

Presence of Keratinophilic Fungi with Special Reference to Dermatophytes on the Haircoat of Dogs and Cats in México and Nezahualcoyotl Cities

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ABSTRACT. In order to study the presence of keratinophilic fungi with special reference to dermatophytes on the coat of dogs and cats living in the cities of Mexico and Nezahualcoyotl in the Metropolitan area of Mexico City, two hundred samples were collected from dogs and one hundred from cats by using the MacKenzie's tooth brush technique, they were processed by routine mycological methods for dermatophyte fungi, results were analyzed by means of the statistical package SAS[®]. There were isolated 67 and 90 keratinophilic strains from cats and dogs samples, respectively. The most commonly fungi isolated in pure culture in this study were *Chrysosporium spp* (25%), followed by *Trichophyton terrestre* (22%), *Microsporum gypseum* (5%), *M. canis* (4%), as well as mixed cultures like *Chrysosporium spp.* & *M. gypseum* (2%) and *T. terrestre* & *T. mentagrophytes* (1%). Keratinophilic fungi were found in higher numbers in the cat haircoat (67 %) than in the dog's (45 %) and the same was true with regard to dermatophytes with 12 isolates out of a 100 samples in cats and 7 Isolates out of 200 samples from dogs. This may represent a health risk for humans in contact with a dermatophyte infected cat or dog.

Key words: Keratinophilic Fungi, Dermatophytes, Dogs, Cats.

RESUMEN. Con el objetivo de conocer la presencia de hongos queratinofílicos con especial interés en los dermatofitos en la piel de perros y gatos habitantes de las ciudades de México y Nezahualcoyotl en el área Metropolitana de la ciudad de México se tomaron 200 muestras de perros y 100 muestras de gatos utilizando la técnica de cepillado con cepillo dental descrita por Mackenzie y se procesaron por medios micológicos rutinarios, para el análisis estadístico de los resultados se utilizó el paquete estadístico SAS[®]. Se aislaron 67 y 90 cepas de hongos queratinofílicos de las muestras de gatos y perros, respectivamente. Los hongos queratinofílicos más comúnmente aislados en cultivo puro fueron: *Chrysosporium spp.* (25%), seguido por *Trichophyton terrestre* (22%), *Microsporum gypseum* (5%), *M. canis* (4%), mientras que en cultivo mixtos *Chrysosporium spp.* y *M. gypseum* (2%) and *T. terrestre* y *T. mentagrophytes* (1%). Se encontró un mayor número de hongos queratinofílicos en la piel de gatos (67 %) que en la de los perros (45 %) tendencia también fue cierta para los dermatofitos encontrando un 12% en gatos y sólo 3.5 % en perros. Esto demuestra que la piel de los perros y gatos representa un potencial peligro de infección por dermatofitos para otros animales y sobre todo para los seres humanos.

Palabras clave: Hongos Queratinofílicos, Dermatofitos, Perros, Gatos.

INTRODUCTION

Keratinophilic fungi live on the haircoat of dogs and cats, most of them can not produce damage, but among them, the so called dermatophytes, are infectious agents and can cause the zoonotic disease dermatophytosis, or "tinea". Due to the clinical presentation of dermatophyte fungal infections they are also referred to as "ringworm fungi". These fungi are classified into three genera: *Microsporum*, *Trichophyton*, and *Epidermophyton*. These genera include many species.¹

Infection begins after physical contact with an infected

outside source. Geophilic dermatophytes are found in the soil, zoophilic on animals such as dogs and cats, and anthropophilic in infected humans. Dermatophytes create inflammation, pruritus and desquamation by invading the keratin of the stratum corneum as well as the nails and the hair shaft. Dermatophyte hyphae seldom move further into the epidermis to damage other tissues.⁴ This study aimed for the analysis of distribution pattern of keratinophilic fungi on the coats of cats and dogs in Mexico and Nezahualcoyotl cities with special reference to dermatophytes, as well as the role that animals play as possible reservoirs of these fungi.



MATERIAL AND METHODS

Two hundred samples from dogs and one hundred from cats were obtained from the cities of Mexico and Nezahualcoyotl, using the MacKenzie's brush technique⁹ with dental brushes disinfected with benzalconium chloride, animals were sampled at antirrabic centers, private houses or veterinary practices during the period from September 1996 to April 1997. The statistical variables considered were age (puppy less than one year old /adult more than one year old), sex (male/female), breed (pure/mixed), life-style (living alone or with other animals), place of residence (Mexico or Nezahualcoyotl city), presence of owner (housed or stray animals) and clinical appearance (presence or absence of lesions).

