

Dermatophytosis Among Outpatients in Gaza, Particularly Tinea Capitis

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Abstract: *Superficial fungal infections caused by dermatophytes, are a public health problem in many parts of the world especially in developing countries. The aim of this study is to determine the prevalence and etiological agents of dermatophytosis, and their distribution according to age and gender in the region of Gaza, Palestine. Skin, hair and nail samples were collected from 111 subjects suspected to have cutaneous mycoses, who attended the dermatology clinic at Gaza over 7-month study period, from March to September 2009. Samples were examined by direct microscopy with 10-20% KOH preparation and culture on Sabouraud's dextrose agar.*

In light of clinical diagnosis, the most common dermatophytic infection was tinea capitis (50.5%), followed by tinea corporis and tinea unguium (12.6% for each), and tinea versicolor (4.5%). Diagnosis was confirmed by microscopic examination in 37 cases (33.3%), and the causative agent was isolated and cultured in 34 cases (30.6%). However, 40 cases (36%) were confirmed by microscopic examination or culture and 31 cases (27.9%) confirmed by both methods.

Dermatophytes were significantly the most common isolated pathogens (28/34, 82.4%), followed by Candida spp. (5/34, 14.7%) and Malassezia furfur (1/34, 2.9%). Among dermatophytes, Trichophyton spp. was the most frequent isolate (14/34, 41.2%), followed by Microsporum spp. (13/34, 38.2%). The least isolated dermatophyte was Epidermophyton floccosum (1/34, 2.9%).

There was no significant difference between the percentage of infection in males (52.5%) and females (47.5%). However, highest prevalence of

dermatophytic infection was detected among age group 1-15 years, in particular tinea capitis, where mostly caused by the genera *Trichophyton* and *Microsporum*.

In conclusion, our study showed that the most common dermatophytic infection was tinea capitis, tinea corporis and tinea unguium respectively and the most common isolated agents were *Trichophyton* and *Microsporum* spp.

Keywords: Dermatophytosis, Outpatients, Tinea capitis, Gaza.

Introduction

The dermatophytes are a group of closely related filamentous fungi that have the ability to invade keratinized tissue including skin, hair, and nails of humans and other animals to produce an infection - dermatophytosis- which commonly referred to as tinea or ringworm [1, 2]. Infection by these fungi usually involves cutaneous nonliving tissue due to the inability of dermatophytes to penetrate the deeper tissues or organs of immunocompetent hosts [3, 4]. The source of infection with dermatophytes can be directly from contact with infected peoples (anthropophilic), animals (zoophilic), and soil (geophilic), or indirectly from fomites [3, 5-7]. Dermatophytes are considered as group of closely related filamentous keratinophilic fungi belonging to the genera *Trichophyton*, *Epidermophyton* and *Microsporum* [8]. While the genus *Epidermophyton* is represented by a single species (*E. floccosum*), the genera *Microsporum* and *Trichophyton* are complex and consist of many species [1, 9]. Worldwide, they are among the most common infectious agents for human [10] and prevalence of infections caused by them has been dramatically risen to such a level in the last decades that skin mycoses now affect more than 20–25% of the world's population, which make them one of the most frequent forms of infections [11]. The distribution of dermatophytes varies among different countries and exhibits geographical and seasonal variations depending on several factors, including life style, type of the population, migration of people and climatic conditions [1, 3, 8, 11, 12].

Tinea capitis, which is one of the most common dermatophytosis in children, is an infection of the scalp and hair shafts [13]. Transmission is promoted by poor hygiene and overcrowding, and can

occur through contaminated hats, brushes, beddings, and other inanimate objects [3, 14].

In Gaza strip and according to the researcher's best knowledge, there were no studies dealing with the occurrence, incidence or prevalence of dermatophytosis among children and/or adults population in this area. For this reason, this study was designed and aimed to determine the distribution of dermatophytes responsible for different types of tinea, the nature of the etiological agents according to age and gender in patients visiting the dermatology clinic of Al Remal Polyclinic in Gaza city, Gaza Strip.

This is the first investigation dealing with dermatophytosis in Gaza city and we hope that the clinical and epidemiological data collected would serve as a reference for further research and may be beneficial in improvement of preventive and educational policies.

