

Dermatophytosis among Basic School Children in Menoufia Governorate (Epidemiological Study)

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Abstract: Back ground: Most superficial mycotic infections of human skin are due to dermatophytes. Children are mostly affected due to different predisposing factors especially overcrowding in classrooms. Meanwhile its transmissibility can be controlled through simple school-health measures. **Objectives:** This study was performed to estimate the prevalence of dermatophytes infections and their related risk factors among the primary and preparatory school pupils. **Methods:** In Menoufia governorate, Egypt, by using multistage random sampling technique, six public primary and preparatory schools were selected with a total number of 3464 pupils. The selected pupils were subjected to a predesigned questionnaire covering personal data and suspected risk factors for superficial dermatophyte infection, clinical examination to detect superficial dermatophyte infection with taking samples from the suspected lesions for mycological examination. **Results:** Among the studied pupils with age ranged from 6 – 14 years, the prevalence of clinically suspected dermatophytes infection was (1.41%) meanwhile the prevalence of culture confirmed cases was (0.98%). The most common clinical type was tinea capitis with specific prevalence (1.01%) followed by tinea pedis, tinea corporis and Onychomycosis. *Microsporum canis* was the only isolated organism on culturing the suspicious samples with positivity rate (69.4%). A statistically significant higher prevalence was observed among males, those with low socio economic level and with the presence of positive family history. Dealing with pits, common use of towels and sharing caps among pupils were significant risk factors of these infections. **Conclusion:** Dermatophytes infection is still prevalent among basic school children in Egypt. It was simply controlled as it was related mostly to preventable risk factors, so, health education program and regular screening should be advised for schools authorities.

[Mostafa Ahmed Hammam; Azza Gaber Antar Farag; Reda Abdel Latif Ibrahim; Rehab Reda Elsayed Tolba. **Dermatophytosis among Basic School Children in Menoufia Governorate (Epidemiological Study).** *Stem Cell* 2017;8(4):26-32]. ISSN: 1945-4570 (print); ISSN: 1945-4732 (online). <http://www.sciencepub.net/stem>. 5. doi:[10.7537/marsscj080417.05](https://doi.org/10.7537/marsscj080417.05).

Key words: epidemiology – dermatophyte infection – Tinea capitis

1. Introduction

Dermatophytes are fungi that require keratin for growth. These fungi can cause superficial infections of the skin, hair, and nails (*Hainer, 2003*) [1]. Tinea refers to dermatophyte infections in the epidermis and areas high in keratin, such as the hair and nails (*Andrews and Burns, 2008*) [2]. Dermatophytes are spread by direct contact from other people (anthropophilic organisms), animals (zoophilic organisms), and soil (geophilic organisms), as well as indirectly from fomites (*Hainer, 2003*) [1].

It was clinically classified according to site: into tinea capitis. (scalp), tinea pedis (Feet), tinea manuum (Hands), onychomycosis (Nail), tinea barbae. (Beard area), tinea cruris (Groin) and tinea corporis (Body including trunk and arms) (*Achterman and White, 2012*) [3].

Infection is very common all over the world. With the exception of tinea cruris (which is typically seen in adults), dermatophytosis is more common in children due to predisposing factors such as overcrowding and low socioeconomic factors; it is

found more in developing countries (*Seebacher et al, 2008*) [4].

In pre pubertal children, tinea capitis and tinea corporis are most common. In adolescents, tinea pedis (TP), tinea cruris, and tinea unguium (onychomycosis) are more common (*Gupta et al 2017*) [5]. This can be attributed to lack of saturated fatty acids in sebaceous gland secretion (a natural protective mechanism that hinder dermatophyte growth) during childhood [6].

The dryness of the skin outer layer also impedes colonization by micro organisms, and the shedding of epidermal cells keep many microbes from establishing residence (*Ilkit and Demirhindi, 2008*). The skin mechanisms of protection may fail because of trauma, irritation, of maceration. Furthermore, occlusion of the skin with nonporous materials can interfere with the skin barrier function by increasing local temperature and hydration (*Ogawa et al, 1998*).

