UNIVERSITI PUTRA MALAYSIA

SKIN CONDITIONS OF DOGS PRESENTED TO UNIVERSITY VETERINARY HOSPITAL, JAN-DEC 2014

NOREHAN BINTI HASIM

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SKIN CONDITIONS OF DOGS PRESENTED TO UNIVERSITY VETERINARY HOSPITAL, JAN-DEC 2014

NOREHAN BINTI HASIM

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in partial fulfillment of the requirement for the
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It is hereby declared that we have read this project paper entitled "Skin Conditions of Dogs Presented to University Veterinary Hospital, Jan-Dec-2014", by Norehan Binti Hasim and in our opinion, it is satisfactory in terms of scope, quality, and presentation as partially fulfillment of requirement for the course VPD4999 – Final Year Project.

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ABSTRACT

An abstract of the project paper presented to the Faculty of veterinary medicine in partial fulfilment of the course VPD 4999 – Project

SKIN CONDITIONS OF DOGS PRESENTED TO UNIVERSITY VETERINARY HOSPITAL, JAN-DEC-2014

by

NOREHAN BINTI HASIM

February, 2015

Supervisor: Associate Prof. Dr. Gurmeet Kaur Dhaliwal

Co-supervisor: Associate Prof. Dr. Malaika Watanabe

A retrospective study was conducted to determine the prevalence of dermatological conditions in dogs presented to University of Veterinary Hospital (UVH), Faculty of Veterinary Medicine, Universiti Putra Malaysia, including the clinical manifestations, depth of investigation performed, and the risk factors for the most common skin conditions encountered. Of 1827 dogs presented to UVH from January 1st to December 31st 2014, 615 dogs were presented with dermatological problems, resulting in a prevalence of 33.66%. Erythema (15.99%) was the most common presenting clinical sign, followed by alopecia (13.38%), pruritus (12.88%),

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maculo-papular-pustular eruptions (11.01%) and scaling (9.33%). The five most common final diagnoses in descending order were malasseziasis, dermatophytosis, otitis externa, neoplasia and cutaneous myiasis. The acetate tape test (32.24%) was the most common diagnostic procedure performed, followed by trichograms (20.39%) and skin scrapes (13.93%). In dogs with malasseziasis, there was no association with age, sex, neuter status nor body condition score (BCS). However, dermatophytosis was significantly associated with the age where older dogs above 6 years of age had a 70% lower risk to have the disease compared to younger dogs. Otitis externa was significantly associated with the age, sex and BCS where females had as 50% lower risk compared to males, and the relative risk was nearly twice in obese and older dogs compared to the others. The top five breeds that were presented for dermatological conditions were mixed breed dogs, Shih Tzus, German Shepherds, Poodles and Cocker Spaniels.

Keyword: canine, skin conditions, erythema, malasseziasis, acetate tape test

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ABSTRAK

Abstrak daripada kertas projek dikemukakan kepada Fakulti Perubatan Veterinar bagi memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek

MASALAH KULIT PADA ANJING DI UNIVERSITI HOSPITAL VETERINAR, 2014

oleh

NOREHAN BINTI HASIM

Februari, 2015

Penyelia: Prof. Madya Dr. Gurmeet Kaur Dhaliwal

Penyelia bersama: Prof. Madya Dr. Malaika Watanabe

Satu kajian retrospektif telah dijalankan untuk menentukan kelaziman masalah dermatologi pada anjing di Universiti Hospital Veterinar (UVH), Fakulti Perubatan Veterinar, Universiti Putra Malaysia, termasuk manifestasi klinikal, kedalaman penyiasatan yang dilakukan, dan faktor risiko bagi masalah kulit yang paling biasa dihadapi. Daripada 1827 anjing, dari 1 Januari hingga 31 Disember 2014, 615 kes melibatkan masalah dermatologi, menjadikan kelazimannya 33.66%. Eritema (15.99%) adalah petanda paling biasa, diikuti dengan alopesia (13.38%), pruritus (12.88%), letusan *macular-papular-pustular* (11.01%), dan kulit bersisik

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(9.33%). Diagnosis akhir yang paling biasa ialah malasseziasis, dermatofitosis, otitis eksterna, neoplasia dan miasis kulit. Pita asetat (32.24%) adalah prosedur diagnostik yang paling biasa dilakukan, diikuti oleh *trichogram* (20.39%) dan *scraping* kulit (13.93%). Bagi malasseziasis, tidak ada faktor pendorong yang jelas mengikut umur, jantina, status pemandulan dan skor keadaan badan (BCS). Walau bagaimanapun, terdapat hubungan yang signifikan antara dermatofitosis dengan umur di mana anjing yang berumur lebih dari 6 tahun berisiko 70% lebih rendah berbanding anjing yang lebih muda. Otitis eksterna pula mempunyai kaitan dengan umur, jantina dan skor keadaan badan di mana otitis eksterna di kalangan anjing betina berlaku 50% lebih rendah berbanding anjing jantan, dan risiko relatif hampir dua kali ganda pada anjing gemuk dan anjing tua. Masalah dermatologi dihadapi kebanyakannya dalam baka tempatan, *Shih Tzu, German Shepherd, Poodle* and *Cocker Spaniel* secara keseluruhannya.

