

**RETROSPECTIVE STUDY OF DERMATOPHYTOSIS IN COMPANION
ANIMAL CASES AT UMK VETERINARY CLINIC FROM THE YEAR 2012
TO 2021**

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CERTIFICATION

This is to certify that we have read this research paper entitled '**Retrospective study of dermatophytosis in companion animal cases at Klinik Veterinar UMK from the year 2012 to 2022**' by Thivashini a/p Chandran. In our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfillment of the requirement for the course DVT 5463 – Research Project.



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Thank You

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DEDICATIONS

I would like to dedicate this treatise to my family that has been a pillar of strength. A particular ounce of gratitude to my beloved parents Chandran and Gowri for always confiding confidence in me and my siblings Tharshini and Gajendran for always believing in me.

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MALAYSIA

KELANTAN

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ABSTRACT

An abstract of the research paper was presented to the Faculty of Veterinary Medicine, University Malaysia Kelantan, in partial requirement for the course DVT 5436 – Research Project.

Dermatophytosis is one of the most common skin infections affecting companion animals. It is a zoonotic disease that has an impact on public health. This study was conducted to determine the prevalence, common species of Dermatophytes, and risk factors of dermatophytosis in companion animals such as cats, dogs and horses. Data was obtained from Klinik Veterinar UMK and Bacteriology lab, FPV UMK, from 2012 to 2021. A Chi-square test was used to analyze the data. The result inferred that the overall prevalence of dermatophytosis in companion animals in Kelantan was 13.7%. Besides that, the most common Dermatophytes identified were *Microsporum* spp. (47%) and *Trichophyton* spp. (19%). Age, immune status, and management of hosts are identified as significant risk factors (P-value < 0.05) associated with the occurrence of dermatophytosis in companion animals. However, the sex factor had no significance. In conclusion, the current findings suggests that dermatophytosis exists in companion animals such as cats, dogs and horses and the occurrence rate is significant. Thus, an awareness campaign should be conducted by authorities to highlight the risk in public health given the zoonotic nature of dermatophytosis. Identification of the disease's potential risk factors may aid in the development of appropriate preventive strategies and to control the spread of disease.

Keywords: Companion animals, Dermatophytosis, *Microsporum* spp., Prevalence, Risk factors, Zoonotic

ABSTRAK

Abstrak daripada kertas penyelidikan dikemukakan kepada Fakulti Perubatan Veterinar, Universiti Malaysia Kelantan untuk memenuhi sebahagian daripada keperluan kursus DVT 5436 – Projek Penyelidikan.

Penyakit kurap atau dermatophytosis adalah salah satu jangkitan kulit yang biasa ditemui dalam haiwan peliharaan. Penyakit ini adalah penyakit zoonosis yang memberi impak kepada kesihatan awam. Kajian ini dijalankan untuk menentukan kelaziman penyakit kurap dalam haiwan peliharaan di negeri Kelantan, spesies Dermatophyte biasa ditemui daripada kes positif penyakit kurap dan faktor risiko yang berkaitan. Sumber data adalah dari Klinik Veterinar UMK dan Makmal Bacteriology, FPV UMK bermula dari tahun 2012 hingga 2021. Ujian Chi-square digunakan untuk menganalisis data. Hasilnya, kelaziman penyakit kurap secara keseluruhan dalam haiwan simpanan di Kelantan adalah 13.7%. Di samping itu, spesies Dermatophyte yang paling biasa ditemui adalah *Microsporum* spp. (47%) dan *Trichophyton* spp. (19%). Umur, status imunisasi serta pengurusan haiwan peliharaan telah dikenalpasti sebagai faktor risiko paling signifikan ($P < 0.05$) yang berkaitan dengan penyakit kurap dalam haiwan peliharaan. Walaubagaimanapun, faktor jantina adalah tidak signifikan. Konklusinya, penemuan semasa cadangkan bahawa dermatophytosis wujud dalam haiwan peliharaan seperti kucing, anjing dan kuda dan kadar penyakit adalah signifikan. Oleh itu, kempen kesedaran perlu dianjurkan oleh pihak berwajib untuk menekankan risiko kesihatan awam. Pengenalpastian faktor risiko yang berpotensi untuk jangkitan dermatophytosis boleh membantu dalam perancangan strategi pencegahan serta pengawalan penyebaran penyakit dermatophytosis.