Epidemics appear to occur through indirect transmission via external agents (sharing fomites, towels & caps) or through person to person

transmission in overcrowded places like schools and refugee camps (*Havlickova et al, 2008*).

Dermatophytosis can be disfiguring. Being of contagious spread from one part of the body or from person to person, sufferers may have varying degree of mental distress and anxiety (*Szepietowski and Reich, 2008*).

Menoufia governorate is located in the northern part of the country in the Nile Delta, according to population estimates from 2015 the majority of residents in the governorate live in rural areas, with an urbanization rate of only 20.6%. Out of an estimated 3,941,293 people residing in the governorate, 3,128,460 people live in rural areas as opposed to only 812,833 in urban areas. It is a mainly an agricultural governorate [11].

From the previous data about our locality and due to lack of national registries for this form of infection in Egypt, we conducted this study.

This work aimed to estimate the prevalence of superficial dermatophyte infections and their related risk factors among the primary and preparatory school pupils in Menoufia governorate, Egypt.

2. Subjects and Methods:

This study was conducted on primary and secondary school children in Berket Elsabea district, Menoufia governorate, Egypt from December 2015 to October 2016.

Sample size calculation

There were a total of 687064 pupils were enrolled in Menoufia basic schools in the scholastic year 2015-2016 (**Menoufia directorate of education records**).

Sample size calculation

On the basis of previous studies that document the prevalence rate of superficial dermatophyte infections as 0.4% (*Mohammed et al, 2013*), with 90% power of the study and 95% confidence interval (CI) for sample size calculation, the calculated sample size was 3415 pupils.

Sampling technique,

A total number of 3464 pupils were selected as a participant in this study by using a multistage clustering sampling method as follows:

The first stage:

One district (Berket Elsabea district) out of 10 ones consisting Menoufia governorate was chosen using simple random sampling technique.

The second stage:

Three primary and three preparatory public schools were chosen randomly.

The third stage:

All classes in the selected schools were included.

Ethical points (consent)

1. Approval from ethical committee in the faculty of medicine, Menoufia University was taken before the beginning of this study.

2. An official permission letter was obtained and directed to the undersecretary of Ministry of Education in Menoufia and to the administrators in the schools where the study were conducted.

Methods

All pupils under the study were subjected to:

1. History taking as regard age, sex, residence, presence of itching and history of contact with animals. Family history was asked about in the form of socioeconomic level of the family and whether one of the family members was similarly affected or not. History of previous treatment was asked about and personal hygiene was taken into consideration.

Information was either obtained directly from the child (if 9 years of age or older) or from their teacher or school health workers (if under 9 years of age) and in certain circumstances with the aid of the school's personal file of the child.

2. Complete dermatological examination (skin, hair, nails and mucous membrane) for detection of superficial dermatophyte infection. Clinically suspected cases were subjected to sample collection from their scalp, skin or nails.

3. The specimens were collected as follows:

For tinea capitis, after cleaning the scalp with 70% ethyl alcohol to reduce the likelihood of bacterial contamination and improve the chance for fungal detection. This was also useful in removing any topical medications that might have been used by the patient.

In cases of scaly lesions, scales were scraped from the surface by the edge of a clean glass slide. Hairs were then epilated by using non toothed epilator forceps sterilized by heating. Hairs were collected from the active edge of the lesion and from the centre as well. Dull, grey or broken hairs were selected. Cutting of hair was avoided as the infection is usually confined to the root and very near to the scalp surface. Hair and scales were then collected in sterile dry and labeled Petri dishes.

For tinea corporis, the site of the lesion was recorded and a specimen was taken. The skin was cleaned with 70% ethyl alcohol using sterile sponge and scales were removed by the edge of a clean glass slide. If the scales were not enough for sampling, a clear adhesive tape was stacked to the surface of the lesion and then removed gently. It was then pressed (adhesive side down) on a clean glass slide and then placed in sterile dry Petri dish.

For onychomycosis, The nail plate was cleaned by 70% ethyl alcohol and the surface was scraped gently by the edge of a glass slide and then deep scrapings were taken from the under surface by the

edge of a sterile scalpel. Specimens were then collected in a sterile dry Petri dish.