Kata kunci: Anjing, masalah kulit, eritema, malasseziasis, pita asetat

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1.0 INTRODUCTION

As the largest organ of the body, the skin provides a variety of functions including the protection of the tissues, regulations of body temperature, as an excretory organ, cutaneous sensation, and vitamin D production. According to Martini and Welch (2001), any abnormalities to the skin are easily recognized due to the facts of the skin is the most visible organ of the body.

There are numerous agents that can cause skin problems in dogs including trauma, allergens, external irritants, burns and infectious agents such as bacteria, fungus, virus and parasite (Moriello *et al.*, 2015). Some of the endocrine diseases and metabolic problems may also cause changes skin structure and induce cutaneous lesions, such as hypothyroidism which is the most common endocrine skin disease in dogs (Paterson, 2008).

There have been several studies done to determine the prevalence of the skin conditions in dogs in other countries and from the nineties, dermatological problems have been reported to be one of the most prevalent seen in veterinary practices. However, in Malaysia, there are hardly any references for overall prevalence of skin diseases of dogs, the most commonly diagnosed diseases, the type and extent of procedures used for diagnosis and the risk factors for the common diseases, if present.

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1.1 Objectives of study

Considering the paucity of information in Malaysia, regarding common canine skin conditions encountered, the prevalence, clinical signs and the type and frequency of diagnostic procedures used for dermatological investigation, the objectives of this study were to:

1. determine the overall prevalence of skin condition of dogs presented to the University Veterinary Hospital (UVH) during a one year period, Jan-Dec 2014
2. report the clinical manifestations for the most common skin conditions of dogs, including the most common diagnostic procedures used
3. determine the risk factors for the most common skin conditions in dogs

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2.0 LITERATURE REVIEW

2.1 The Skin

2.1.1 Functions of skin

Being the largest organ of the body, skin provides a wide range of functions in the animal. According to Paterson (2008), skin provides a protective barrier against chemical, physical and microbial damage, prevents excessive loss of water, electrolytes and macromolecules and provides elasticity for normal movement to occur. It is also involved in the production of adnexae, acts as sensory organ, regulates body temperature, and functions as a storage for nutrients. Langerhan cells, keratinocytes and lymphocytes together, provide the immunosurveillance capability of the skin to prevent the occurrence of neoplasm and infections, while the antibacterial and antifungal activities of the skin help in fighting microbial infections (Miller, Griffin and Campbell, 2013). Additionally, vitamin D is also produced by the skin to regulate proliferation and differentiation of the epidermal layer that occurs from stimulation by solar radiation. Besides this, the skin also functions to protect against solar radiation and reflects the health of the animal in some instances.

2.2 Prevalence of dermatological conditions in veterinary practice

There have been several studies conducted to determine the prevalence of skin conditions in dogs. In a study done at a veterinary hospital in Canada, dermatological problems accounted for 18.8% of all cases presented for dogs (Scott and Paradis, 1990). A more recent study conducted in 20 small animal practices around United Kingdom revealed that 24.1% of dog consultations in general practice

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were related to dermatological problems (Hill *et al*., 2006), while a study done from September 2007 to March 2011 in a veterinary teaching hospital in Iran determined that 17% of total patients presented were dermatological cases (Khoshnegah *et al.,* 2013). It is however noted that the studies from Canada and Iran were done in a veterinary hospital while the study in United Kingdom was a collation of data obtained from 20 small animal practices around the region.

In another study, electronic patient records (EPR) of dogs attending clinics across central and south-eastern part of England from 1st September 2009 to 31st March 2013 were analysed and dermatology cases encountered comprised 15.5% (O'Neill *et al.,* 2014). In Asia, a study in Japan reported that 22.9% of the total number of insured dogs had dermatological problems and seeked veterinary attention. This information was obtained from an insurance program (Inoue *et al.,* 2015). All these studies show that dermatological problems are one of the most common reasons for canine veterinary consultation. The lack of such information for dogs in Malaysia is one of the main reasons for doing this study.

2.3 Common dermatological conditions

In Iran, a study conducted at Ferdowsi University of Mashhad Veterinary Teaching Hospital on dermatological conditions in dogs, revealed that the most common diagnoses were superficial pyoderma, canine leishmaniasis, flea and tick infestation, hypersensitivity, atopic dermatitis, scabies, unspecified dermatoses, otitis, furunculosis, and food allergy (Khoshnegah *et al.,* 2013), while in a study in Bangladesh, skin conditions of pet dogs were mostly ectoparasite related, and caused by lice, fleas, ticks and mites (Tarafder and Samad, 2010). This variability of most

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common skin diseases in dogs in different countries could be due to several factors including the region of the study, the climatic conditions, the level of preventative care, the environment dogs are exposed to and also the population.

According to Hill *et al*., (2006), most of the dermatological diagnoses in dogs in general practices in the United Kingdom were otitis, pyoderma, anal sac impaction, flea infestation and allergies, atopic dermatitis, tick infestation and acral lick dermatitis. Comparing these results with another study by O'Neill *et al.,* (2014) conducted in the same region, the latter determined that otitis externa, anal sac impaction, overgrown nails, lipoma, unspecified dermatitis, skin hypersensitivity, cutaneous mass, claw injury, dog bite injury and laceration were among the most frequent disorders recorded in dogs attending primary veterinary practices in England. It was also reported that some of the dogs had more than one skin conditions and that one skin condition may contribute to the presence of another.

