VETERİNER HEKİMLER DERNEĞİ DERGİSİ
JOURNAL OF THE TURKISH VETERINARY MEDICAL SOCIETY

ISSN: 0377-6395
e-ISSN: 2651-4214
Dergi ana sayfası /*Journal homepage:* http://dergipark.org.tr/vetheder

OPEN ACCESS

10.33188/vetheder.1469398

Araştırma Makalesi / Research Article

Epidemiological analysis of dermatophytes isolated from cats and dogs in Ankara

Nevra KESKİN YILMAZ [1,a*], ***Bülent BAŞ*** [2,b]

[1] *Ankara University Faculty of Veterinary Medicine, Department of Internal Medicine, Ankara, 06110, Türkiye*
[2] *Ankara University Faculty of Veterinary Medicine, Department of Microbiology, Ankara, 06110, Türkiye*

0000- 0002-6287-1157[a]; 0000-0001-9992-8738[b]

MAKALE BİLGİSİ / ARTICLE INFORMATION:

Geliş / Received:
16 Nisan 24
16 April 24

Revizyon/Revised:
20 Mayıs 24
20 May 24

Kabul / Accepted:
12 Haziran 24
12 June 24

Anahtar Sözcükler:
Dermatofit
Kedi
Köpek

Keywords:
Dermatophyte
Cat
Dog

ABSTRACT

Dermatophytosis, a common fungal infection caused by dermatophytes, affects both cats and dogs and poses significant importance to veterinary professionals and pet owners. In this study conducted in Ankara, it is aimed to investigate the causative agents of dermatophytosis in domestic cats and dogs within the region by reviewing the reports of the samples analyzed in Ankara University Veterinary Faculty Department of Microbiology Laboratory. Key findings from this research revealed a significant prevalence of dermatophytosis in both feline and canine populations in the suspected cases with positive culture results of 76% and 88% in cats and dogs, respectively. Seasonal changes were identified as one of the most significant risk factors for dermatophytosis, with a higher culture positivity rate observed in samples analyzed during the autumn season compared to other seasons. *Alternaria spp* in cats and *Microsporum canis* in dogs were the most frequently isolated microorganisms. In conclusion, dermatophytosis continues to be a significant problem for pet health in Ankara. These findings underline the importance of veterinarians utilizing diagnostic laboratory methods to prevent, diagnose and treat dermatophytosis, thereby protecting animal health while reducing potential zoonotic risks.

Ankara'daki kedi ve köpeklerden izole edilen dermatofitlerin epidemiyolojik analizi

ÖZET

Dermatofitlerin neden olduğu yaygın bir mantar enfeksiyonu olan ve kedi ve köpekleri etkileyen dermatofitoz, veteriner hekimler ve evcil hayvan sahipleri için büyük önem taşır. Ankara'da yapılan bu çalışmada, Ankara Üniversitesi Veteriner Fakültesi Mikrobiyoloji Anabilim Dalı Laboratuvarı'nda analiz edilen numunelere ait raporlar incelenerek, bölgedeki evcil kedi ve köpeklerde dermatofitozis etkenlerinin araştırılması amaçlandı. Bu araştırmada analiz edilen kedi ve köpek örneklerinden sırasıyla %76 ve %88 pozitif kültür sonuçları elde edilmesiyle hem kedi hem de köpek popülasyonlarında dermatofitosizin önemli bir prevalansının olduğu ortaya konuldu. Mevsimsel değişikliklerin dermatofitoz için en önemli risk faktörlerinden biri olduğu, sonbahar mevsiminde analiz edilen örneklerde kültür pozitifliği oranının diğer mevsimlere göre daha yüksek olduğu belirlendi. Kedilerde *Alternaria spp* ve köpeklerde *Microsporum canis* en sık izole edilen mikroorganizmalardı. Sonuç olarak dermatofitoz Ankara'da evcil hayvan sağlığı açısından önemli bir sorun olmaya devam etmektedir. Bu bulgular, veteriner hekimlerin dermatofitozu önlemek, teşhis etmek ve tedavi etmek için laboratuvar teşhis yöntemlerinden yararlanarak hayvan sağlığını korurken potansiyel zoonotik riskleri azaltmasının önemini vurgulamaktadır.

