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Epidemiology of dermatophyte infections among school children in Menoufia Governorate, Egypt

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Summary

Most superficial mycotic infections of human skin are due to dermatophytes. Children are frequently affected due to different predisposing factors, particularly overcrowding in classrooms. This study aimed to estimate the prevalence of dermatophytes infections and their related risk factors among school children in Menoufia Governorate, Egypt. Six public primary and preparatory schools were randomly selected and their pupils (n = 3464) were asked to complete a predesigned questionnaire covering both personal data and suspected risk factors for superficial dermatophyte infections. The children were also examined for dermatological diseases. Any suspected lesions were biopsied for mycological examination. The prevalence of clinically suspected dermatophytes infections was 1.41%, whereas the prevalence of culture confirmed cases was 0.98%. The most common clinical type was tinea capitis with a prevalence of 1.01%. *Microsporum canis* was the only isolated organism from the suspicious lesions with a 69.4% positivity rate. A higher prevalence was observed among boys, low socio-economic pupils and those with a family history of dermatophyte infections. Pet contact and sharing towels and caps among pupils were significant risk factors. Dermatophyte infection is still prevalent among basic school pupils. Fortunately, it is related to preventable risk factors. We recommend regular screening and use of educational health programmes for kids to control it.

KEYWORDS

dermatophyte infections, epidemiology, school children, tinea capitis

1 | INTRODUCTION

Dermatophytes are fungi that require keratin for growth. They can cause infections of the epidermis and of areas rich in keratin such as hair and nails, which is known as Tinea. Dermatophytes spread through direct contact with infected people (anthropophilic), animals (zoophilic), and/or soil (geophilic) as well as indirectly from fomites.^{1,2} Tinea is clinically classified according to the affected site:- tinea capitis (scalp), tinea pedis (feet), tinea manuum (hands), onychomycosis (nail), tinea barbae (beard area), tinea cruris (groin) and tinea corporis (body, including the trunk and arms).³

Dermatophyte infection is very common worldwide. It is more frequent in developing countries due to risk factors of crowding, low socio-economic status and improper personal hygiene. Risk factors lead to epidemic potential, most notably in overcrowded places like schools and refugee camps.⁴ It is also more common in children due to lack of saturated fatty acids in sebaceous gland secretion during childhood.⁵⁻⁷ Tinea capitis and tinea corporis are the most common clinical forms in pre-pubertal children, whereas tinea pedis (TP), tinea cruris and onychomycosis are more common in adolescents.^{8,9} Dermatophyte infection can be disfiguring, and sufferers may have varying degrees of mental distress and anxiety.¹⁰

TABLE 1 Descriptive statistics of socio-demographic criteria of the studied pupils

Socio-demographic criteria	The studied group N = 3464	
Age		
X ± SD	9.88 ± 2.37	
Range	6-14	
	N	%
Age group		
6-9 years	1041	30.1
9-12 years	1300	37.5
12-15 years	1123	32.4
Sex		
Male	1763	50.9
Female	1701	49.1
Residence		
Rural	1619	46.7
Urban	1845	53.3
SEL		
Low	855	24.7
Middle	1492	43.1
High	1117	32.2

X, mean; SD, standard deviation; N, number; SEL, socio-economic level.

Menoufia is, located in the northern part of Egypt in the Nile Delta; it is a rural governorate with an urbanisation rate of only 20.6%. It is mainly an agricultural society.¹¹ The number of pupils may reach beyond 80 per class in Menoufia basic schools.

This study aimed to estimate the prevalence of superficial dermatophyte infections and their related risk factors among pupils of these basic schools in Menoufia Governorate, Egypt.

2 | SUBJECTS AND METHODS

This study was performed on basic school children in Menoufia Governorate, Egypt from December 2015 to October 2016. Before the beginning of this study, an institutional review board (IRB) approval was obtained from the ethical committee, Faculty of Medicine, Menoufia University and an official permission letter was provided by the Menoufia bureau, Ministry of Education, Shebin Elkom, Egypt. Every guardian/parent of enrolled school child provided their informed consent, prior to the collection of relevant data.