All specimens were then transported to the laboratory for mycological examination.

Mycological examination

The hair specimens, collected scales of tinea corporis lesions and nail scrapes were processed for examination by 10% **KOH** solutions by the following procedure: A drop of KOH reagent was placed on the centre of a clean sterile glass slide. The hair sample was placed in the solution and teased lightly by two sterile inoculating needles to avoid damage of the hair shaft. The material was then covered by a cover slip which was gently taped over the slide. The excess KOH from the outer side of the cover was wiped with paper tissue. The slide was then left to dry at room temperature for 10 minutes (to digest keratinous material) before examination.

Gentle warming of KOH preparation was used sometimes to shorten the time elapsing examination and to remove air bubbles that might have been trapped underneath the cover slip. Excess heating was avoided to guard against crystallization and crystal formation.

Microscopic examination was then done using low and high power of light microscope. Hair was examined from the root upwards and from the surface to the centre for detection of fungal spores and whether they are ectothrix or endothrix. In cases of ectothrix invasion, the size of spores was observed whether they are large or small spores.

Either the specimen was KOH negative or positive; it was then cultured on Sabouraud Dextrose Agar (SDA) media supplemented with Cycloheximide and Chloramphenicol. Chloramphenicol was added to control bacterial growth and cycloheximide was added to inhibit saprophytic fungal growth. They are heat stable and so can be incorporated into the media before autoclaving.

Cultures were then incubated at (26 – 28C).

Cultures were examined three times weekly for detection of fungal growth. Cultures were incubated for 2 weeks after which it was considered negative if no growth occurred.

Data processing and statistical analysis

The data were collected, tabulated, and analyzed by SPSS (statistical package for social science) version 17.0 on IBM compatible computer (*SPSS Inc., Chicago, IL, USA*). Mean, standard deviation and range were used to describe numerical data; categorical data was described as frequency and percentage. Chi squared and Fisher's Exact tests were used to compare categorical data accordingly. P value was considered significant at a value ≤ 0.05 (two sided).

3. Results

Table 1: Socio-demographic criteria of the studied pupils

Socio demographic criteria	The studied group N = 3464	
	No	%
Age X \pm SD Range	9.88 \pm 2.37 6 – 14	
Age group		
6 – 9	1041	30.1
9 – 12	1300	37.5
12 – 15	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

SEL = socioeconomic level

Table 2: Prevalence of superficial dermatophyte infections among the studied pupils

	The studied group N = 3464	
	No	%
Superficial dermatophyte infections		
Positive	49	1.41
Negative	3415	98.6
Prevalence of different clinical types		
Tinea capitis	35	1.01
Tinea corporis	4	0.12
Tinea pedis	6	0.17
Onychomycoses	4	0.12
Fungal culture		
Negative	15	0.43
Positive (confirmed cases)	34	0.98

Table 3: Superficial dermatophyte infections in relation to socio-demographic characters of the studied pupils

	Superficial dermatophyte infections				Test	P value
	Positive N=49		Negative N= 3415			
Age X ±SD Range	9.86 ±2.35 6 – 14		10.10±2.35 6 – 14		t-test 0.74	0.46
	No	%	No	%	X²	
Sex Male Female	41 8	2.3 0.5	1722 1693	97.7 99.5	21.4	<0.001
Residence Rural Urban	26 23	1.6 1.2	1593 1822	98.4 98.8	0.80	0.37
SEL Low Middle High	38 4 7	4.4 0.3 0.6	817 1488 1110	95.6 99.7 99.4	75.3	<0.001

X² = Chi squared test P value >0.05 = non-significant, <0.05 = significant, <0.001 = highly significant

Table 4: Risk factors of superficial dermatophyte infection among the studied pupils

	The studied group N = 3464				Test	P value
	Positive N = 49		Negative 3415			
	No	%	No	%	X ²	
Family history Positive Negative	31 18	63.3 36.7	288 3127	8.4 91.6	FE 173.7	<0.001
Dealing with pits Yes No	36 13	73.5 26.5	272 3143	8.0 92.0	F 255.9	<0.001
Use towels of other family member Yes No	35 14	71.4 28.6	321 3094	9.4 90.6	201.6	<0.001
Use of colleagues tools Yes No	32 17	65.3 34.7	566 2849	16.6 83.4	80.3	<0.001