How to cite this article: Keskin Yılmaz N, Baş B. Epidemiological analysis of dermatophytes isolated from cats and dogs in Ankara. Vet Hekim Der Derg 95 (2): 132-139, 2024. DOI: 10.33188/vetheder.1469398

* *Sorumlu Yazar e-posta adresi: knevra@ankara.edu.tr / Corresponding Author e-mail address: knevra@ankara.edu.tr*

1. Introduction

Dermatophytosis, a non-fatal but significant cutaneous affliction resulting from superficial fungal infections, is a noteworthy concern in the realm of veterinary medicine, particularly when it comes to feline and canine populations. This condition predominantly manifests in domestic animals, with dogs and cats exhibiting heightened susceptibility to infections caused by various microorganisms, such as *Microsporum spp, Trichophyton spp, Alternaria spp*, *Aspergillus spp, Penicillium spp.* and these animals serve as reservoirs for the fungal pathogens, perpetuating the cycle of transmission (1,2).

The prominence of the disease arises from both its high contagiousness among animals and its potential zoonotic transmission, emphasizing the need for a comprehensive understanding and effective management. Although dermatophytes can also be isolated from asymptomatic animals (3); fungal species are more commonly isolated in culture samples from animals with clinical signs compared to asymptomatics (4). The relationship between these dermatophytes and their animal hosts underscores the importance of further research to elucidate the dynamics of this interaction, facilitating the development of targeted preventive measures and therapeutic interventions. Because dermatophytosis demands attention not only for its impact on animal health but also for its potential implications on human health, necessitating a multidisciplinary approach for comprehensive disease management and prevention (4).

Dermatophytosis development is influenced by age, accompanying diseases, immune status, and environmental factors (4,5). While well-cared pets typically exhibit localized lesions, animals with nutritional deficiencies or in unhygienic environments may develop widespread disease with secondary bacterial infections (6). This multifactorial perspective is crucial for effective disease management in diverse animal populations, emphasizing the need for a holistic approach that considers various contributing factors. Therefore, careful monitoring becomes imperative in environments such as shelters, group housing for animals, and facilities with multiple cats or dogs, as they pose an increased risk for potential outbreaks of dermatophytosis (6,7). Although in most cases of dermatophytosis the disease tends to heal spontaneously, it is important to shorten the duration of the infection, especially in cases where microorganisms of zoonotic importance are identified (8).

In recent years, notable progress has been witnessed in the field of veterinary mycology, particularly regarding the diagnosis and treatment of dermatophyte infections in dogs and cats. Despite these advancements, culture-based microorganism identification remains the gold standard in laboratory methods for diagnosing dermatophytosis (5,9). Despite the array of methods available for isolating dermatophytes, Sabouraud dextrose agar (SDA) stands out as one of the most consistently recommended agars in prior studies (10,11).

Comprehensive investigations into dermatoses in cats and dogs have been conducted worldwide, providing valuable insights into the prevalence and characteristics of these conditions. However, there remains a notable scarcity of epidemiological analyses specific to Türkiye (12-14). Despite the wealth of global research, understanding the unique regional patterns, risk factors, and prevalence rates of cat and dog dermatoses in Türkiye is crucial for tailoring effective preventive and therapeutic strategies. Bridging this gap in epidemiological research in Türkiye is essential for the development of targeted veterinary interventions, fostering a more localized and contextually relevant approach to the management of dermatoses in the country's feline and canine populations. This study aims to systematically evaluate the microbiological analyzes of out-of-hospital samples referred from various clinics in Ankara region to obtain data on the prevalence of dermatophytosis cases in cats and dogs.

2. Material and Methods

A retrospective analysis was conducted on case files comprising microbiological analysis findings from skin swabs and hair samples taken from cats and dogs suspected of dermatophytosis. These samples were collected by private veterinarians from veterinary clinics across the Ankara region. Subsequently, they were analyzed as out-of-hospital specimens in the Microbiology Laboratory of Ankara University Faculty of Veterinary Medicine, Department of Microbiology.

The study encompassed an analysis of a comprehensive dataset consisting of 75 cat and 50 dog samples, all collected and examined between October 2017 and December 2020. To ensure a holistic understanding of the factors influencing dermatophytosis, critical parameters such as age, gender, environmental conditions, and the precise date of sample collection were assessed.

Furthermore, to discern potential seasonal patterns in the prevalence of the disease, the dataset was systematically categorized based on the four distinct seasons: spring (March-May), summer (June-August), autumn (September-November), and winter (December-February).

For the laboratory analysis, the collected samples were placed in sterile petri dishes, further emphasizing the commitment to maintaining a sterile environment throughout the procedure. To safeguard the integrity of the samples and expedite the diagnostic process, all specimens were transported to laboratory within a strict timeframe of 24 hours following collection. Only samples meeting these criteria were considered for inclusion in the study, thereby ensuring the reliability and accuracy of the diagnostic analyses. This approach aimed to minimize potential contamination and preserve the quality of the samples for subsequent laboratory investigations.