2.1 | Sample size calculation

Based upon previous reports, the prevalence rate of superficial dermatophyte infections was 0.4% in Al Fayoum, Egypt.¹² With a power of (90%) and 95% confidence interval (CI), the calculated sample size was 3415 pupils. We used Al-Fayoum because it is a comparable rural area in Egypt, which may differ from urban areas, such as Alexandria.

2.2 | Patients and sampling

A total number of 3464 pupils were selected as participants in this study from three primary/elementary and three preparatory/mid public schools using a multistage clustering sampling method.

2.3 | All enrolled pupils were subjected to

1. Personal data and history taking including age, sex, residence, personal hygiene and history of pet contact. Family history of socio-economic status and whether one of the family members was similarly affected or not affected.
2. Complete dermatological examination (skin, hair and nails) for the detection of superficial dermatophyte infection. Clinically suspected cases were subjected to sample collection from the affected site.
3. Specimens were collected as follows:
 - Cleaning of the lesion with 70% ethyl alcohol.
 - Biopsy: The specimen was obtained using the edge of a clean glass slide. The sample was obtained from each clinical site accordingly.
 - Specimens were then collected in a sterile Petri dish. All specimens were then transported to the laboratory for mycological examination.¹³

2.4 | Mycological examination

Collected specimens were aliquoted. One was examined using direct wet method for dermatophytes by 10% potassium hydroxide (KOH). Microscopic examination was then performed using low and high power light microscopy. Another aliquot was cultured on Sabouraud Dextrose Agar (SDA) media supplemented with cycloheximide (to inhibit saprophytic fungal growth) and chloramphenicol (to suppress bacterial growth). Cultures were incubated at (26-28°C) and examined three times weekly for the detection of fungal growth over 2 weeks after which it was considered negative if no growth had occurred.¹⁴ All positive cultures were further processed for identification using morphological, biochemical and molecular markers in a clinical microbiological laboratory in Menoufia University hospital.

2.5 | Statistical analysis

Data were collected, tabulated, and analysed using SPSS version 17.0 on an IBM compatible computer (SPSS Inc., Chicago, IL, USA). Numerical data represented as the mean, standard deviation and range, whereas categorical data were expressed as frequency and percentage. Chi squared (χ^2) and Fisher's Exact tests were used to compare categorical data accordingly, Student's *t* test was used to compare two groups of normally distributed quantitative data. The *P* value was considered significant at a value $\leq .05$ (two sided).

TABLE 2 Association between clinical types of dermatophyte infection and age, sex and culture results

	Type of dermatophyte infections								Test	
	Tinea capitis N = 35		Tinea corporis N = 4		Tinea pedis N = 6		Onychomycosis N = 4		χ^2	P value
	N	%	N	%	N	%	N	%		
Age group										
6-9 years	14	40.0	0	0	0	0.0	3	75.0	24.7	<.001
9-12 years	12	34.3	4	100	0	0.0	0	0.0		
12-15 years	9	25.7	0	0.0	6	100	1	25.0		
Sex										
Male	31	88.6	0	0	6	100	4	100	23.10	<.001
Female	4	11.4	4	100	0	0.0	0	0.0		
Fungal culture										
Negative	4	11.4	1	25.0	6	100	4	100	28.8	<.001
Positive	31	88.6	3	75.0	0	0.0	0	0.0		

N, number; χ^2 , Chi square test; P value >.05, non-significant; <.05, significant; <.001, highly significant.

3 | RESULTS

The age of our cohort (n = 3464 pupils) was (9.88 ± 2.37) years, ranging between 6 and 14 years, according to age, pupils could be distributed further into 30.1% (n = 1043), 37.5% (n = 1299), and 32.4% (n = 1122) for age range subgroups 6-9 years, 9-12 years and 12-15 years respectively. According to their gender, females constituted 49.1% (n = 1700) of our study participants with a male to female ratio of (1.04:1). Urban residents were 53.3% of our study population. According to their socio-economic status; pupils were classified into 24.7% (n = 856), 43.1% (n = 1493) and 32.2% (n = 1115) low, middle and high levels respectively (Table 1).

