Incidence of Dermatophytes in Human and Animal Dermatophytosis and Their Isolation by Conventional Methods

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Abstract

Dermatophytes are keratinophilic fungi that infect keratinized tissues causing diseases known as dermatophytoses. Dermatophytes are classified in three genera, *Epidermophyton*, *Microsporum*, and *Trichophyton*. This investigation was performed to study the prevalence of dermatomycosis among 200 samples were collected from human and some animal species (100 samples from each of human and animal), human samples were collected from skin diseases center at Ismailia clinic while animal samples were collected from El-Salhia farm, Internal medicine clinic Faculty of Veterinary Medicine, Suez Canal University in Ismailia, Al- Zahraa farm and private pet animal clinics in cairo. The skin scraping and hair samples were obtained aseptically by plucking hair with forceps around the affected area and scraping the epidermal scales with a sterile scalpel blade. All collected samples were examined by direct microscopy and culture technique. Laboratory identification of the fungal isolates was based on their colonial and microscopic characteristics. Dermatophytes were isolated in a percentage 40% in human samples while the percentage was 61% in animal samples. The most common isolated dermatophyte species in human were *M. canis*, *T. violaceum* and *T. mentagrophytes*, in pets was *M. canis*, in cattle was *T. verrucosum* and in horse were *T. mentagrophytes* and *T. verrucosum*.

Introduction

Dermatophytosis is considered one of the most important fungal skin diseases which infects animals and is transmitted from animal to animal, as well as from animal to human and vice versa ***(Richardson and Warnock, 2003).*** Dermatophytes are filamentous fungi, which invade keratinized tissues of humans and animals, causing mild to severe, localized and/or diffuse infections ***(Cafarchia et al., 2013).***

In warm, wet locations and seasons, fungi can easily survive and reproduce, and superficial mycosis

can be spread easily. Superficial mycoses, commonly detected in dermatological area with a high incidence and recurrence rate ***(Wu 2005, Chen and Wang 2011)*** and the infection rate being 20% to 25% in the human population worldwide ***(Havlickova et al., 2008)***.

Dermatophytosis is a common contagious disease caused by dermatophytes. Dermatophytes belong to a group of organisms that are able to break down the keratin in tissues such as the epidermis, hair, nails, feathers, horns and hooves. Most of these fungi reside in the soil and are involved in decomposition; however, the dermatophytes can infect living hosts. In living hosts, dermatophytes usually remain in superficial tissues such as the epidermis, hair and nails. Serious consequences are uncommon and infections can be self-limiting. However, the illness may be disfiguring and uncomfortable, especially when the lesions are widespread. Economic effects, such as damage to hides, are also important in livestock. ***(Acha and Szyfres, 2003).***

Dermatophyte infections in human can affect the skin on almost any area of the body, such as the scalp (tinea capitis), legs (tinea pedis), arms (tinea corporis), feet (tinea corporis), groin (tinea cruris) and nails (tinea unguium). These infections are usually itchy, redness, scaling, or fissuring of the skin, or a ring with irregular borders and a cleared central area may occur. If the infection involves the scalp, an area of hair loss may result. More aggressive infections may lead to an abscess or cellulitis. Areas infected by dermatophytes may become secondarily infected by bacteria. Symptoms typically appear between 4 and 14 days following exposure ***(Ananthanarayan and Paniker, 2009).***

Both *M. canis* and some *T. mentagrophytes* complex members are zoophilic and cause different forms of tinea infections in humans ***(Panasiti et al., 2007).***

Fungi of the genera *Microsporum* and *Trichophyton* cause animal dermatophytosis; among these *T. equinum* and *M. canis* frequently cause disease in horses, particularly in young animals ***(Chermette et al., 2008).*** Other species such as *T. mentagrophytes* and *M. gypseum* have also been isolated from skin lesions, whereas *T. bullosum* and *M. praecox* have been isolated from healthy animals and the surrounding environment. The reaction to dermatophyte infection ranges from mild to severe depending on the reaction of the host to metabolic products of the fungus, virulence of the species, anatomic location of the infection and local environmental factors ***(Weitzman and Summerbell 1995).*** Generally, clinical signs include mild to severe alopecia associated with erythema. Lesions due to *T. equinum* and *M. canis* infection are typically dry, with thin powdery scales and hairs broken at

their base. Lesions are usually not pruritic; kerion and military dermatitis may also occur, with the latter extending rapidly from the saddle and girth to the body ***(Chermette et al., 2008).***

Microsporum canis is the most common species of dermatophyte in cats and dogs, with cats considered to be the most important reservoir hosts. This organism is also found regularly in horses and rabbits, and it has been reported in other animals including cattle, sheep, goats, camelids and swine. All domesticated mammals are susceptible to dermatophytes. Wildlife can also be affected. The most common agents vary with the host and the geographic region, and may also be affected by management practices (e.g., whether animals can contact other species). Overall, the most common dermatophytes in domesticated mammals are *M. canis, M. gypseum, T. mentagrophytes, T. verrucosum, T. equinum* and *M. nanum* (in pigs). ***(Cafarchia et al., 2004).***

This study was aimed to determine the fungal species isolated from human and some animals suspected of having dermatomycoses and their incidence.