In the laboratory analysis, skin swap and hair samples were examined by following the routine procedures. In summary, the samples placed on a slide and 10% KOH solution was dropped on them for direct microscopy. The specimens were then covered with a coverslip, heated slightly from below, and then left at room temperature for half to one hour. Spore and hyphae were searched under the microscope (15).

For the skin culture, the samples were placed on SDA surface containing antibiotics. The microorganisms were cultured by embedding them in the medium with the help of a sterile scalpel and forceps. The skin culture was then incubated at 25°C in an aerobic environment for four weeks. The media was checked daily to identify growth based on macroscopic and microscopic characteristics. Macroscopic observations included colony growth, structure, and pigmentation on the Petri dish, while microscopic identification was performed by examining fungal colony features like hyphae, macroconidia, microconidia, and spore structures under a light microscope at 40X and 100X magnifications (15).

3. Results

Out of the 75 cat and 50 dog cases examined in this study, a significant 76% of cats (57 out of 75) and 88% of dogs (44 out of 50) showed positive cultures for dermatophytes. Among the feline cases with positive cultures, 33 were female, while 24 were male. For dogs, there was an even distribution of positive cultures among both females and males.

It was established that all sampled cats, whose specimens tested positive for dermatophytes, were exclusively indoor-dwelling felines. Similarly, the dogs included in this study were predominantly indoor canines; however, they were granted access to outdoor environments.

In the present study, the mean age±SD of the entire cat population was determined to be 4.5±3.3 years, and a notable decrease was observed in culture-positive cats, where the value declined to 4.16±3.07 years. Similarly, in the canine population, the overall mean age was 5.5±3.6 years, with a decrease to 5.41±3.62 years in culture-positive dogs. Notably, culture-negative cats exhibited a mean age of 4.75±3.39 years, while culture-negative dogs displayed a slightly higher mean age of 6.06±3.84 years. Our findings reveal a consistent trend across both feline and canine populations, wherein the oldest individuals were consistently identified among those from which culture-negative samples were obtained.

Upon scrutinizing the distribution of dermatophyte-positive samples across seasons, a discernible pattern emerged, revealing that the highest rate of sample admissions occurred during autumn (Figure 1) for both cats (33.33%) and dogs (45.45%). During our comprehensive 15-month study commencing in the autumn season, we observed an elevated number of cases during this period. Notably, when we narrowed our investigation to a 12-month timeframe, the seasonal distribution consistently exhibited the same characteristics, reaffirming the prominence of autumn in influencing case numbers.

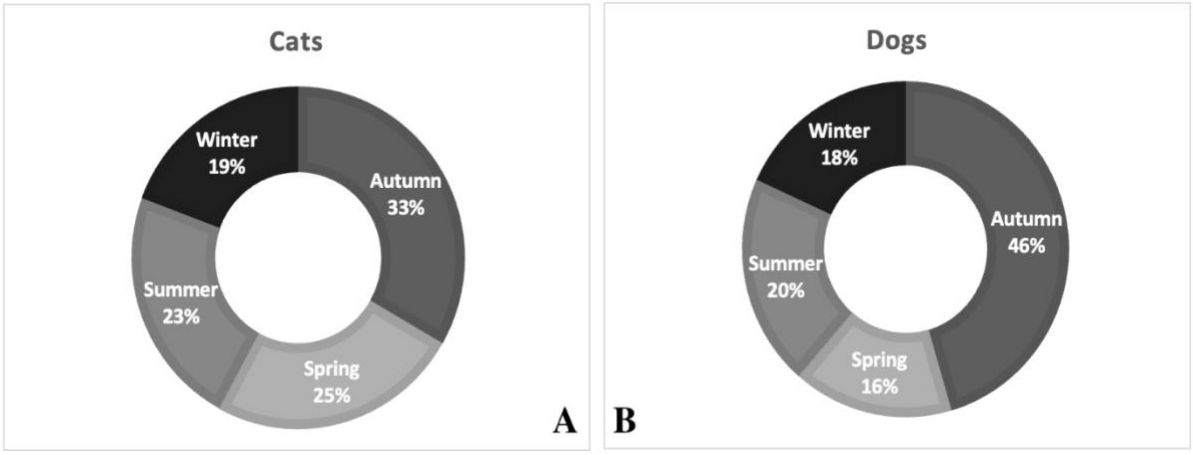

Figure 1: Seasonal distribution (%) of cases in cats (A) and dogs (B)
Şekil 1: *Kedilerde (A) ve köpeklerde (B) vakaların mevsimsel dağılımı (%)*