X² = Chi squared test, FE= Fisher's Exact test

P value >0.05 = non-significant, <0.05 = significant, <0.001 = highly significant

The results of this work found that, the mean age of the studied group was (9.88±2.37) year and ranged from 6 – 14 years, 1701 (49.1%) of our participants were females with male to female ratio (1.04: 1), 1845 (53.3%) of them were of urban residence, 1300 (37.5%) of them were in age group (9-12 years), and 1123 (32.4%) of them were in age group (12-15) years, 855 (24.7%) of the pupils were of low socioeconomic level, 1492 (43.1%) of them were of middle socioeconomic level (SEL) and 1117 (32.2%) of high SEL (Table 1).

The prevalence of clinically suspected cases with superficial dermatophyte infections was 49 cases (1.4%) of the studied pupils. With mycological examination, 34 cases (0.98%) were confirmed cases (both clinical and mycological evidence) and 15 cases

(0.43%) were suspected cases (negative culture), with positive predictive value of mycological examination (69.4%). On clinical base, the prevalence of tinea capitis was 35 cases (1.01%) tinea pedis, 6 cases (0.17%) and both tinea corporis and onychomycosis were 4 cases of each (0.12%) (Table 2).

Different clinical types were distributed among clinically suspected cases as 71.4% of cases were Tinea capitis, 12.2% of them were tinea pedis, 8.2% were tinea corporis and the same percentage for Onychomycosis (figure 1).

There was non significant relationship between dermatophytosis and both age and residence of the studied pupils, while, males were more affected than females (2.3% Vs 0.5%) for males and females respectively, also dermatophytosis was significantly

more frequent among pupils with low SEL (4.4%) than middle SEL (0.3%) and high SEL (0.6%) (**Table 3**).

There was significant association between positive family history of dermatophytosis and positivity of the disease also, There was significantly higher rate of superficial dermatophyte infection

among pupils who are dealing with pits, using towels of other family member, using tools of colleagues with percentage of (73.5 % Vs 8%, 71.4 % Vs 9.4% & 65.3 % Vs 16.6%) respectively (**table 4**).

Tinea pedis cases were of significantly higher age than other clinical types of dermatophytosis. (p value = 0.005) (**Figure 2**).

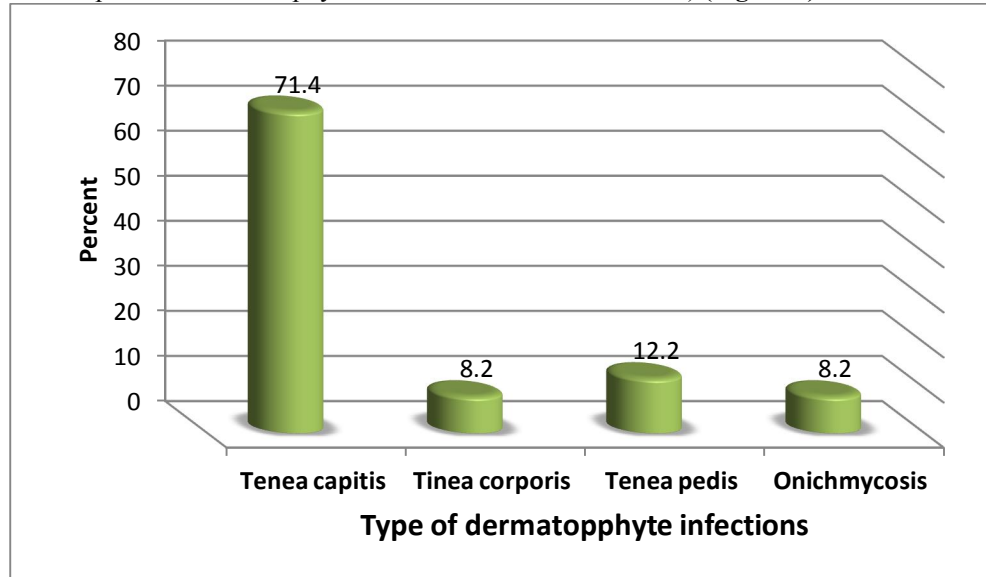


Figure 1: Distribution of clinical types of dermatophyte infections among the studied pupils