The prevalence of clinically defined cases with superficial dermatophyte infections was 1.41% (n = 49 cases). The prevalence of tinea capitis was 1.0%, of tinea pedis 0.17%, and of tinea corporis and onychomycosis 0.12% each respectively. Mycological examination revealed 34 positive cultures. *Microsporum canis* was the only detected organism. Positive culture was observed in 88.6% of tinea capitis cases and 75% of tinea corporis cases, whereas all cases of tinea pedis and onychomycosis revealed negative culture. Tinea capitis was mostly prevalent among young children (6-9 years), whereas tinea pedis cases were (100%) present among adolescent pupils (12-15 years; Table 2).

Dermatophytosis was not associated with both age and residence of the studied pupils, while it was significantly more frequent among males (83.7%) than females (16.3%), and among pupils with low SEL (77.6%) than middle SEL (8.2%) and high SEL (14.3%) of positive cases. A statistically significant high rate of superficial dermatophyte infection was observed among pupils with a family history of dermatophytosis, pupils who were in contact with pets and in pupils who shared towels with other family members or with colleagues (Table 3).

4 | DISCUSSION

According to our findings, the prevalence of clinically diagnosed dermatophytosis was 1.41% (distributed as 1.0% tinea capitis, 0.17% tinea pedis, 0.12% tinea corporis and 0.12% Onychomycosis) and the prevalence of confirmed cases was 0.98%. Consistent results were reported in Egypt by Bassyouni et al¹² who estimated the incidence of tinea capitis among school children in Fayoum city as (0.4%), which was also consistent with findings obtained by Zarrin et al¹⁵ who reported that the prevalence of superficial fungal infections among primary school children in Iran was (0.4%). A relatively higher prevalence was observed in a study performed by Fathi and Alsamaraiya,¹⁶ who estimated the prevalence of tinea capitis among school children in Iraq. It was recorded that clinically diagnosed cases were 4.57% and the prevalence of confirmed cases was 2.7%. Moreover, Omar,¹⁷ estimated the prevalence of Tinea capitis in primary school children in Alexandria, Egypt and recorded that the prevalence of clinically suspected cases was 4.9% and confirmed cases was 2.9%. This difference may be contributed to different sample size, different climatic conditions and different subject's life style, including personal hygiene.

Noticeable higher prevalence was observed by Oke et al,¹⁸ whose study revealed a prevalence of superficial fungal infection of 35% in Nigeria. The highest prevalence was observed by Kalu et al,¹⁹ it was documented to be 72.3% for infectious dermatoses in Nigeria. Tropical climate, poor hygiene, dirty environment, overcrowding, intimate association with animals and scarcity of water may serve as an explanation for this high prevalence rate.²⁰

The current work showed that the culture was positive in 69.4% of clinically defined cases and *M. canis* was the only detected organism in their specimens. It was observed in isolates of tinea capitis (88.6%) and tinea corporis (75%) but tinea pedis and Onychomycosis samples were culture negative. An Egyptian study also observed the predominance of *Microsporum* species (*Microsporum canis*, 52% and