In Malaysia, P'ng (1997) conducted a 4 week study on dogs presented to UVH and reported that 14.8% of dogs were presented due to skin problems. The most common cause 14 years ago, was attributed to bacterial infections (25.6%) and tick infestation (25.6%). This was followed by dermatophytosis (12.8%), cutaneous myiasis (7.7%) contact irritant (7.7%), demodicosis (5.1%), otitis externa (2.6%) and neoplasia (2.6%) (P'ng, 1997). In light of the gradual but positive changes in practice of preventive medicine, the availability of more tests, the advancement in the field of dermatology and more interested and informed clients regarding their pets' health, these findings may differ from today.

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2.4 Common dermatological tests

According to Medleau and Hnilica (2006) there are many diagnostic procedures available to diagnose dermatological cases such as skin scrapes, cutaneous cytology, acetate tape strip test, otic swabs, bacterial and fungal cultures, trichograms, Wood's lamp examination, biopsy, polymerase chain reaction (PCR), serology, immunostaining techniques, diascopy, allergy testing, patch testing, and last but not least, therapeutic trials.

Basically, initial diagnostic tests should be performed in every dermatological case to rule out the common causes of diseases, such as fungal, bacterial and ectoparasites, before proceeding to further diagnostic tests. Paterson, (2008) recommends that the minimum database for skin problems in both dogs and cats should include the wet paper test, coat brushings, diascopy, acetate tape test, skin scrapings, hair pluck and cutaneous cytology. In addition, investigations of otitis problems should also include examination of impression smears or exudates from the lesions and ear discharge. These initial diagnostic tests will provide important information and also justify the necessity for further tests in the case. However, it ultimately depends on the owner's decision either to proceed with further examinations or not. Advanced examinations of dermatological conditions include bacterial and fungal cultures, biopsy, allergy testing and trial therapy.

The diagnostic procedures used in investigating dermatological cases also depend on the experience of the dermatologist and it may vary from one to another based on the differential diagnosis that requires investigation. Khoshnegah *et al.* (2013) reported that haematology and biochemistry tests were the most frequent

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diagnostic step done in dermatological investigations, followed by skin scrapings, otoscopic examination, cytology, bacterial culture and sensitivity test, biopsy, coat brushings, Wood's lamp and radiography.

In small animal practices around United Kingdom, Hill *et al*., (2006) reported that the most common diagnostic procedures done were otoscopic examinations, followed by skin scrapings, cytology, biopsy, coat brushings, fine-needle aspiration cytology, bacterial culture and sensitivity, intradermal allergy test and thyroid-stimulating hormone stimulation tests, in descending order.

However, the type and frequency of the diagnostic procedures done were also related to the most common dermatological diagnoses reported in animals of that particular region and depend on the facilities available in the study.

2.5 Risk Factors associated with skin conditions

There have not been many studies done to investigate the risk factors of dermatological conditions in dogs in general. Most studies focus on a particular disease and the risk factors for that particular disease were investigated. Scott and Paradis, (1990) and Khoshnegah *et al.,* (2013) showed in their studies that breeds such as the Boxer, Dachshund and Bichon frise, Spitz, Terriers, and German Shepherds appeared to be at an increased risk for dermatological disease.

In another study by Saridomichelakis *et al.,* (2007) which investigated the relationship between the signalment, history, clinical and laboratory findings and the various primary, secondary and perpetuating causative factors of ear canal inflammation, found that atopic dermatitis and adverse food reactions-associated

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otitis externa were more common in female dogs and those with a history of pruritic skin disease, while grass awn-induced otitis externa occurred in cocker spaniels and acute cases. The most common primary causes for otitis externa were allergic dermatitis (43/100 dogs), grass awns (12/100 dogs) and otoacariasis (7/100 dogs) while the most common secondary factors were *Malassezia* spp. (66/100 dogs), cocci bacteria (38/100 dogs) and rods bacteria (22/100 dogs).

The anatomical structure of a dog's ear also plays an important role to the development of canine otitis externa. Based on a study by Hayes *et al.*, (1987), otitis externa was found to occur more frequently in dogs with pendulous ears and heavy ear canal hair (P less than 0.01) than dogs with other ear types. Also dogs with erect ears, regardless of the amount of ear canal hair, had lesser risk (P less than 0.01) of the disease compared to mixed breed dogs.

In Turkey, a study was done to identify the prevalence of dogs and cats with dermatophytosis in the two big provinces in the country. However, there was no association detected between the prevalence of the infection, and sex of the animal but there was an association found with the age. Young dogs and cats below one year of age were more predisposed to dermatophytosis compared to others. Even though there was no association between the isolation rate with the season, dermatophytosis in dogs was found to be more prevalent in the spring and winter (Seker and Dogan, 2011). In Malaysia, there have been no reports on the types of and frequency of use of tests for dermatology, nor risk factors for common dermatological diseases present. This current study also aims to fill this gap of information.

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3.0 MATERIALS AND METHODS

3.1 Selection of cases

This retrospective study was conducted by firstly identifying the case number of dogs with skin related problems from the Canine Case Log Book for 2014. This log book is a register of all the dogs that were presented at UVH during 2014, their case numbers, signalment and diagnoses or conditions. Any words related to the skin, hair or adnexae in the diagnosis column were identified, case number noted and the associated patient files were retrieved.

3.2 Data extraction

The data extraction from selected patient files included patient signalment such as the sex, age, neuter status, body condition score (BCS), the clinical manifestations recorded, particularly involving the skin, the diagnostic techniques performed and the final diagnosis for each case.