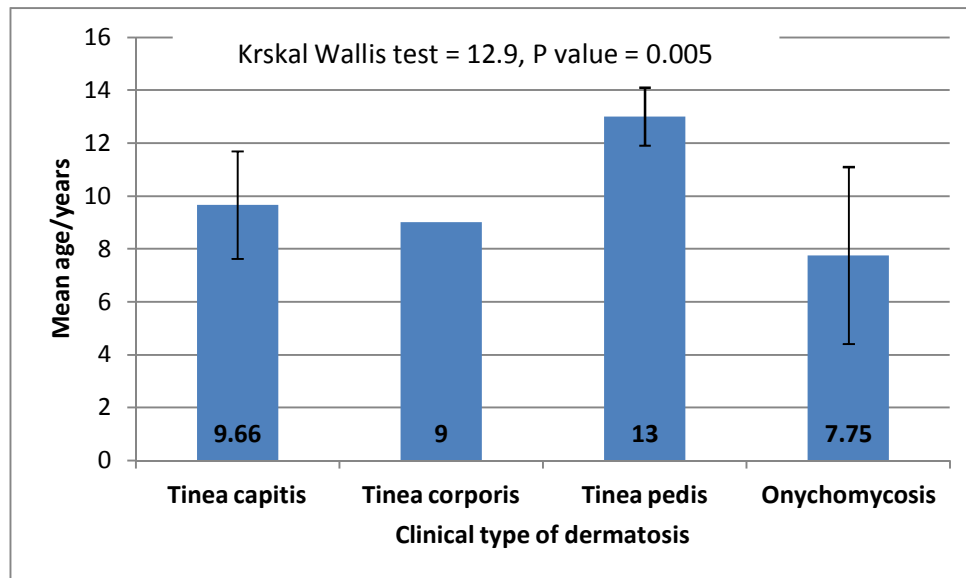


Figure 2: clinical type of dermatophytosis in relation to age of participants

4. Discussion

The results of this study recorded that, the prevalence of clinically suspected cases of superficial dermatophyte infections was 1.4% with 35 cases (1.01%) with tinea capitis, 6 (0.17%) with tinea pedi and 4 cases (0.12%) with tinea corporis and the same percent for onychomycoses. Prevalence of confirmed

cases by mycological examination was 34 cases (0.98%) with positive predictive value 69.4% (table 2 and figure 1). This is in keeping with *Mohammed et al; 2013* who estimate the incidence and aetiology of tinea capitis in Fayoum city, Egypt. The incidence rate was (0.4%) of the total students, also this is in concordance with *Zarrin et al, 2011* who determine

the prevalence, clinical types and causative agents of superficial fungal infections among primary school children in **Ahvaz, Iran**. the study was conducted on 2827 randomly selected primary school pupils aged (6 – 12) years and the prevalence was (0.4%). A relatively higher prevalence was noticed in the study of **Fathi and Alsamaraia; 2000** who estimate the prevalence of tinea capitis among school children in Iraq, survey of 4461 primary school was carried out for the epidemiological, clinical and mycological feature of tinea capitis. It recorded that, 204 cases (4.57%) was clinically diagnosed cases, mycological examination of hair and scalp scraping gave positive results in 120 with prevalence rate (2.7%) of confirmed cases. Relatively higher prevalence was also noticed also in **Omar, 2000** who study the prevalence of Tinea capitis in 510 primary school children in Alexandria, Egypt, and documented that, the prevalence of clinically suspected cases of tinea capitis was 4.9% and confirmed cases was 2.9% with positive predictive value of mycological examination 60%.

Our results however, differ from that of **Oke et al, 2014**. whose study was carried out on 800 respondents in **ile-Life** south western Nigeria school children and revealed that the prevalence of superficial fungal infection was 35%. The disagreement may be contributed to different sample size, different climatic conditions and different subject's life style including personal hygiene.