Materials and Methods

This study was performed at the dermatology clinic of Al Remal polyclinic in Gaza city from March to September 2009. A total of 111 outpatients suspected for dermatomycosis were included in this study. They are 49 males and 62 females aged 1 to 65 years old. In all suspected cases, hair, skin or nail specimens were collected by a dermatologist who diagnosed and treated the patient for mycological infection. These specimens were obtained by clippings or scrapings of the scales at the periphery of the skin lesions and by subungual curettage of affected nails. Briefly, scale scrapings were collected from infected area with a sterile surgical blade and about 10-15 hair roots were removed with sterile epilator forceps. All specimens (one from each patient) were sent to the microbiology laboratory for direct microscopy and culture investigations. Direct microscopic examination of skin and hair specimens was performed after digestion in 10% (w/v) potassium hydroxide (KOH) aqueous solution, while nail specimens were digested using 20% KOH. Briefly, a portion of each sample was placed on a sterile empty petri plate and a few drops of KOH were added. After 5-10 min for skin and hair samples and after 30 min for nail samples, part of this wet preparation was transferred to clean, dry microscopic slide and examined under low (x100) and high (x400) magnification for the presence of arthroconidia, mycelium and /or spores.

For culture analysis, specimens (irrespective of the negative or positive microscopic examination result) were inoculated onto petri plates and slants of Sabouraud's dextrose agar (SDA) containing chloramphenicol, gentamicin and cycloheximide (HIMEDIA, India), which was prepared according to the manufacturer's instructions. All cultures were incubated at room temperature (25–30 °C) and examined two times weekly for growth. Slant samples were declared as negative only if there was no growth after four weeks of incubation [15]. Fungal growth was usually apparent after one to two weeks and identification of isolated colonies was based on macroscopic and microscopic morphology according to standard criteria [15]. Age, sex, clinical suspected diagnosis, KOH and culture results were tabulated, encoded and statistically analyzed using the Statistical Package for the Social Sciences (SPSS) version 15. Data were compared using analysis of Pearson Chi-square test as appropriate. The level of statistical significance was set at $P < 0.05$.

Results

Table (1): Description of study population and clinical samples

Age groups				
Sex	(1-15) No. (%)	(16-40) No. (%)	(41-65) No. (%)	Total No. (%)
Males	27 (55.1)	13 (26.5)	9 (18.4)	49 (44.1)
Females	28 (45.2)	31 (50.0)	3 (4.8)	62 (55.9)
Total	55 (49.5)	44 (39.6)	12 (10.8)	111 (100)
Clinical sample	(1-15) No. (%)	(16-40) No. (%)	(41-65) No. (%)	Total No. (%)
Hair	47 (90.4)*	2 (3.8)	3 (5.8)	52 (46.8)
Skin	6 (14.0)	29 (67.6)**	8 (18.6)	43 (38.7)
Nail	2 (12.5)	13 (81.3)**	1 (6.3)	16 (14.4)
Total	55 (49.5)	44 (39.6)	12 (10.8)	111 (100)

* Statistically significant higher hair samples in age group 1-15 years (P -value = 0.0001).

** Statistically significant higher skin and nail samples in age group 16-40 years (P -value = 0.0001).

In this study, the total number of examined patients was 111, 49 males (44.1%) and 62 females (55.9%), aged 1-65 years old. There are 55 (49.5%) patients aged 1-15 years, 44 (39.6%) aged 16-40 years and

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12 (10.8%) aged 41-65 years. There are 52 (46.8%) hair specimens, 43 (38.7%) skin specimens and 16 (14.4%) nail specimens that investigated (Table 1).

Clinically and as shown in table 2, tinea capitis was the most commonly diagnosed dermatophytic infection (56, 50.5%), where it represents about half of patients investigated, followed by tinea corporis and tinea unguium, that both together account for 25% of the total tested patients. However, by direct microscopic examination and/or culture, tinea capitis again was the most commonly confirmed cases (52.5%), followed by tinea corporis and tinea unguium (10%).