3.3 Data analysis

By using SPSS 22.0 statistical software, the descriptive statistics were performed to identify the frequency of the common dermatological cases, the clinical manifestations, and the diagnostic procedures performed in dogs presented to UVH. For the risk association, chi-square and relative risk were calculated for the most common dermatological conditions.

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4.0 RESULTS

4.1 Population demographics and prevalence of skin conditions in dogs presented to UVH (Jan – Dec, 2015)

A total of 1827 dogs were presented to UVH during a one-year period from 1st January to 31st December 2014. Of the total, 615 dogs (with 859 dermatological diagnoses) were presented with one or more dermatological conditions, resulting in a prevalence of 33.66%.

Three hundred and fifty two dogs (52.8%) were male and 315 dogs (47.2%) were female, with 499 (74.9%) of the 859 dogs being intact, and 167 (25.1%) that had been neutered. More than half of the total number of dogs with skin problems (57.8%), were 1 to 5 years of age, 31.5% (n=205) were >5 to 10 years old, 10.3% (n=67) were 10 to 15 years old, and only two, 0.3% (n=2) were old dogs aged >15 to 20 years of age. Evaluation of the body condition score (BCS) showed that 80% (n=439) of the dogs with dermatological conditions had the ideal condition of 3 of the 5 body condition score points on a five-scale point system.

4.2 Common canine skin conditions

The most common diagnoses of the dogs with dermatological problems were malasseziasis (20%), dermatophytosis (9%), otitis externa (9%), cutaneous neoplasia (8%) and cutaneous myiasis (6%) (Table1). However, it is to be noted that an animal could have more than one skin condition concurrently.

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Diagnosis	Frequency	Percentage
Malasseziasis	170	20%
Dermatophytosis	78	9%
Otitis externa	74	9%
Neoplasia	67	8%
Cutaneous myiasis	53	6%
Tick infestation	49	6%
Demodicosis	39	5%
Generalized pyodermatitis	37	4%
Food allergy	31	4%
Unspecified lumps	30	3%
Aural hematoma	24	3%
Mange infestation	24	3%
Contact allergy	23	3%
Bacterial dermatitis	20	2%
Pododermatitis	19	2%
Atopic dermatitis	14	2%
Moist dermatitis	12	1%
Papular dermatitis	10	1%
Abscess	10	1%
Perianal mass	9	1%
Tick bite allergy	8	1%
Generalized dermatitis	6	1%
No diagnosis	4	0%
Dust mite infestation	4	0%
Hypothyroidism	4	0%
Callus	3	0%
Flea infestation	3	0%
Deep pyoderma	3	0%
Bed sores	3	0%
Cushing's disease	3	0%
Juvenile pyoderma	2	0%
Insect bite	2	0%
Dust mite allergy	2	0%
Fur mite	2	0%
Furunculosis	1	0%
Post vaccine reaction	1	0%
Post injection reaction	1	0%
Flea bite allergy	1	0%
Ear mite	1	0%
Cheyleytiella mite	1	0%
Lice infestation	1	0%
Mosquito bite	1	0%
Superficial Pyoderma	1	0%
Eosinophilic plaque	1	0%
Systemic Lupus Erythematosus	1	0%
Nail bed infection	1	0%
Nevus	1	0%
Dry skin	1	0%
Hematoma	1	0%
Cysts	1	0%
Granuloma	1	0%
Total	859	100%

Table 1: Specific dermatological diagnoses for 615 dogs presented to UVH for skin problems, Jan–Dec 2014

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4.3 Malasseziasis associated with other diseases

Malasseziasis is usually secondary to other problems. Figure 1 shows the most common conditions associated with *Malassezia*. The most common conditions associated with malasseziasis were otitis externa and bacterial dermatitis, followed by demodicosis, and lastly food allergy dermatitis.

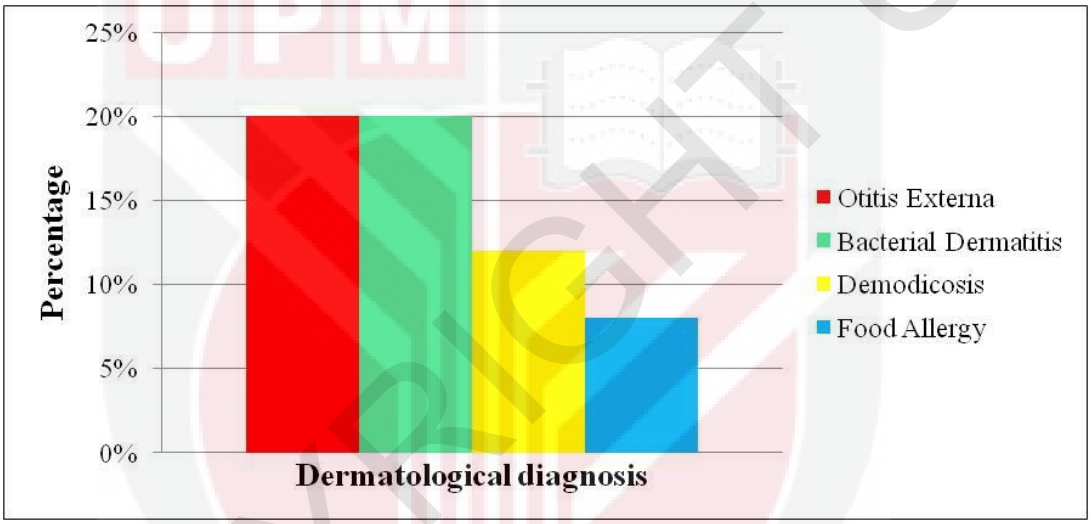

Figure 1: Percentage of association of malasseziasis with other dermatological conditions

4.4 Breed distribution

The dog breeds most frequently presented to UVH for dermatological problems were the mixed breed dogs, followed by the Shih Tzus, German Shepherds, Poodle and Cocker Spaniels, in descending order. However, the breed distribution could be due to over-presentation of these breeds in the veterinary hospital (Table 2).