Materials and Methods

Study population

A total of 200 skin scrapping and hair samples infected by dermatophytes were collected from diseased human and animal dermatophytosis (100 from clinic human cases aged between 4-50 years and 100 from animal cases aged between 3 weeks to 10 years). Different animal species were used for sample collection (50 samples from cat, 26 from dog, 10 from cattle and 14 from horse).

Sample collection

The samples were obtained by plucking hair with forceps around the affected area and scraping the epidermal scales with a sterile scalpel blade following cleaning of affected areas with 70% ethanol. The samples from each lesion were placed in separate sterile Petri dishes and submitted on the day of collection to the Veterinary Mycology Laboratory at the Faculty of Veterinary Medicine, Suez canal University, Egypt. Sample collection was adopted according to ***Miller and Michael (1999).***

Direct microscopic and cultural examinations

Each sample collected was divided into two portions. One portion was used for direct microscopic examination using potassium hydroxide (KOH) 20%. The remaining sample was cultured onto Sabouraud's dextrose agar (SDA) with Dermasel selective supplement (Oxoid, Thermo Fisher Scientific; Basingstoke, UK) (0.05% chloramphenicol and 0.5% cycloheximide) and on dermatophyte test medium (DTM, HiMedia laboratories; Mumbai,

India). The plates were incubated at 30°C for 4 weeks and examined for any growth at 3 day intervals.

Isolates were identified on the basis of phenotypic characteristics of the colonies on SDA (texture, growth rate, pigmentation, surface and reverse colour), color change to red in case of DTM and microscopic examination of lactophenol cotton blue wet mounts ***(Kwon-Chung and Bennett, 1992).*** The isolates were sub-cultured on milk-honey-bromothymol blue (MHB) medium ***(Taha et al., 2013)*** and rice grain (RG) medium ***(Fisher and Cook 1998)*** at 30°C for 15 days and then were observed for the growth rate and change of the medium color.

Results

In case of human samples 40 dermatophytes were isolated from skin scrappings and hair samples were identified as 3 species namely: *M.canis* 33 (82.5%), *T. violaceum* 5 (12.5%) and *T. mentagrophytes 2* (5%) as shown in table (1). In case of animal samples 61 dermatophytes were isolated from skin scrappings and hair samples, including 30 isolates were obtained from cat, 20 isolates were obtained from dog, 5 isolates from cattle and 6 isolates from horse. The identified species in case of cat and dog was *M. canis*, in cattle was *T. verrucosum* and in horse were *T. mentagrophytes* and *T. verrucosum* (5 and 6 isolates respectively) (Table 2 and 3).

Cultural characters and Microscopical examination of *M.canis* colonies on SDA are flat fluffy with white surface and yellow to yellow orange reverse. Micromorphological examination revealed large spindle thick walled macroconidia with hook or knob at its end and clavate to pyriform microconidia alongside of hyphae. On DTM change color to red. While for

T. violaceum colonies are glabrous with deep violet surface and reverse color. Irregular and bizzar hyphae (pigmented red) and chlamydospores which become numerous in old culture are microscopically characteristics.

Cultural characters and Microscopical examination of *T. mentagrophytes* colonies are glanular creamy surface with creamy to reddish brown reverse color. Macroconidia are elongated with thin wall and microconidia are clavate to pyriform alongside of hyphae. While for *T. verrucosum* appeared as heaped, folded and waxy with white surface and colorless reverse. Microscopical examination showed chains of chlamydospores, macroconidia and cigar shape (rare) and rounded microconidia.

Tinea capitis is a dermatophyte infection of the hair and scalp. While tinea corporis, or ringworm, occurs on the trunk and extremities infections often spread to the neck and wrists of adults in contact with infected children.

Tinea faciei and tinea barbae are dermatophyte infections occurring on the face. Tinea faciei is seen on the nonbearded parts of the face. Tinea barbae is an infection of the hairs and skin in the beard and mustache area, and is usually seen in men.