Table (2): Distribution of dermatophytosis (Tinea) according to clinical suspected diagnosis and to the laboratory diagnosis

Type of tinea	Frequency (%) (Clinical diagnosis)	Frequency (%) (Lab. diagnosis)
Tinea capitis	56 (50.5)	21 (52.5)
Tinea manuum	4 (3.6)	2 (5)
Tinea corporis	14 (12.6)	4 (10.0)
Tinea unguium	14 (12.6)	4 (10.0)
Tinea cruris	5 (4.5)	3 (7.5)
Tinea pedis	5 (4.5)	1 (2.5)
Tinea barbae	2 (1.8)	1 (2.5)
Tinea faciale	6 (5.4)	1 (2.5)
Tinea versicolor	5 (4.5)	3 (7.5)
Total	111 (100)	40 (100)

Out of the total clinically suspected tinea cases examined, there were 40 (36%) patients found to be positive for dermatophytic infection by direct microscopic examination or culture (Table 3). Of these positive cases, culture alone was positive in 34 (30.6%), direct microscopic examination was slightly higher and was positive in 37 (33.3%), while both methods were positive in 31 (27.9%) of the study population. All five direct microscopic positive samples that revealed *Candida* spp. were also positive by culture. While only one out of the three *Malassezia furfur* direct microscopic positive samples grown on SDA culture.

Table (3): Positive results of direct microscopy and/or cultures

Number of positive cases		
	Microscopic	Microscopic
		Total

	positive	negative	
Culture positive	31 (27.9%)	3 (2.7%)	34 (30.6%)
Culture negative	6 (5.4%)	71 (64%)	77 (69.4%)
Total	37 (33.3%)	74 (66.7%)	111 (100%)

From the total isolated pathogens identified by culture growth, dermatophytes genera were the most common pathogens, accounting for 82.3% (28), followed by *Candida* spp. (5, 14.8%). The least encountered pathogen isolated was *Malassezia furfur* (1, 2.9%) (Table 4). There was a statistically significant difference between dermatophytes and other pathogens ($P < 0.01$). The most common isolated genera of dermatophytes were *Trichophyton* spp. and *Microsporum* spp., where higher *T. rubrum*, *T. violaceum* and *M. canis* species were isolated. The *Trichophyton* and *Microsporum* genera were significantly higher than the genus *Epidermophyton*.

Table (4): Frequency of causative agents causing dermatophytic infections isolated from positive cultures

Pathogen isolate	Frequency	Percentage
<i>Trichophyton</i> spp.	14	41.2%*
<i>Microsporum</i> spp.	13	38.2%*
<i>Epidermophyton floccosum</i>	1	2.9%
<i>Candida</i> spp.	5	14.8%
<i>Malassezia furfur</i>	1	2.9%
Total	34	100%

* Statistically significant higher *Trichophyton* and *Microsporum* in comparison to others pathogens (P -value < 0.01).

Fifty two of patients with mycotic pathogens were males and 47.5% females. Superficial fungal infections were found slightly higher in males than females, but this difference did not reach statistical difference.

Table 5 shows the distribution of dermatophytosis according to age and type of sample collected. The frequency rate of positive samples which is mostly in the form of tinea capitis was higher (52.5%) in age group 1-15 years (mostly children) than other age groups. Also, the frequency rate of positive samples from hair (52.5%)

was higher in comparison to skin (37.5%) and nails (10%) samples. There was a statistically significant difference between different age groups and also between type of collected samples ($P = 0.01$). Tinea capitis was diagnosed mostly and significantly in 1-15 years age group and mostly caused by *Trichophyton* and *Microsporum* species.

Table (5): Distribution of positive samples (40) according to sex, age group and type of specimen

Factor	positive samples	Percentage (%)
	No.	(%)
Sex		
Male	21	52.5%
Female	19	47.5%
Age group		
1-15 years	21	52.5%*
16-40 years	12	30.0%
41-65 years	7	17.5%
Type of specimen collected		
Hair	21	52.5%§
Skin	15	37.5%
Nail	4	10.0%
Total	40	100%

* Statistically significant higher prevalence of positive samples in age group 1-15 years.

§ Statistically significant higher prevalence of positive samples in hair specimens.