Laboratory procedures were carried out at the Mycology Laboratory at the Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México. Culture was performed in plates containing a selective medium Sabouraud Dextrose Agar added with 0.05% of cycloheximide and 0.005% of chloramphenicol,⁶ the tooth brush was used to inoculate the medium by placing the bristles onto the agar, plates were incubated at 30°C up to 15 days.⁵ Primary identification was based on the color of the colony, as is well known most of the dermatophytes showed a white to creamy color, the colony texture range from velvety to cottony, the speed of growth is usually slow and the presence of pigment is an important feature specially in *Microsporum canis* and *Trichophyton rubrum*. The isolates were examined for microscopic morphology by using lactophenol cotton blue stain and in those resembling dermatophyte characteristics were processed by the slide culture technique¹⁶ in order to identify their characteristic macro and microconidias as well as any other feature of the culture. A complete characterization of each isolate was performed by using the reference identification manuals, it was done in dermatophytes and non dermatophytes fungus.^{5,6,15} In some cases, additional methods such

as hair perforation test or growth in medium that induces sporulation (boiled rice grain) were carried on to complete the final identification, mainly in *Trichophyton* species isolates.^{5,6,15}

The Statistical Analysis System package (SAS) was used to analyze the data, using the CATMODE procedure for linear models with categorical dependant variables. Chi-square test and Fisher exact test were applied analyzing interactions between variables, significance for both test was determined at $P \leq 0.05$.³

RESULTS AND DISCUSSION

The results of culture of fungi from the coats of cats and dogs are showed in Tables 1, 2 and 3. Keratinophilic fungi were recovered from 67 out of 100 on the cat samples (67%) and 90 of the 200 dog samples (45%) (Table 1).

Out of the one hundred samples of cats the keratinophilic fungi isolated in pure culture were: *Chrysosporium* spp. 25 isolates (25%), *Trichophyton terrestre* 22 isolates (22%), *Microsporum gypseum* 5 isolates (5%), *M. canis* 4 isolates (4%), in mixed cultures *Chrysosporium* spp. / *T. terrestre* 8 isolates each (8%), *Chrysosporium* spp. / *M. gypseum* 2 isolates each (2%) and *T. terrestre* / *T. mentagrophytes* 1 isolate each (1%). A total of 12 dermatophytes isolated (12%) (Table 2).

Table 1. Keratinophilic isolates from the haircoat of dogs and cats.

Animal	Positives	Negatives	Total	% Positives
Cats	67	33	100	67%
Dogs	90	110	200	45%

Table 2. Keratinophilic fungi recovered from cats.

Organism	No. of isolates	Percentage of total isolates	Total of strains
<i>Chrysosporium</i> spp	25	25	25
<i>Trichophyton terrestre</i>	22	22	22
<i>Microsporum gypseum</i> ‡	5	5	5
<i>Microsporum canis</i> ‡	4	4	4
<i>Chrysosporium</i> spp/ <i>T. terrestre</i>	8 each	8	16
<i>Chrysosporium</i> spp/ <i>M. gypseum</i> ‡	2 each	2	4
<i>T. terrestre</i> / <i>T. mentagrophytes</i> ‡	1 each	1	2
Total	67	67	78
‡ Dermatophytes	12	12	12

Table 3. Keratinophilic fungi recovered from dogs.

Organism	No of isolates	Percentage of total isolates	Total of strains
<i>Chrysosporium</i> spp.	49	24.5	49
<i>Trichophyton terrestre</i>	26	13	26
<i>Microsporum gypseum</i> ‡	3	1.5	3
<i>Microsporum canis</i> ‡	3	1.5	3
<i>T. ajelloi</i>	1	0.5	1
<i>T. mentagrophytes</i> ‡	1	0.5	1
<i>Chrysosporium</i> spp./ <i>T. terrestre</i>	5 each	2.5	10
<i>Chrysosporium</i> spp./ <i>T. ajelloi</i>	1 each	0.5	2
<i>T. terrestre</i> / <i>T. ajelloi</i>	1 each	0.5	2
Total	90	45	97
‡ Dermatophytes	7	3.5	7