Kata kunci: Companion animals, Dermatophytosis, *Microsporum* spp., Prevalence, Risk factors, Zoonotic

1.0 Introduction

Dermatophytosis, also known as ringworm, is a zoonotic disease caused by a fungal infection of the skin by the species dermatophyte (Paryuni *et al.*, 2020). Common dermatophytes found in companion animals are *Trichophyton* spp., *Epidermatophyton* spp, and *Microsporum* spp. Dermatophytes are geophilic, zoophilic, and anthropophilic (Nor Fazliyana *et al.*, 2019). Geophilic dermatophytes can replicate and inhabit the soil while zoophilic and antropophilic dermatophytes are obligate pathogens where they need a host for replication (Quinn *et al.*, 2011) Clinical signs most commonly shown are pruritus, hair loss, skin erythema, and crusty skin (Paryuni *et al.*, 2020).

The most common diagnostic approach to dermatophytosis is to conduct a Trichogramma examination, where hair samples are collected and examined under direct microscopy. Hair samples are also used for fungal culture and identification. An additional method would be Wood's lamp examination; an ultraviolet lamp is held across the skin surface, where an infected area shows fluorescent apple green or blue (Moriello *et al.*, 2019). However, confirmatory diagnosis can be reached based on the fungal culture and histopathological examination of the affected skin biopsy.

The transmission of this disease from infected animals to other susceptible hosts such as animals and humans commonly occurs through direct contact or contaminated inanimate objects. Hence, the prevalence of dermatophytosis in companion animals, the common species of dermatophytes identified, and the risk factors associated with dermatophytosis are further discussed in this study.

2.0 Research problem

Dermatophytosis is one of the major differential diagnoses in skin diseases among companion animals. Yet, the prevalence of dermatophytosis and most commonly affecting dermatophyte species among companion animals in the state of Kelantan is not in record. Many factors such as host status, individual immune status, and management practices contribute to the development of dermatophytosis. However, the most common risk factors contributing to the infection of this disease among companion animals are not identified. Hence, this study aims to conduct a retrospective analysis of data obtained from Klinik Veterinar UMK (KV-UMK) and Bacteriology Laboratory, Faculty of Veterinary Medicine, Universiti Malaysia Kelantan for the past ten years on the dermatophytosis cases in companion animals.

3.0 Research questions

- 3.1 What is the prevalence of dermatophytosis in companion animals in Kelantan state?
- 3.2 What are the common species of dermatophytes found in companion animals in Kelantan?
- 3.3 What are the risk factors associated with dermatophytosis in companion animals in Kelantan?

4.0 Research hypothesis

- 4.2 The prevalence of dermatophytosis is high in a companion animals in Kelantan.
- 4.3 *Microsporum* spp. and *Trichophyton* spp. are the most common fungi that cause dermatophytosis in companion animals in Kelantan.
- 4.4 Animal species, breed, management, age and immune status of the animals are the major risk factors for dermatophytosis in companion animals in Kelantan.

5.0 Research objectives

- 5.1 To determine the prevalence of dermatophytosis in companion animals in Kelantan state.
- 5.2 To identify the common species of dermatophytes found in companion animals in Kelantan state.
- 5.3 To determine the risk factors associated with dermatophytosis in companion animals in Kelantan state.

6.0 Literature review

6.1 Etymologia of dermatophytosis

Dermatophytes are a group of three filamentous fungi that can invade the keratinized tissues and introduce superficial infections in susceptible hosts (Santana *et al.*, 2020).

6.2 Pathogenesis of dermatophytosis

Dermatophytes adhere to the keratin tissues of the host's nails or hair during the start of the infection phase (Ilhan Z *et al.*, 2016). Predisposing factors such as the host's immune status and physiological state, quantity of infective spores, and transmission frequency of the dermatophytes play a role in disease development (Moreillo *et al.*, 2019). The entry points of the dermatophytes are open wounds at the skin due to burns, mechanical injuries, or damp and wet skin conditions (Paryuni *et al.*, 2020). The disease's transmission can occur through direct contacts with infected animals or indirectly through contamination of inanimate objects with spores.