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Breed	Frequency	Breed	Frequency
Mixed Breed	150	Dalmatian	3
Shih Tzu	84	French Bulldog	3
GSD	42	Corgi	3
Poodle	32	Maltese	2
Cocker Spaniel	25	Lhaso Apso	2
Rottweiler	24	Jack Russel	2
Terrier	22	Boxer	2
Golden Retriever	19	Chihuahua	2
Labrador	18	Bull Mastiff	2
Schnauzer	16	Pitbull	2
Spitz	10	Chow Chow	1
Beagle	10	Bichon frise	1
Pekingese	9	Vizsla	1
Siberian Husky	9	Spanish Bulldog	1
Doberman	8	Japanese Chin	1
Miniature Pinscher	7	Shar Pei	1
Daschund	7	Dutch Shepherd	1
Pug	5	Nepolitan Hound	1
Belgium Shepherd	5	Great Dane	1
Collie	3	Total	540
Basset Hound	3		

Table 2 : Distribution of the breeds presented to UVH for dermatological problems (Jan –Dec, 2014)

*Total is less than 615 because of some files were untraceable and could be retrieved

4.5 The five most common breeds with dermatological conditions

The mixed breed dogs, were presented to UVH with the most common skin conditions of dermatophytosis, cutaneous neoplasia and malasseziasis, at 14%, 13% and 12%, respectively. Twenty-five percent of the Shih Tzus with dermatological problems were due to malasseziasis, and seven percent were due to otitis externa and generalized pyodermatitis, each. German Shepherds were mostly presented due to malasseziasis, otitis externa and cutaneous myiasis at 19%, 16% and 13% respectively. Malasseziasis (34%), superficial pyoderma (9%) and otitis externa

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(8%) were seen in poodles while Cocker Spaniels were mostly seen with dermatological conditions of malasseziasis (26%), otitis externa (21%) and cutaneous neoplasia (9%) (Figure 2).

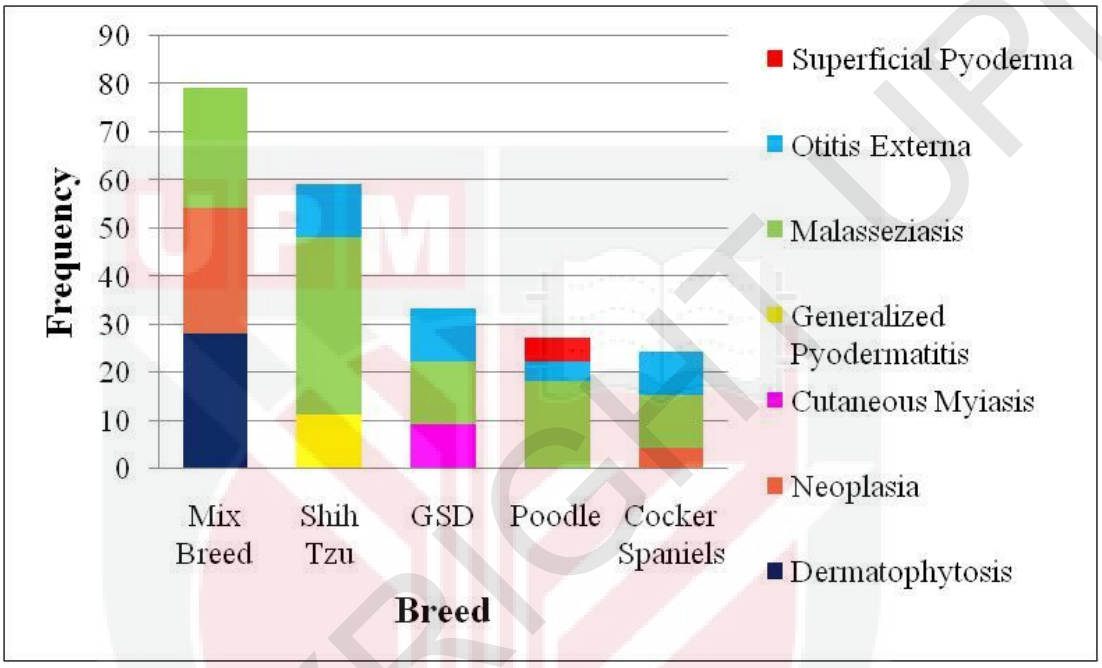

Figure 2: The frequency of dermatological conditions in the five most common breeds presented with dermatological problems to UVH

4.6 Clinical manifestations of dermatological conditions in dogs

The clinical signs in dogs presenting with dermatological problems are shown in figure 3. Erythema was the most common presenting sign, and accounted for 16% of all dermatological consultations, followed by alopecia (13.4%), pruritus (12.9%), maculo-papular-pustular eruptions (11%), scaling (9.3%), crusts (5.6%), odoriferous (4.4%), lichenification (3.2%), lumps (3.1%) and hyperkeratosis (2%) and other clinical signs were uncommon as primary presentations.