The fungi isolated from the two hundred dog samples were: in pure culture *Chrysosporium* spp. 49 isolates (24.5%), *T. terrestre* 26 isolates (13%), *M. canis* 3 isolates (1.5%), *M. gypseum* 3 isolates (1.5%), *T. ajelloi* 1 isolate (0.5%) as well as *Trichophyton mentagrophytes* 1 isolate (0.5%), while in mixed cultures *Chrysosporium* spp. / *T. terrestre* 5 isolates each (2.5%), *Chrysosporium* spp. / *T. ajelloi* 1 isolate (0.5%) and *T. terrestre*/*T. ajelloi* 1 isolate (0.5%). A total of 7 dermatophytes isolated (3.5%) (Table 3).

Mexico city is a highly populated city and the number of pets (mainly dogs and cats) has increased. The possibility of transmission of infectious agents between humans and their pets is a constant risk. This is true not only for dermatophytosis, but also for other zoonotic diseases. Nezahualcoyotl city is located on the west border of Mexico city making a large part of the urban area, they are joined and share the same problems but in Nezahualcoyotl due to a lower socioeconomic level they seem to be worse.

We do not have doubt that as this two examples there are many other cities that could have the same problem, but in Mexico the amount of research that have been performed on dermatophytes is scanty.

Studies performed in other countries^{8,10,17} have reported that sex is not a variable that could have influence on the presence of dermatomycoses in animals, whereas age could be a factor to get it. Studies by Moriello, Larsson and Mignon,^{7,11,12} have shown results stating that sex and age are not of importance in the presence of dermatophytes in both dogs and cats. In this work the results show that in cats none but one of the factors studied had influence on the presence of dermatophytes in agreement with them, the only factor with significance was when more than one cat

lived in the same house, but in dogs, results showed that there is a statistical significance when lifestyle and place were evaluated, (risk factors statistical results for cats and dogs are shown in Tables 4 and 5). These findings could be explained due to the fact that dog population is large on the streets and when an stray dog is captured in the street is send to antirrabic centers, from where many of our dog samples were obtained. These centers rarely receive cats, so only one cat sample was obtained of this source, while houses and veterinary clinics were the main source for cat samples although, we had four samples from an animal shelter all of which were positive to *M. canis*.

It was not possible to obtain a large number of samples from pure breed animals, so this variable was excluded from the statistical analysis, but a general analysis of the

Table 4. Statistical analysis from cat results.

Variable	Probability (P)
Sex	0.53
Age	0.95
Lifestyle	* 0
Sex/Age	0.99
Sex/Lifestyle	0.69
Age/Lifestyle	0.33

* Statistical significance



Table 5. Statistical analysis from dog results.

Variable	Probability (P)
Sex	0.44
Age	0.13
Lifestyle	0.83
Housed	0.15
Place	*0.01
Sex/Age	0.5
Housed/Place	0.97
Lifestyle/Place	*0.05
Sex/Place	0.97
Age/Place	0.8

* Statistical significance

data showed that breed animals or stray animals were equally affected.

It is important to notice that dermatophytes were not the only fungi recovered, *Chrysosporium* spp., a non pathogenic keratinophilic fungus, was also recovered, and this is similar to the reports made by Piontelli in Chile¹³ and Caretta in Italy.² A study by Quaife¹⁴ raised the point that *M. canis* was a normal inhabitant on the coat of cats, but Moriello¹² and more recently Mignon¹¹ have showed that this is not probable, they always isolated *M. canis* from cats that were infected or in a high risk of infection. We found four isolates, all four were from cats living in a shelter, one of them had lesions and the other 3 were in contact with it, this supports the statement that a dermatophyte is not a normal fungus in the haircoat of cats.

The results obtained shown that cats are much more likely to have keratinophilic fungi and specially dermatophytes on their haircoats than dogs. It is important to understand that cats are considered mechanical carriers (they do not have apparent lesions but could have fungi spores).

Because of that this group of animals (mechanical carriers) is the most difficult problem to the humans because cannot avoid be in contact with them, because apparently they look as healthy animals.¹¹

We found that an animal in contact with other animals had a higher probability to get the same fungus including dermatophytes. Due to the particular behavior that cats have, such as taking soil baths and grooming, cats are more prone than dogs to harbor keratinophilic fungi in their haircoats.

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