogs, cats, goats and birds. Given that *Tricophyton mentagrophyte* (the commonest isolate in this study) can be both anthrophilic and zoophilic in its origin, the frequency of animal to human contact is suggested to be part of the likely means of transmission of the infection among our respondents.

Taking into consideration the risk factors identified in this study, which were mainly patient factors such as personal cleanliness and environmental hygiene, a focused health education was conducted among the pupils surveyed.

Because teachers are important in identifying pupils with skin infection and encouraging them to seek proper treatment, they were given health education on how to recognize pupils with skin infection and to inform parents and guardians appropriately.<sup>4</sup>



In conclusion, the study has shown that superficial fungal infections are common among pupils in the study area and the risk factors remain high. Health education, provision of social amenities and improvement in the socio-economic status of the parents are necessary in the prevention and control of superficial fungal infections among the pupils.

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