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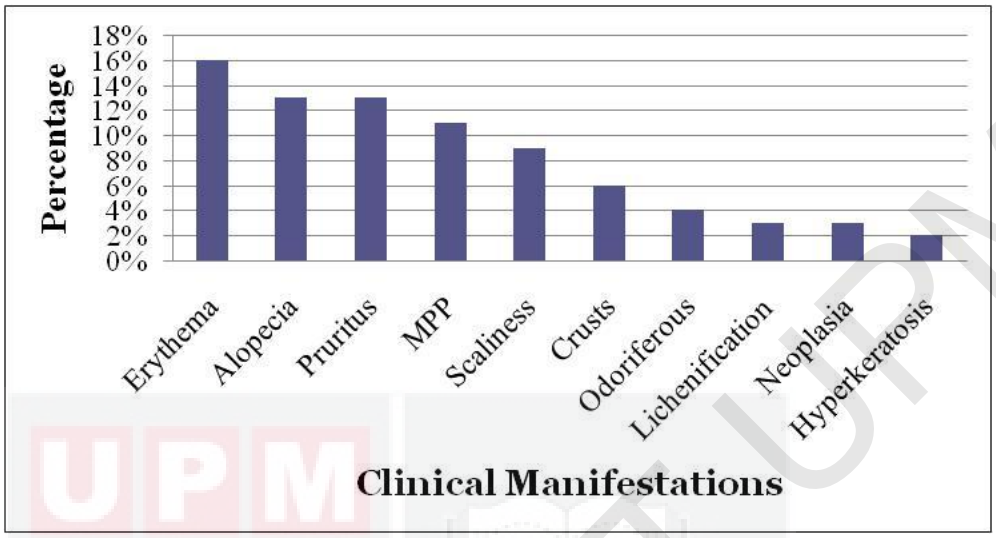

Figure 3: Percentage of common clinical manifestations in dogs with dermatological problems presented to UVH

*MPP Maculo-papular-pustular eruptions

4.7 Diagnostic procedures for investigation of skin problems

There are many diagnostic tools that can be used for the diagnosis of skin diseases. In UVH, the most common tests performed are the acetate tape test, hair pluck, skin scrape, impression smear and fine needle aspirate (FNA). Table 3 shows the frequency of the diagnostic tests performed in the investigation of skin conditions of dogs in UVH.

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Diagnostic Procedure	Frequency
Acetate Tape Test	294
Hair Pluck	186
Skin Scrape	127
Impression Smear	70
Fine Needle Aspiration	51
Swab	41
Wood's Lamp Examination	34
Biopsy	24
Food Allergy Trial	18
Otoscopy	14
Bacterial Isolation	13
Ear Mite Check	13
Total T4	8
Cortisol Level	5
Treatment Trial	2
Radiograph	1
Hyposenstization Trial	1
Serum Allergy Testing	1
Total	912

Table 3: Diagnostic procedures performed to investigate dermatological problems in Dogs at UVH (Jan-Dec, 2014).

*Total is greater than 615 because more than one test was performed in some animals

4.8 Risk factors associated with skin conditions

Of all the dermatological problems in dogs presented to UVH, malasseziasis, dermatophytosis and otitis externa were the most frequently diagnosed by the clinicians. Malasseziasis had no association with the age, sex, neutered status and body condition score (BCS). However, dermatophytosis showed significant association [P value = 0.021 (α = 0.05)] with the age while otitis externa showed significant association with the age [P value = 0.023 (α = 0.05)], sex [P value = 0.003 (α = 0.05)] and BCS [P value = 0.017 (α = 0.05)]. The relative risks were

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calculated and dermatophytosis was seen 78.4% (relative risk = 0.784) less in older animals above 6 years of age while otitis externa was seen in females was 50% (relative risk = 0.504) less than in males, with the relative risk being nearly twice in obese (relative risk = 1.964) and older (relative risk = 1.801) dogs compared to the others.

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5.0 DISCUSSION

5.1 Prevalence of skin conditions in dogs presented to UVH, Jan –Dec 2014

The prevalence of skin conditions of dogs presented to UVH for the year 2014 was significantly higher if compared to that reported in other countries such as United Kingdom, Iran and Canada. This may be due to several reasons. The first most likely factor is that our climatic conditions in Malaysia are tropical with humid and warm temperatures throughout the year. This is very conducive for bacteria, yeast and fungus to thrive. Additionally, when considering the life cycles for ectoparasites such as fleas and ticks, our warm and humid climate supports the developmental stages quite efficiently. A study by Randall *et al.*, (2003) on the quantitation of dust mites in households, showed that the houses with higher allergen concentrations had a significant association with a maximum relative humidity of more than 75%.