At the early stage of infection, arthroconidia of the spores attach to the keratin tissues (Paryuni *et al.*, 2020). Then the spores germinate and invade the stratum corneum of the skin where the fungi colonize resulting in an inflammatory reaction causing erythema and swelling, which are one of the clinical signs (Vermout *et al.*, 2008).

One of the dermatophytes' pathogenic factors is to synthesize keratolytic and proteolytic enzymes, which causes the lysis of keratin cells to be used for the

metabolism of dermatophytes. This allows fungal development in the stratum corneum and epidermal keratinization (Faway *et al.*, 2008). Proteolytic activity is initiated by releasing serine proteinase, which consists of activator plasminogen tissue and urokinase that damages the host's external proteins, resulting in skin injury (Lakshmipathy *et al.*, 2010).

6.3 Predisposing factors in the development of dermatophytosis

Hosts status such as geriatric individuals, individuals diagnosed with persistent diseases or infections, impaired immune system due to medications, nutritional deficiency, or stress, making the host more prone to dermatophytosis infection. The host's natural and active immune response determines the host's susceptibility to the disease (Silver *et al.*, 2008).

6.4 Diagnosis of dermatophytosis

One of the standard practices to diagnose dermatophytosis is direct microscopy examination of samples collected from a skin scraping, hair pluck, and nails where fungal could be visualized. The sensitivity of direct microscopy examination can be increased by staining the sample with Congo Red Stain. The polysaccharides in the fungal cell bind to this stain; hence, they can be visualized under the microscope (Slifkin *et al.*, 1988). Colony morphology such as colony pigmentation, development rate, and distinguished morphological structures such as macroconidia, microconidia, pectinate branches, and nodular organs can be identified under direct microscopy of the cultured colony (Robert *et al.*, 2008). Sabaroud Dextrose Agar is a common standard used to cultivate these organisms for at least 14 days at room temperature. Sample the colony with an acetate tape,

then place the sample on a glass slide with one to two drops of lactophenol cotton blue dye, and a direct microscopy examination should be done. This is the golden standard for the diagnosis of dermatophytosis.

Wood's lamp examination where ultraviolet light is screened on the skin surface and infected areas can be seen illuminating in fluoresce apple green. The advantages of this test are that it is affordable, gives fast results, and a large number of animals can be screened simultaneously. It also enables us to distinguish between infected and non-infected hairs to be collected for Trichogramma (Silver *et al.*, 2008).

6.5 Prevalence of dermatophytosis in companion animals in Malaysia

A study by Binti Hj *et al.*, (2019) conducted in Shah Alam, Selangor, reported that *Penicillium sp.* was the most prevalent dermatophytic fungi compared to *Aspergillus sp.*, *Microsporum sp.*, *Trichophyton sp.*, and *Epidermaphyton sp.* in cats. Most dermatophytes found in dogs were *Microsporum canis* (70%), while the others were *Microsporum gypseum* as much as 20% and *Trichophyton spp. mentagrofit* as much as 10% (Ridzuan *et al.*, 2021). While in horses, the highest frequencies of dermatophytosis were reported between October and December, when the humidity was relatively high. In cases of dermatophytosis, the most common area to be affected were the mane, neck, shoulder, and thoracoabdominal regions, which was at 28.6%, followed by the tail base, back, and rump at 14.3%, facial area at 9.5%, and chest at 4.8% (Azman *et al.*, 2016).

6.6 Prevalence of dermatophytosis among the human population in Malaysia

Most common dermatophytes isolated from human samples are *T. mentagrophytes* and *T. rubrum*. The majority of dermatophytes are anthropophilic and zoophilic in Malaysia. However, geophilic was the minor type of dermatophyte isolated, given that Malaysia has relatively high humidity and is a tropical country (Ng *et al.*, 2002).