Among the culture-positive cat samples, a noteworthy occurrence of multiple fungal growth was identified in 7 out of 57 samples. The predominant dermatophyte recovered from these feline samples was *Alternaria spp*, constituting 28.12% of the isolates. Following closely, *Penicillium spp* accounted for 26.56%, *Aspergillus spp* for 23.43%, and *Microsporum spp* for 17.18% of the fungal isolates. Additionally, *Trichophyton spp, Mucor spp*, and *Candida albicans* were each isolated once, contributing to the overall diversity of fungal species detected.

Within the canine population, multiple fungal growth was identified in 4 out of 44 culture-positive samples. The predominant dermatophyte retrieved from these dog samples was *Microsporum canis (M. canis)*, constituting 29.16% of the isolates. Subsequently, *Aspergillus spp* accounted for 22.91%, *Alternaria spp* for 18.75%, *Penicillium spp* for 16.66%, and *Trichophyton spp* for 12.5% of the fungal isolates. The information regarding the distribution of dermatophytes were summarized in Figure 2.

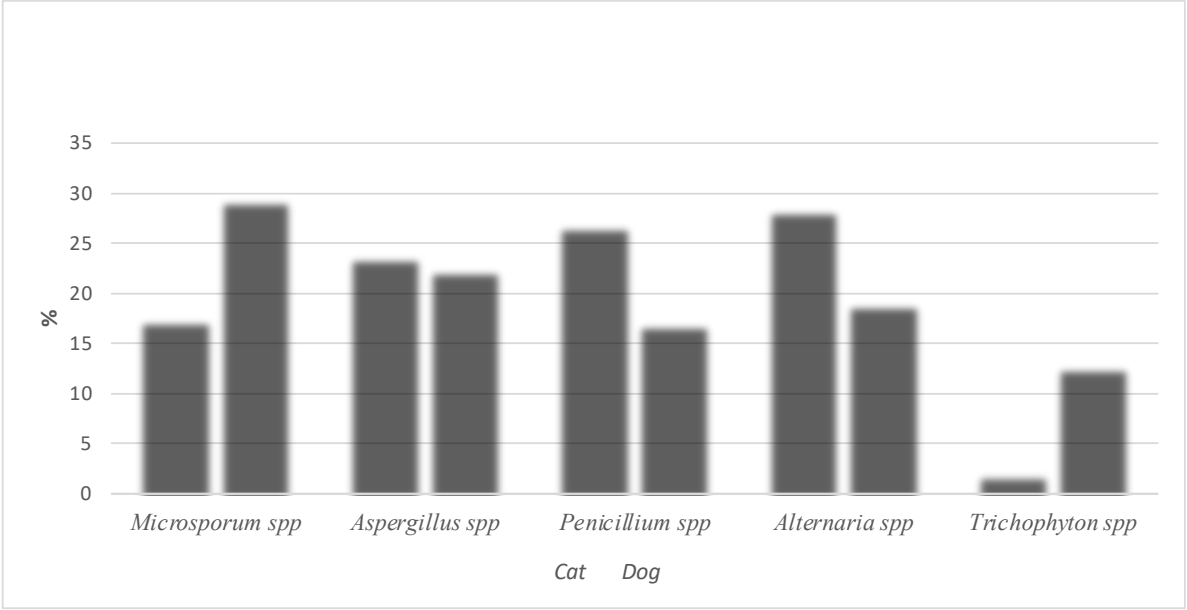

Figure 2: Distribution of isolated microorganisms in cats and dogs
Şekil 2: *Kedilerde ve köpeklerde izole edilen mikroorganizmaların dağılımı*

4. Discussion and Conclusion

The study results demonstrated a higher prevalence of dermatophytosis among suspected cases in dogs compared to cats, exceeding the incidence reported in earlier studies where positive findings ranged from 14-37% (12, 16,17). These findings in the presented study could be attributed to the detailed examination of cases by veterinarians prior to sample submission to laboratory, thereby assembling a case sample characterized by a heightened likelihood of dermatophyte positivity. This underscores the crucial role of thorough clinical assessments in shaping the composition of samples for diagnostic purposes and contributing to the observed prevalence of dermatophytosis.