Table (1): *Incidence of identified dermatophytes from different human clinical samples:*

Patient samples and No.	**Positive isolate by microscopical examination (No. & %)**	**Identified species (No. & %)**
Tinea capitis (40)	+ve 19 (47.5%)	*M.canis* 12(30%) *T. violaceum* 2 (5%)
Tinea corporis (20)	+ve 9 (45%)	*M.canis* 7 (35%) *T. mentagrophytes* 2 (10%) *T. violaceum* 1 (5%)
Tinea faciei(25)	+ve 6 (24%)	*M.canis* 9 (36%) *T. violaceum* 1 (4%)
Tinea barbae(14)	+ve 6 (42.8)	*M.canis* 5 (35.7%) *T. violaceum* 1 (4%)
Tinea pedis (1)	+ve 0 (0%)	----------
Total (100)	40	*M.canis* 33 *T. violaceum* 5 *T. mentagrophytes* 2

Table (2): *Demographic data and clinical findings of positive animals with dermatomycoses.*

Animals (age & No.) Number of animals (100)	**Clinical signs and symptoms**	**Positive animals**		**Identified species**
		By culture (No., %)	**By microscopy (No., %)**	
Cat 50 1 month—4 years	One or more irregular or circular areas of hair loss with or without scales in the body and paws	**30 (60)**	**25 (50)**	*M.canis*
Dog 26 3 weeks—9 years	The scaling to inflammatory lesions, hairless and vesicles on the head and trunk	**20 (77)**	**12 (46.1)**	*M.canis*
Cattle 10 1—8 years	Circular, painless, thick, white and scattered with occasional production of large plaques in the head, neck and less frequently in the back, flank and limbs	**5 (50)**	**6 (60)**	*T. verrucosum*
Horse 14 1 year- 10 years	Dry, scaly and multiple lesions in any part of the body especially in the groomed part	**6 (43)**	**6 (42.8)**	*T. mentagrophytes* (2 isolates) *T. verrucosum* (6 isolates)
Total (100)		**61 (61%)**	**49 (49%)**	

Discussion

In this study, three different species were isolated from human skin scrappings and hair were identified as *M.canis* 33 (82.5%), *T. violaceum* 5 (12.5%) and *T. mentagrophytes* 2(5%).

In the present research, population study and clinical assessment of different types of skin mycosis and their etiological agents was done in 100 patients aged between 4 years to 50 years in skin diseases center at Ismailia city. Tinea capitis (47%) followed by tinea corporis (45%) and tinea barbae (42.8%) were the most common types of tinea infection. During the last few decades, a substantial increase in the prevalence of mycotic scalp infection and a remarkable change in the pattern of the causative dermatophytes among different developed countries has been observed ***(Ginter-Hanselmayer et al., 2007; Raccurt et al., 2009).*** The incidence of tinea capitis varies according to the climate, temperature, relative humidity, economic status, and precipitation of different geographic regions, as well as, the natural reservoir of infection ***(Moraes et al., 2006; Ginter-Hanselmayer et al., 2007; Ngwogu and Otokunefor, 2007; Samarai, 2007).***

In this study, *T. violaceum, T. mentagrophytes* and *M. canis* were isolated from tinea corporis and this result go hand in hand with ***Zaki et al. (2009)*** who examined dermatophyte infections in patients referred to the Department of Dermatology, El-Houd El-Marsoud Hospital, Cairo, Egypt during March 2004 to June 2005. Of 506 patients enrolled in their investigation, tinea capitis (76.4%), followed by tinea corporis (22.3%) and tinea unguium (1.2%) were the most common infections. The most frequently isolated dermatophyte species was *T. violaceum* followed by *M. canis.*

The most susceptible persons to tinea capitis were children below 10 years because of the lack of protective fatty acids in their scalp. This infection was rarely reported in persons above fifty years of age. Earlier, several authors have corroborated this finding. Some factors implicated in infection include poor personal hygiene, crowded living conditions, and low socioeconomic status such as ***Rebollo et al. (2008)*** who reported that tinea capitis is mostly exclusive to children and rarely occurs after puberty, probably due to changes in the pH of the scalp and an increase in fatty acids serving a protective role. Consequently, most cases occurring in adults involve women with hormonal disorders resulting in carryover of tinea capitis from childhood or in patients with severe immunodepression due to leukemia, lymphoma, or treatment with immunosuppressant drugs.

M.canis was the most common species isolated from tinea capitis, this findings was in agreement with ***Ginter-Hanselmayer et al. (2007)***

who reported that *Microsporum canis*, a zoophilic dermatophyte, is still the most common reported causative agent of tinea capitis in children in Europe. This may be attributed to playing of children with dogs and cats.