6.7 Dermatophytosis infection in humans in Malaysia

Microsporum gypseum is one of the common dermatophytes found in the soil of Malaysia; however, only from two patients who had foot infections was this organism isolated. The low prevalence of this dermatophyte species may be related to the fact that in Malaysia, a tropical country, most of the population uses open-toed footwear, which prevents the infection from growing. The utilization of close-toed footwear may be a factor that promotes fungal growth due to enclosed and humid conditions. *Microsporum canis*, a zoophilic dermatophyte often seen in domestic animals, was the most common dermatophyte isolated from all ethnic groups except Malay ethnicity. This may be attributed to the fact that the Malay ethnicity, which is mainly composed of Muslims who do not prefer to have dogs as their pets; hence they are less likely to be exposed to *M.canis* implying that domesticated dogs constitute the main *M.canis* reservoirs in Malaysia (Ng *et al.*, 2002).

6.8 Zoonotic importance

Dermatophytosis is a major zoonotic threat since it causes ringworm in nearly all species of animals and humans. The most prevalent form of infection transmission is direct contact with diseased hosts. Infection can also be spread by inanimate objects harboring the fungal spores (Hayette *et al.*, 2015). Poor hygiene, health standards, and stray animals are one of the leading causes of the outbreak of this zoonotic disease. The awareness of these risk factors is essential for better control, treatment regime, and effective preventive methods (Moretti *et al.*, 2013).

6.9 Treatment for dermatophytosis

Lime Sulphur, enilconazole, or a miconazole/chlorhexidine shampoo should be used two times a week as an effective topical treatment regime for dermatophytosis in cats and dogs (Newbury *et al.*, 2021). Miconazole is more effective when combined with chlorhexidine (Mason *et al.*, 2000).

Itraconazole, ketoconazole, terbinafine, and griseofulvin are the most often used systemic antifungal drugs in veterinary medicine for dermatophytosis. The most effective and safest drugs are itraconazole and terbinafine (Moriello *et al.*, 1995).

Itraconazole can be administered at a dosage of 10 mg/kg for 21 days, concurrent with lime Sulphur or chlorhexidine/miconazole topically two times a week, and in 36 days, completely healed skin from fungal infection can be observed (Newburry *et al.*, 2011).

For example, environmental disinfection helps reduce the risk of disease transmission from animals to humans. Disinfectants used should be a good antifungal agent, with no toxicity and less or no irritation to animals and users. They should also be inexpensive, user-friendly, and easy to obtain. Sodium hypochlorite, enilconazole, and hydrogen peroxide are effective disinfectants for dermatophytosis. Isolation of diseased animals is significant as an even more efficient environmental decontamination can be done. This can also decrease the risk of disease transmission to other susceptible hosts (Moriello *et al.*, 2013).

7.0 Methodology

7.1 Study design

A retrospective study on dermatophytosis in companion animals in UMK Veterinary Clinic, Kelantan, from 2012 until 2021 was conducted. The reference population in this study are cats, dogs, and horses that have been presented to the clinic or attended to in the field. The inclusion criteria of this study are any animal that fulfills the characteristics of a companion animal. Data related to dermatophytosis in companion animals (cats, dogs, and horses) presented to UMK Veterinary Clinic and Bacteriology Laboratory, Universiti Malaysia Kelantan from the year 2011 until 2021 was collected. Vital information such as species, age, sex, type of dermatophyte identified, and diagnostic approach was gathered from the case files in UMK Veterinary Clinic and laboratory records at Bacteriology Laboratory, UMK. The data was collected, tabulated, and analyzed using MS Excel and SPSS 27.0.1. The data was analyzed and presented using pie charts and graphs.

7.2 Data Extraction

Data were collected from case files in UMK Veterinary Clinic and Bacteriology Lab, UMK. Collected data were tabulated in Microsoft Excel.

7.3 Data analysis

Data were analyzed using Statistical Package for Social Science (SPSS), version 27.0. The prevalence of dermatophytosis in companion animals (cats, dogs, and equine) in Kelantan was calculated by identifying several positive cases for dermatophytosis reported in UMK Veterinary Clinic and then dividing by the number of cases reported to UMK Veterinary Clinic. The Chi-square test was used to determine the predisposing factors of dermatophytosis, where a P-value <0.05 was considered statistically significant.