In the present study, gender-based prevalence rates exhibited a notable similarity between males and females. While some prior research has suggested a higher prevalence of dermatophytosis among males compared to females (14,18), our findings are consistent with other studies that do not indicate a significant gender-based dominance in the occurrence of dermatophytosis. (17, 19- 21). This concurrence underscores the complexity of gender-related patterns in dermatophytosis prevalence and highlights the importance of considering multifactorial influences in future investigations to comprehensively elucidate potential associations.

Despite the absence of evidence indicating an elevated risk of infection among older pets, it is noteworthy that the susceptibility to dermatophytosis appears to increase during the early stages of life when the immune system is still maturing (18, 22). Although this study did not specifically establish an average age below 1 year for the animals, the observation that animals with negative culture results tended to have a higher average age implies a potential association between age and the risk of dermatophytosis. This finding encourages further investigation of age-related dynamics as potential risk factors for disease, highlighting the need for comprehensive studies to reveal the complex interplay between age and susceptibility to dermatophyte infections.

Our investigation revealed a heightened risk of dermatophytosis during the autumn months in the Ankara region, characterized by generally warm yet rainy conditions. This observation aligns with findings from other studies, underscoring a consistent trend wherein the incidence of dermatophyte cases tends to surge in climates characterized by increased humidity and warmth (8). Notably, the prevalence of dermatophytosis in cats peaks during the subsequent winter months, following the autumn period. This temporal pattern may be attributed to heightened stress levels during winter, as evidenced by the impact of seasonal variations on the circadian rhythms of cortisol and its receptors, showcasing elevated amplitudes during winter. The shorter daylight hours in winter, coupled with shifts in physiological activity, contribute to a more pronounced immune response to acute stress, potentially rendering cats more susceptible to dermatophytosis during this season (23, 24). Further exploration of these seasonal dynamics is warranted to elucidate the intricate interplay between environmental factors, stress, and the occurrence of dermatophyte infections.

Previous studies indicate that *Alternaria* is the most common form of fungal disease sampled from granulomatous nodular lesions (25,26). *Alternaria*, known as dematiaceous (pigment-producing) fungi, is soil saprophyte that commonly cause sporadic infections causing non-healing wounds of the skin usually because of traumatic implantation of fungus in subcutaneous tissues in animals and humans (27,28). In addition, *Alternaria* can be found in humid places (29) and therefore indoor-only cats might have an increased risk of exposure to *Alternaria,* which may, in turn, explain the high incidence of *Alternaria* positive cases in the presented study. Our findings underscore the diverse fungal spectrum within the culture-positive cat samples, with *Alternaria* spp emerging as the most prevalent. The identification of various dermatophytes further emphasizes the complexity of fungal colonization in this population, laying the foundation for a comprehensive understanding of the specific fungal taxa involved and their potential implications for feline health.

The most recovered fungus from dogs *M. canis,* confirming the results from past studies (8,12,30). One of the findings in our study is that the incidence of *M. canis* was as 1 out of third samples determined to be like a study conducted in Poland (30) but was lower when compared to research from Italy which revealed nearly up to 78% positive results (18). Another study with a higher incidence was conducted in Türkiye with a rate of 57% positive samples (12).

The variations in incidence observed between studies may be attributed to regional conditions and epidemiological differences.

The fungal species identified in cats and dogs in the presented study have a high zoonotic potential and there is an emerge of antifungal resistance (31,32). Therefore, making the correct diagnosis in animals with suspected dermatophytosis is also of great importance for protecting human health as much as animal health under the umbrella of One Health approach that considers the interconnectedness of human and animal health (33). Consequently, it is important to expand epidemiological studies and conduct case-based evaluations for each patient in order to prevent unnecessary and long-term drug use within the scope of veterinary practice and to prevent indirect side effects, including increased antifungal resistance.

Conflict of Interest

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Funding

This study is not funded.

Authors' Contributions

Motivation/Concept: Nevra KESKİN YILMAZ, Bülent BAŞ
Design: Nevra KESKİN YILMAZ, Bülent BAŞ
Control/Supervision: Bülent BAŞ
Data collection and/or processing: Bülent BAŞ
Analysis and Interpretation: Nevra KESKİN YILMAZ, Bülent BAŞ
Literature review: Nevra KESKİN YILMAZ
Writing the article: Nevra KESKİN YILMAZ
Critical review: Bülent BAŞ

Ethical Statement

This study was approved by Ankara University Animal Experiments Local Animal Ethics Committee (Decision number: 2024-06-39).

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