Superficial dermatophyte infections						
	Positive N = 49		Negative N = 415		Test	P value
Age						
X ± SD	9.86 ± 2.35		10.10 ± 2.35		t-test: 0.74	.46
Range	6-14		6-14			
	N	%	N	%	χ^2	
Age group						
6-9 years	17	34.7	1024	30.0	0.76	.72
9-12 years	16	32.7	1284	37.6		
12-15 years	16	32.7	1107	32.4		
Sex						
Male	41	83.7	1722	50.4	21.40	<.001
Female	8	16.3	1693	49.6		
Residence						
Rural	26	53.1	1593	46.6	0.80	.37
Urban	23	46.9	1822	53.4		
SEL						
Low	38	77.6	817	23.9	75.30	<.001
Middle	4	8.2	1488	43.6		
High	7	14.3	1110	32.5		
Family history						
Positive	31	63.3	288	8.4	FE: 173.7	<.001
Negative	18	36.7	3127	91.6		
Dealing with pets						
Yes	36	73.5	272	8.0	FE: 255.9	<.001
No	13	26.5	3143	92.0		
Sharing towels with family member						
Yes	35	71.4	321	9.4	χ^2 : 201.6	<.001
No	14	28.6	3094	90.6		
Sharing tools with colleagues						
Yes	32	65.3	566	16.6	χ^2 : 80.3	<.001
No	17	34.7	2849	83.4		

χ^2 , Chi square test; FE, Fisher's Exact test.

P value >.05 = non-significant, <.05 = significant, <.001 = highly significant.

M. audouinii, 36%)¹² whereas Omar¹⁷ reported *Trichophyton violaceum* in their isolates.

The predominance of *Microsporum canis* in our isolates requires further investigations, but may be attributable to the spread of stray cats and dogs (reservoirs of *Microsporum canis*) with which young children usually play. Furthermore, it is also very common in our agricultural community to have cats and dogs with farm animals reared in animal sheds (which are related to the houses), and the corresponding lack of veterinary care may also be a contributing factor to the predominance of this specific microsporum species.

This study demonstrated a higher prevalence of tinea capitis in subjects of young age (6-9), whereas tinea pedis existed only in pubertal age children (12-15 years). This is in parallel to findings obtained by Younis et al,²¹ and Aktas et al,²² who documented that cases of tinea capitis mainly occurred in children below the age of 10 years.

TABLE 3 Superficial dermatophyte infections in relation to socio-demographic characters and predisposing factors among the studied pupils

This may be attributed to a lack of saturated fatty acids in children's sebaceous gland secretions (considered as natural protective mechanism) which first appear at puberty and persisted into adulthood²³ in addition to a lack of personal hygienic measures in the younger age group. Regarding tinea pedis, Ilkit and Durdu²⁴ documented that tinea pedis prevalence increases with increasing age.

The dermatophyte infections were more common among males than females, which is consistent with Bassyouni et al¹² and Kalu et al,¹⁹ who proved male predominance in dermatophyte infection. This may be because females are often more conscious of their appearances and personal hygiene than males. In addition to easier implantation of spores and easier detection of even small lesions that could be attributed to male short hair.

In this study, an insignificant difference between urban and rural pupils regarding the prevalence of superficial dermatophyte infections

was noted and this was in contrast to findings obtained by Nweze & Okafor²⁵ who documented a predominance of dermatophyte infection among rural dwellers. Because the difference between rural and urban prevalence in our locality was minimal, it may be attributed to the fact that the Menoufia Governorate is characterised by a semi urban character of its urban zones.

In this study, low socio-economic status plays a significant role as a risk factor for dermatophyte infections. This finding is supported by Ranganathan et al²⁶ and Fathi and Al-samarai.¹⁶ The later¹⁶ also supports the increased prevalence of dermatophytosis with a family history of such an infection. A significantly high rate of superficial dermatophyte infections was found among pupils who had contact with pets, shared towels with other family members and shared tools with colleagues; similar results were noted by Fathi and Al-samarai,¹⁶ Ogbu et al,²⁷ and Sehgal et al²⁸ whose studies revealed that poor personal hygiene and intimate association with house hold pets along with the sharing of beds and hats among children were the suspected sources of infection.

Thus, it is evident that dermatophytosis is common in our society, Menoufia Governorate, Egypt. Our findings may indicate an epidemiological change that requires more in-depth studies. Preventable measures in the form of screening by school nurse or assigned school health team as well as using educational programmes to promote health knowledge among school pupils and teachers could help in controlling any preventable risk factor such as personal hygiene, pet contact as well as class crowding.

CONFLICTS OF INTEREST

None.

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