8.0 Results

8.1 Prevalence of dermatophytosis in companion animals in UMK Veterinary Clinic from year 2012 to 2021

Out of the 133 cases reported in 10 years in UMK Veterinary Clinic, the prevalence of dermatophytosis was highest in 2014 (19.5%) and 2015 (16.67%), respectively. However, the lowest was encountered in 2012 (0%), followed by 2019 (7.59%), as shown in Figure 8.1. The overall prevalence of dermatophytosis over the ten years is 13.7%.

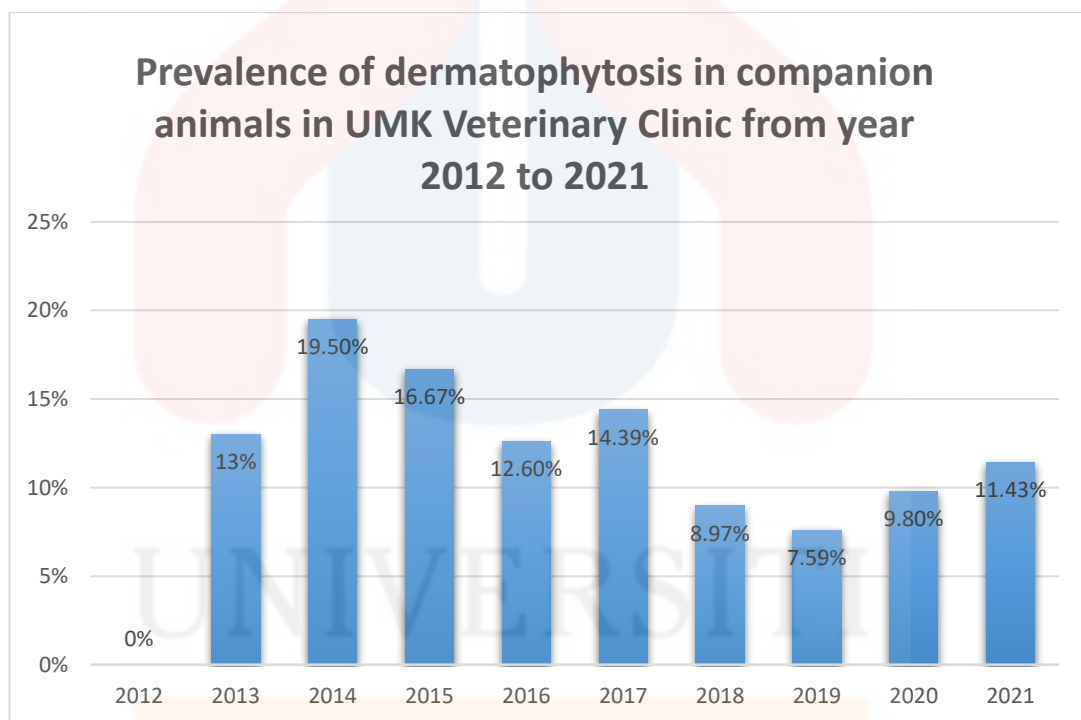


Figure 8.1 Prevalence of dermatophytosis in companion animals in UMK Veterinary Clinic from year 2012 to 2021.

8.2 Most common dermatophyte identified from positive cases in companion animals from the year 2011 to 2021 in UMK Veterinary Clinic

Based on the data collected and analyzed, the most common dermatophyte identified in companion animals were *Microsporum* spp. and *Trichophyton* spp, with 47% and 18%, respectively. The least common dermatophyte identified over ten years is *Epidermatophyton* spp which is 1%.