Secondly, the level of owner compliance and commitment towards preventive medicine in the current study may vary from that present in developed countries. Although there has been an encouraging change over the years here, there still remain owners who present their pets to a clinic only when there is a problem, rather than regular veterinary visits for preventive care. Preventatives for ticks and fleas need to be continually given and throughout the year, which can be costly too. Therefore cost may be a factor that affects compliance. Another factor may be related to the type of management of the pet dogs. Outdoor dogs are more prone to the pathogens and ticks. This is supported by a study done by Pappalardo *et al.*, (1997) who investigated the seroprevalence to *Bartonella vinsonii* subspecies

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berkhoffii in a population of dogs and the risk factors. They reported that, seropositive dogs were predominantly outdoor dogs and were more likely to have a history of heavy tick infestation. In Malaysia, many of the dogs, particularly large breed dogs, are kept not only as pets but also play a dual role as guard dogs for protection, and are thus more likely to be kept outside within the compound. In some instances, these dogs are allowed to roam freely in the neighbourhood, get into fights and contract diseases from strays. This could also be a risk factor for the dogs to be exposed to tick infestations, develop wounds and further cutaneous myiasis.

Lastly, for the other studies, it is unknown if these were conducted in small animal practices with separate dermatology services. In UVH, as of last year, a dermatology service was set up and could perhaps be another reason why the prevalence for skin problems in dogs is high, as they may be over-represented in the normal case load received at UVH. This may also explain the higher prevalence compared to the study done 14 years ago in UVH (P'ng, 1997). Additionally, with the changing trend over the recent years, of owners being more informed of their pets' health and small breeds becoming more popular and being kept indoors, they are regarded more as family pets, rather than guard dogs. Being indoor family pets, the human-pet bond is stronger and more time is spent with these pets. This results in a greater chance of owners noticing early cutaneous changes and seeking prompt veterinary attention. It would be interesting to further investigate prevalence of dermatological conditions in dogs in general practices around Malaysia.

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5.2 Common canine dermatological conditions in UVH

The canine dermatological conditions most frequently diagnosed at UVH were malasseziasis, dermatophytosis and otitis externa. Malasseziasis is caused by an organism, *Malassezia* spp., a unicellular fungi that thrives in areas of the skin with higher lipid content (Lewis, 2010). There are many species of this organism including six lipid dependant yeasts (*Malassezia furfur, Malassezia sympodialis, Malassezia slooffiae, Malassezia globosa, Malassezia obtuse* and *Malassezia restricta)* and one lipid-independent species, *Malassezia pachydermatis* which is a normal flora of canine skin. However it is also an opportunistic pathogen under certain circumstances, can cause problems in the animal (Nardoni *et al.*, 2004). In this study, malasseziasis was predominantly seen in dogs presented to UVH and it could be due to the awareness of veterinarians of the association of this organism with other skin conditions. In the late 1980s, *Malassezia* was not routinely diagnosed by dermatologists (Scott and Paradis, 1990). However, since the last 20 years, there has an increasing frequency of malasseziasis being diagnosed by dermatologists (Mason and Evans, 1991). According to Lewis, (2010) malasseziasis is more commonly seen in geographical regions with high humidity, and this would include Malaysia, which not only has high humidity but also warm temperatures throughout the year. This could also be one of the reasons for high number of cases of malasseziasis observed in this study.

In previous studies, there were variations in the most common specific diagnoses reported by the researchers in different geographical regions. Scott and Paradis (1990) reported that the most common final diagnoses in dogs examined at a

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university small animal clinic, Canada were bacterial folliculitis, allergic dermatitis and endocrinopathy while Hill *et al.*, (2006) found that most of the dermatological cases encountered in 20 small animal general practices around United Kingdom were undiagnosed, followed by otitis and pyoderma. It is noted that some of the studies classified the dermatological diagnoses either by the agent or by the clinical appearance of the cutaneous lesions found. This is probably because a single agent, such as bacteria causing a skin infection, can produce a variety of cutaneous lesions in the affected dog. A recent study by Khoshnegah *et al.*, (2013) revealed that bacterial folliculitis, canine leishmaniasis and flea allergy and infestation were commonly diagnosed in dogs presented to a university small animal clinic in North Iran. In 1997, the most common skin conditions of dogs at UVH were due to bacteria, ticks, fungus and cutaneous myiasis. While fungal infection remains one of the frequent diagnoses in the current study, malasseziasis was the most common. This could be due to the better understanding of veterinarians today of the significance and pathogenic effect of *Malassezia* spp. in dogs, including familiarity with the tests done for diagnosis, compared to then.

5.3 Frequency of the clinical manifestations of canine skin problems

The skin reacts to injuries by producing pathological changes and are usually described as primary or secondary lesions. Primary lesions occur directly as a result of a trauma while secondary lesions result progressively after an event of injury or self-inflicted trauma (Hill, 2002). Thus, primary lesions provide more specific diagnostic information compared to the secondary lesions.

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In this study, apart from alopecia and pruritus, erythema and macula-papular-pustular eruptions were the most common presenting signs observed in dogs with skin problems presented to UVH. These are primary lesions and it suggests that the owners did notice the abnormalities in their pet early in the course of the disease. This is also may reflect the closeness of the animal-human bond today and the fact that changes in the skin are very noticeable to owners unlike those of other internal organs such as the heart and kidneys.

Other previous studies also investigated the variety of the presenting signs in animals with skin disorders. A 'problem-oriented' approach is very useful to relate the signs that the animal presents with during the consultation with the possible differential diagnoses for the problem.