The study revealed that *T. violaceum* was the cause of tinea capitis and this result was inaccordance with ***Patel and Schwartz (2009)*** who reported that tinea capitis is a fungal infection specifically involving the scalp and hair. Also stated that tinea capitis is the most common dermatophyte infection in children under 12 years of age, with predominance in those of sub-Saharan African descent. ***Patel and Schwartz (2009)*** reported that the causative species of tinea capitis are from the *Microsporum* and *Trichophyton*. Our results may be due to *T. violaceum* is anthropophilic that mean dermatophyte for human more than animals.

T. mentagrophytes were isolated from tinea corporis (10%) this findings in agreement with ***Omar, 2004*** who isolated *T. mentagrophytes* from tinea corporis in a percent of 12.2%.

In this study *M. canis* and *T. violaceum* were isolated from tinea barbae and this result was inaccordance with ***(Gräser et al., 2008)*** that isolated *M. canis* and *T. violaceum* from tinea barbae. This may be attributed to *T. violaceum* is anthropophilic dermatophyte while *M. canis* is zoophilic dermatophyte which transported for human during dealing with dogs and cats.

M.canis and *T. violaceum* can cause tinea faciei and this result in agreement with ***(Gräser et al., 2008)*** who isolated *M. canis and* and *T. violaceum* from tinea faciei.

Animal dermatophytosis is of great importance in public health because the majority of dermatophytes isolated from animals are zoonotic with three major fungal species concerned, i.e. *M.canis* from cats and dogs but also from other animals, *T. verrucosum* from cattle and *T. mentagrophytes* from various hosts and not only rodents ***(Romano et al., 1997).*** *T. verrucosum* has been cited as the major agent isolated in cases of bovine, ovine and caprine ringworm. In this study *T. verrucosum* was the predominant species isolated from cattle and this in agreement with ***Cabañes (2000) and Cafarchia et al., (2004)*** who found that *T. verrucosum* was the only species isolated from cattle ringworm and is zoophilic dermatophyte causing dermatophytosis in cattle. In this study, the primary dermatophytes detected in pets presenting skin lesions are *Microsporum canis* (65.8%) and this result in agreement with ***Cafarchia et al., (2004).*** This is due to *Microsporum canis* is zoophilic dermatophyte affects dogs and cats.

Our findings revealed that *T. verrucosum* and *T. mentagrophytes* were the most common species causing dermatophytosis in horse

samples and this result go hand in hand with ***Tartor et al. (2016)*** who stated that *M. canis*, *T. verrucosum*, *T. mentagrophytes var. mentagrophytes* and *M. equinum* are the most common species causing dermatophytosis in Arabian horses.

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نسبة تواجد الفطريات الجلدية فى الانسان والحيوان المصابين وطريقة عزلها بالطرق التقليدية

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الفطريات الجلدية هى عبارة عن مجموعة من الفطريات المحبة لطبقة الكيراتين الجلدية مسببة ما يعرف بمرض التينيا . تنقسم الفطريات الجلدية الى ثلاثة انواع ابيديرموفايتون و ميكروسبورم و ترايكوفايتون. هذه الدراسة تهدف الى دراسة نسبة تواجد الفطريات الجلدية فى عدد 200 عينه من الانسان وبعض فصائل الحيوان بمعدل 100عينه من كلاهما. عينات الانسان تم تجميعها من مركز الامراض الجلدية فى الاسماعيلية بينما عينات الحيوان تم تجميعها من مزرعة الصالحية وعيادة قسم طب الحيوان بكليه الطب البيطرى جامعة قناه السويس بالاسماعيلية ومزرعه الزهراء للخيول والعيادات الخاصه بالقطط والكلاب فى القاهرة. تم تجميع العينات عن طريق نزع الشعر من حول المنطقة المصابه باستخدام ملقط وتجميع القشور الجلدية باستخدام مشرط معقم. تم تحليل العينات بواسطة الفحص المباشر بالميكروسكوب وزرع العينات. تم التعرف على العزلات عن طريق شكل نموها على الاوساط الميكروبية والفحص المباشر تحت الميكروسكوب حيث تم عزل الفطريات الجلدية بنسبه 40% فى الانسان و 61% فى الحيوان. وكان من اهم مسببات الفطريات الجلدية فى عينات الانسان ميكروسبورم كانز و ترايكوفايتون فيوليشيم و ترايكوفايتون منتاجروفيتس أما مسببات الفطريات الجلدية فى عينات الحيوان هى ميكروسبورم كانز فى القطط والكلاب و ترايكوفايتون فروكوزم فى الابقار بينما تم عزل ترايكوفايتون منتاجروفيتس و ترايكوفايتون فروكوزم من عينات الخيول.