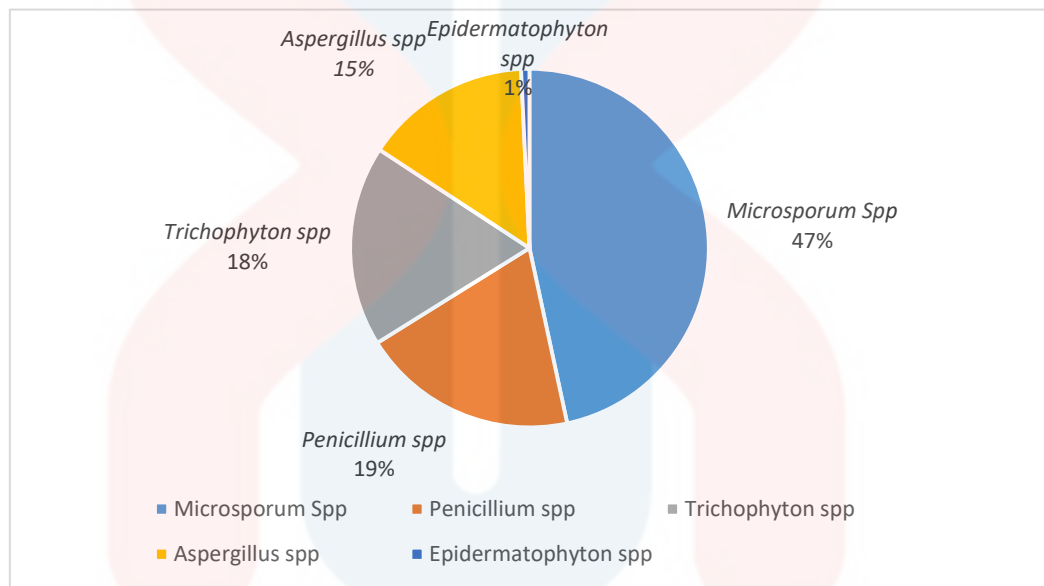


Figure 8.2 Most common dermatophyte identified from positive cases in companion animals from 2011 to 2021 in UMK Veterinary Clinic.

8.3 Risk factors associated with the occurrence of dermatophytosis in companion animals in UMK Veterinary Clinic

The association between risk factors such as sex, immune status, age, and management was calculated with the Chi-square test. As tabulated below, the results show that dependent variables, including immune status, age, and control, are all significant ($P < 0.05$) except the sex factor ($P > 0.05$).

Table 8.3 Risk factors associated with the occurrence of dermatophytosis in companion animals in UMK Veterinary clinic

	Risk factor	Prevalence (%)	P-value	Significant?
Sex	Male	37.30	0.11	No
	Female	62.70		
Immune status	With concurrent infection	52.50	0.0003	Yes
	Without concurrent infection	47.50		
Age	Less than three years old	65.60	0.02	Yes
	3 to 6 years old	13.60		
	More than six years old	20.80		
Management	Indoor	52.60	0.000335	Yes
	Outdoor	47.40		

9.0 Discussion

The study showed the prevalence of dermatophytosis among companion animals in UMK Veterinary Clinic state for ten years duration from the retrospective analysis data collected from UMK Veterinary Clinic (UMKVC) and Bacteriology laboratory, UMK. Based on the analyzed data, the overall prevalence from 2012 to 2021 is 13.7%. This prevalence rate is relatively high, as about 13.7% of cases presented to UMKVC are dermatophytosis. A high prevalence of dermatophytosis is expected as Malaysia is a tropical country. Dermatophytes also grow well in hot, moist, and humid conditions, which is Malaysia's weather throughout the year and Kelantan (Zaki *et al.*, 2021).

The highest prevalence was in the year 2014 (19.5%). In 2014, Kelantan state experienced a prolonged rainy season leading to floods, which might have increased the occurrence of dermatophytosis in companion animals in Kelantan, where geophilic dermatophytes thrive in damp environment and damp skin where it promotes spores germination (Quinn *et al.*, 2011). Furthermore, the most common dermatophyte identified from positive cases of dermatophytosis in companion animals (cats, dogs, and horse) is *Microsporum* spp. (47%). *Microsporum* spp. is a zoophilic dermatophyte that causes infections mainly in cats and dogs and causes ringworm disease in humans (Chupia *et al.*, 2022). This is also supported by the prevalence of *Microsporum* spp. in a study conducted on dogs in Shah Alam, where the majority was 70% (Ridzuan *et al.*, 2021). In addition to that, the second most common dermatophyte identified was *Trichophyton* spp. (19%) which is more common in horses. Especially *T. equine*, a horse-specific dermatophyte (Quinn *et al.*, 2011). The mode of transmission is from direct contact with infected animals or contaminated fomites. Clinical lesions such as