Discussion

Fungal infections still create a main health problem all over the world affecting all ages particularly children. Therefore, many studies have been conducted concerning different epidemiological, economical, control as well as therapeutic features of this infection [7]. Dermatophytosis is considered as the most common human fungal infections, and about 20–25% of the world's population estimated to have skin mycoses [4]. The causative agents include the dermatophytes, *Candida* spp. and *Malassezia furfur*. They can be transmitted from person to person in various human habitats and also from animals to human especially in children [16, 17]. The actual prevalence of fungal diseases and their most common causative agents among children and adults in Gaza are unknown. Several studies

conducted worldwide, including Palestine demonstrated that dermatophytes still the most frequent etiologic agents of skin, nail and hair fungal infections diagnosed in mycological laboratories [6, 16–28]. Also, in our study, dermatophytes (82.3%) were the most common isolates, and *Trichophyton* spp. and *Microsporum* spp., were the most frequently isolated pathogens. Our results are in agreement with many studies in different countries around the world as in Turkey, Tunisia, Iran, Malta, USA, Libya, Mexico, and Japan where the authors found that dermatophytes were the most prevalent fungal agents [6, 16, 17, 18, 21, 24, 26, 29-32].

Tinea capitis is a typical illness of the hairy head of pre-pubertal children but it can occur in adults. However, it is more seldom type of superficial infections in adults. The incidence of dermatomycoses in general and tinea capitis in particular is influenced by various factors such as race, socio-economic conditions, cultural patterns, and public health measures. The problems associated with tinea capitis are its contagiousity and the long duration of the treatment even with modern antifungals. Both zoophilic and anthropophilic dermatophyte species are possible pathogens with considerable geographic differences [7]. Our study revealed that tinea capitis was the commonest dermatophytic infection by both clinical (50.5%), and laboratory (52.5%), diagnosis, especially in children. There are many studies in many countries in different geographical areas are in agreement with our findings as in Iran where it was responsible for 39.6% of infections, in Tunis where it account for 69.4% of dermatophytic infections, in Malta, in KSA, tinea capitis account for 47.7% and *M. canis* was the commonest causative agent responsible for 46.9% of ringworm infections, in Palestine in Nablus city, the authors found that tinea capitis is the most common type of skin infection and the most prevalent dermatophyte was *M. canis*, followed by *T. tonsurans* and the least isolated was *E. floccosum*. Also, in occupied Palestine, tinea capitis was the major fungal infection from the beginning of the 20th century until the end of the 1950s and recently until 2009, where the most isolated pathogen was *M. canis* [14, 24, 25, 28, 29, 31, 33]. However, there are also many studies around the world and sometimes coming from the same country showed tineas in general and tinea capitis in particular is not the predominant superficial infection and

another type of infections are the predominant superficial infections as onychomycosis in two studies conducted in Turkey, one study in Sweden, another study in Kuwait, KSA, Tunisia and Greece [2, 6, 10, 11, 17, 34, 35]; tinea corporis in Libya [21]; tinea pedis in Jordan, Mexico and Turkey [5, 18, 36] and tinea cruris in Iran [32]. These results showed that the predominant dermatophyte infection and its dermatophyte causative agent may change in different localities and even in the same locality with time. This change could be due to several factors as activity related to human and animal hygiene and interaction between human and human, animal and soil, and changing population over the time [10]. Also, the high incidence of tinea capitis in children may be due to the low level of fungistatic fatty acids in skin at the early age before puberty, the use of unsterilized barbering instruments and the sharing of clothing, towels, and hair accessories with infected individuals and exposure to domestic animals and pets as cats and dogs may lead to the spread of these infections [17]. We found that zoophilic infection was the commonest causative agent of tinea capitis in Gaza. We think this could be due to the high number of cats in the city.

As we mentioned previously, dermatophytes were the commonest isolated agents, while *M. furfur* that is a lipophilic yeast present as part of the normal microflora of the skin was the least found. It can become the cause of a superficial cutaneous infection in humans with poor hygiene and because of predisposing factors and is more common in warm, humid climates. In our study, *M. furfur* account for 2.9% out of dermatophytic infection. This result is in agreement with the findings of a study conducted in Turkey, where the prevalence of *M. furfur* was 3% [17]. However, there is a higher incidence of this pathogen in another countries as Libya [21].