Some of the studies (Hill *et al.*, 2006; Khoshnegah *et al.*, 2013) had consistent findings of pruritus as the most common presenting signs in dogs with dermatological problems. However this observation may be very subjective as the definition or recognition of pruritus may vary from one individual to another. Owners sometimes do not realize that some of the behaviours that their dogs express are actually signs of pruritus. Hence, a thorough physical examination and detailed history are critical for successful diagnosis of a skin problem.

5.4 Frequency of diagnostic procedures performed

The use of the acetate strip test, skin scrapes, hair plucks and Wood's lamp is the basis of investigation in most of the skin conditions. Skin scrapes are used for diagnosis of ectoparasites such as *Sarcoptes* spp. and *Demodex* spp. and is the initial

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step in any dermatological condition that is associated with scabs, scales or pruritus. The acetate strip test is used mostly for assessment of skin debris, occasionally mites but mostly for the presence of *Malassezia* spp. The hair pluck is used not only to estimate the stage of growth of the hair cycle but also in a majority of cases for the assessment of fungal infections. Often times, if fungal disease is suspected, a Wood's lamp is performed first to examine for fluorescence of the hair, followed by a hair pluck from the area, for culture and identification, or direct examination for arthrospores using the light microsope. Thus it is not surprising that these tests were the most frequently used in the current study, as the top two most frequently diagnosed skin diseases were malasseziasis and dermatophytosis.

The acetate tape test was the most common diagnostic procedure performed in diagnosing skin conditions of dogs presented to UVH. This test is used widely in a variety conditions to collect a sample of hair or skin debris superficially including the diagnosis of mites, trichogram purposes, but mostly for identification of yeast (Medleau and Hnilica, 2006). Of the total number of dogs with skin conditions presented to UVH, malasseziasis accounted for 20%, followed by dermatophytosis and otitis externa. According to Joyce (2010), yeast infections are usually secondary to other underlying problems. Hence, it is not surprising that the acetate tape test is the most common diagnostic procedure performed in investigating dermatological problems in the present study as it is usually used to detect *Malassezia* spp. that occurs secondarily in other diseases. The second most common diagnosis in this study was dermatophytosis, hence it is understandable to note that the second most common diagnostic test performed was the hair pluck which is routinely done for

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fungal culture, or direct examination of the hair microscopically for arthrospores. Additionally, hair plucks are used to determine the stage of hair growth cycle and for the diagnosis of demodicosis, particularly where pododermatitis is a feature.

The investigations reported in a study by Hill *et al.,* (2006) were limited where 72% of dermatological problem in dogs were diagnosed only by physical examination alone. This may also explain the results where most of the final diagnoses in the study were not determined. Otoscopic examination was the most common diagnostic procedure performed in the study and it was also consistent with the findings of otitis as the second most common specific diagnosis in the study. Although clinical signs present during physical examination alone may give us a suspicion of the condition present, preliminary diagnostic tests must be performed to prevent a misdiagnosis of the case.

5.5 Risk factors associated with skin conditions

In the present study, the risk factors for malasseziasis, dermatophytosis and otitis externa were identified by calculating the relative risk against the age, sex, neuter status and also body condition score (BCS). However, only dermatophytosis and otitis externa had associations with some of these factors above. The absence of risk factors for malasseziasis in this study is similar to the findings of Chen (1997) who reported that it can occur in dogs of any age, sex and breed.

Dermatophytosis was found to be significantly associated with the animals younger than 6 years of age. In comparison, a study done in Turkey also found a significant association of age to the occurrence of dermatophytosis where younger

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animals, particularly younger than one year of age were more predisposed to the skin fungal infections (Seker and Dogan, 2011).

Otitis externa in this study showed significant association with the age, sex and BCS where females had a 50% lesser risk of developing otitis externa compared to males. The relative risk was nearly twice in obese and older dogs compared to the others. In a study done in a veterinary teaching hospital in Israel, there were no association for the occurrence of otitis externa with the sex, neuter status and also age of onset. The study also shows that otitis externa was not predisposed by any of the risk factors, however, it can be very severe in older dogs. The Shar Peis, German Shepherds and Cocker Spaniels were over-represented in the study of having the problem. In the present study, 29% (9/31) of Cocker Spaniels and 21% (11/52) of German Shepherds had otitis externa but it is noted that these may be over-presented in this study.

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6.0 CONCLUSIONS

In conclusion, the overall prevalence of canine skin conditions presented to UVH in a one year period, from 1st January to 31st December 2014 was 33.66%, representing a third of all canine cases presented to UVH and this is a high prevalence compared to temperate countries. Of all skin condtions, malasseziasis was the most common diagnosis with the percentage of 20%, followed by dermatophytosis, and otitis externa accounting 9% each. The most common clinical manifestations observed in the dogs with dermatological problems presented to UVH were erythema, alopecia, pruritus and maculo-papular-pustular eruptions. The most frequently used tests were the acetate tape test, hair pluck, skin scrape and impression smear which are simple tests that form the basis of skin investigation before other tests are done. Dermatophytosis was associated with the age while otitis externa had significant association with the age, sex and body condition score (BCS).

7.0 RECOMMENDATIONS

For future research, computerization of the hospital data would useful for more complete data in research, and prospective studies for particular diseases are recommended in order to have more in depth information regarding these conditions. It would be interesting to do more in-depth research into individual diseases such as to study specifically the relationship of malasseziasis and immunity of the animals. Feline dermatological diseases also could be included in the future studies to complete the information of dermatological diseases in small animals.

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