patchy alopecia, erythema, and scaling, and crusting of skin can be observed (Higgins *et al.*, 2006). Hence, the most common dermatophytes causing ringworm infection in humans are *Microsporum spp.* and *Trichophyton spp.*, as there is direct contact between infected companion animals and their owners. This is supported by a prevalence study of dermatophytosis in humans in Kuala Lumpur, Malaysia (Ng *et al.*, 2002).

The least common dermatophyte identified was *Epidermatophyton spp.* (1%). Growth factors where unlike other dermatophytes, which grow at room temperature (25°C) *Epidermatophyton spp.* develops more readily in high temperatures (35°C) could have contributed to the low prevalence in companion animals (Hussein *et al.*, 2009). Besides that, risk factors such as immune status, age, and management have shown significant association (P-value < 0.05) between the occurrences of dermatophytosis in companion animals in Kelantan. However, there is no significant association with the sex factor (P-value > 0.05). Other studies reported male dogs had more occurrences of dermatophytosis (Cafarchia *et al.*, 2004). While several studies mentioned there is no significant association between sex and infection of dermatophytes (Cabanès *et al.*, 1997; Mancianti *et al.*, 2002). Hence, there is still room for speculation as to sex factor to be included as a risk factor for dermatophytosis.

The animal's immune status has a strong association (p-value < 0.05) with the occurrence of dermatophytosis. Animals with concurrent infection (52.5%) have more affair of dermatophytosis than animals without concurrent infection (47%). This could be because concurrent infection might downregulate the immune system, causing

compromised immune system, making the animal more susceptible to dermatophyte infection. The host's immune system depends on the susceptibility to dermatophyte infection, making it a risk factor (Paryuni *et al.*, 2020; Pascoe *et al.*, 1976).

Concerning age as a risk factor for dermatophytosis, this study presents those young animals (<3 years old) were five times more frequently exposed to dermatophytes compared to adult animals (> 6 years old). The high prevalence in young animals could be due to their still-developing immune system lacking in specific acquired immunity following exposure to dermatophytes for the first time and innate immunological processes like the amount and composition of sebaceous lipids on the epidermis layer of the skin. (Ahdy *et al.*, 2016; Bond *et al.*, 2010).

Last but not least, a strong association (p-value <0.05) between the management of companion animals regards this as a risk factor for the occurrence of dermatophytosis. The prevalence was higher in companion animals managed indoors (47.4%) than in outdoor management (37.1%). This could be due to better ventilation in outdoor environments and decreased air humidity outside (Berlin *et al.*, 2020). As for horses that are kept indoors (in a stable), this may be due to the bedding's wet and damp conditions, making the host more susceptible to infection (Bowman *et al.*, 2019).

10.0 Conclusion

In conclusion, the overall prevalence of dermatophytosis among companion animals (cat, dog, and horse) in UMK Veterinary Clinic from 2012 to 2022 was 13.7%, considered relatively high. The most common dermatophyte species identified among positive cases were *Microsporum spp.* and *Trichophyton spp.* Among the risk factors investigated, age, management, and immune status of the host had a significant association with the occurrences of the disease. Hence, this study serves to reference dermatophytosis status among companion animals in Kelantan and the potential risk factors.

11. 0 Recommendations

A few setbacks were encountered when conducting this study, such as, incomplete data. Hence these data were excluded from the study and that might have affected the statistical analysis to determine the actual prevalence and risk factors for the occurrence of dermatophytosis. Therefore, full data must be obtained for proper analysis which could give better results for a meaningful interpretation. In addition to that, data from various sources such as private veterinary clinics in the state of Kelantan should be obtained for a more precise result. Besides that, to investigate the association of dermatophytosis with its zoonotic aspect, a prevalence study of dermatophytosis reported among pet owners in Kelantan should be done in future.

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