In this study, superficial fungal infections were slightly higher in males than females (52.5% vs. 47.5%; 1.1:1). Our findings are in agreement with many studies that showed no significant difference of dermatophytosis among males and females as in Kuwait [10] and Mexico [29], however, there are many studies showed higher infection among males [17, 22, 32, 37] and others showed more infection among females [7, 21, 24, 35]. The reason for these variations is not fully understood, but it indicates that gender may influence susceptibility to a particular form of tineas [32].

The initial diagnosis of tinea depends on clinical features, but this finding alone is inadequate owing to the common mistakes in clinical diagnosis result from cases of dermatoses that mimic tinea clinically. In this study, 36% of clinically suspected patients were positive for dermatophytic infection by direct microscopic examination or culture, where culture alone was positive in 30.6%, and direct microscopic examination in 33.3%. We noted that 7.5% of positive samples had no growth on SDA culture. The probable reason for negative culture growth from microscopically positive samples could be that highly contaminated samples were grown over by fast-growing saprophytic species (as *Aspergillus* spp.), which inhibited the growth of dermatophytes. It could be related to an antifungal treatment or inappropriate use of antimycotic drugs or self-medication before sampling, or because some patients can give incorrect information. Moreover, many antifungal drugs used for treatment of dermatophytosis are retained within stratum corneum of epidermis for a long time, and drug residues in the sample may inhibit the growth of dermatophytes on Sabouraud's dextrose agar [17]. Therefore, in the presence of lesions suspected to be mycotic infection, it is useful to perform direct microscopic examination with culture to increase diagnosis, although direct microscopic examination is preferred by some clinicians because culture takes about 1–2 weeks to give visible growth [11].

According to findings of our study, the incidence of superficial fungal infections caused by dermatophytes was significantly higher in children aged 1-15 years than the other group ages (Table 6). Most of positive hair samples were from children, while most of positive skin and nail samples were from adults. There are many studies supported our findings [11, 14, 29, 31, 36]. Tinea capitis was the most common form of infection before the age of 13 years. This has been mainly endorsed to the sensitivity of dermatophytes to certain fatty acids secreted from sebaceous glands that appear at puberty. In Gaza, we think that living conditions, large family size, growing domestic animals at home especially cats and close contact with infected children at crowded schools and kindergartens may facilitate fungal transmission. In this study, anthropophilic and zoophilic agents were the main isolated dermatophytes (79.4%). Moreover, children are

particularly at risk of zoophilic dermatophyte infections because they like physical contact with animals as cats and also they prefer playing outside especially in rural areas.

Table (6): Correlation of sample type with sex and different age groups

Specimen	Sex		Total (%)	P-value	Age group (years)			Total (%)	P-value
	Male (%)	Female (%)			1-15 (%)	16-40 (%)	41-65 (%)		
<i>Hair</i>	10 (47.6)	11 (52.4)	21 (100)	0.27	17 (81.0)	1 (4.8)	3 (14.3)	21 (100)	0.001
<i>Skin</i>	11 (73.3)	4 (26.7)	15 (100)	0.012	3 (20.0)	8 (53.3)	4 (26.7)	15 (100)	0.01
<i>Nail</i>	0 (0.0)	4 (100)	4 (100)	N.D.	1 (25.0)	3 (75.0)	0 (0.0)	4 (100)	N.D.
Total	21 (52.5)	19 (47.5)	40 (100)	0.614	21 (52.5)	12 (30.0)	7 (17.5)	40 (100)	0.03

N. D. Not determined

In conclusion, tinea capitis is a major type of superficial fungal infections especially among children (age group 1-15 years). The frequency of tinea corporis and tinea unguium was higher in adult patients. We recommend further nationwide epidemiological researches highlighting the socioeconomic factors attributed to the prevalence of dermatophytosis and to find out in more details the species that responsible for such infections. We recommend routine direct microscopic and culture examination for every suspected case to confirm clinical diagnosis.

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