The extreme opposite results were found by **Kalu et al; 2015** whose work conducted on 400 primary schools children in a rural south eastern Nigeria. Age of pupils ranged from 6 – 12 years. The prevalence of infectious dermatoses was 72.3%. The most prevalent clinical form of infectious dermatoses was tinea capitis 35.2%. this very high prevalence explained as due to tropical climate (which predisposes to excessive sweating), poor hygiene, dirty environment, overcrowding, intimate association with animals, and scarcity of water (**Emele & Oyeka, 2008**).

The causative organism:

The current work showed that 69.4% of the suspicious cases were of positive culture and all of culture positive cases were caused by *M.Canis* (figure3). This is in line with the study of **Mohammed et al; 2013**, who revealed that *M.canis* is the most common (40%) of the isolated fungi. Also these results agree with **Zarrin et al; 2011** who found that the etiological agent of tinea capitis was *M.canis*. Our results, however, were different from that of **Younes et al; 2012** whose study found that *T.vialeceum* was the causative organism, also the result conflict with that of **Oke et al, 2014** whose study revealed that *Microsporum audouinii* was the leading organism isolated.

Regarding to the prevalence of superficial dermatophyte infections among different age groups of the studied pupils, our study showing that tinea capitis more prevalent in age (6 – 9) table (5). which is in keeping with **Younis et al, 2012** who determine that tinea capitis was prevalent among patients less than 10 years. This is in keeping to the documented view that cases of tinea capitis mainly occur in children below the age of 10 years **Aktas et al; 2009**. This may be attributed to saturated fatty acids that present in sebaceous gland secretions that first appear at puberty and persist into adulthood which considered as natural protective mechanism (**Akbaba et al., 2008**) in addition to lack of personal hygienic measures in this age group than older age.

Regarding to sex, the dermatophyte infection was more common among males than females 41(83.7%) of clinically suspected cases were male versus only 8(16.3%) of them were females table (6). This is agreement with **Mohamed et al 2013** who proves male predominance (83%), also similar results was found in **Kalu et al 2015** who document male predominance in dermatophyte infection, this may be due to the fact that females are more conscious of their appearances; and they care more about personal hygiene, which promote health, than males. On the other hand, easier implantation of spores and easier detection of even small lesions that can be attributed to male short hair.

In our study, there is no statistical difference between urban and rural pupils regarding prevalence of superficial dermatophyte infection table (7). Dissimilar results were noticed by **E.I. Nweze & Okafor, 2005** that report significantly higher rate of dermatophyte infections among rural dwellers. This dissimilarity can be explained by the fact that, the nature of the community in Menoufia governorate which tend to be more semi urban than to be of frank urban character.

Regarding socioeconomic level, our results revealed that 77.6% of clinically suspected cases were of low SEL and 8.2% of middle level, 14.3% of them were of high level table (8). These results is supported by that of **Ranganthan et al 1995** who documented increased prevalence of dermatophytoses in low SEL followed by middle and the lowest prevalence recorded among high socioeconomic level. Dissimilar results was documented by **Fathi and Al-samarai, 2000** who recorded the association between dermatophytoses and low education and low occupation levels of parents.

The current study documented a significant association between positive family history of dermatophytoses and its prevalence among the pupils table (9), the same results were observed in **Fathi and Al-samarai, 2000**.

Regarding the risk factors, in our study there was significantly higher rate of superficial dermatophyte infection among pupils who are dealing with pits, using towels of other family member, using tools of colleagues with percentage of (73.5% Vs 8%, 71.4% Vs 9.4% & 65.3% Vs 16.6%) respectively **table (10)**.

This is in agreement with **Ogbu et al. 2015** whose study was carried out among primary school pupils in AWKA, south local Government Area of Anambra state Nigeria and revealed that poor personal hygiene and intimate association with house hold pets among the children were the suspected sources of infection. Also there is agreement of these results with **Fathi and Al-samarai, 2000** who document a significant association between dermatophytes infection and animal contact, bed sharing and hats sharing. Also **Sehgal et al, 1985** found that animals played a significant role in the prevalence of tinea capitis with 18% of affected children involved in rearing animals.

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