Research Article

Patterns of skin diseases in pet animals: a hospital based study in South-Eastern part of Bangladesh

Ferdous, S., Rudra, P. G., Islam, M. F., Debnath, A., Eima, F. E., Banu, S. and Sikder, S.*

Department of Medicine and Surgery, Chattogram Veterinary and Animal Sciences University, Zakir Hossain Road, Chattogram-4225, Bangladesh

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ABSTRACT

A total of 151 small pet animals that had at least one skin problem were presented to the SAQ Teaching Veterinary Hospital, Chattogram Veterinary and Animal Sciences University were included in this study. Among patients with skin diseases, dogs (60.93%) were presented with the highest number of cases followed by cats (25.17%) and rabbits (13.91%). Flea infestation was the predominant skin problem recorded in dogs (25%) and cats (42.11%). However, all the rabbit patients (21/21) presented to the hospital were suffering from mange. Other skin conditions of dogs were recorded as allergic dermatitis (23.91%), mange (16.30%), pediculosis (9.78%), myiasis (8.70%), fungal infection (5.43%), acariasis (5.43%), nutritional disorders (3.26%) and malassezia dermatitis (2.17%). Mange with allergic dermatitis (23.68%), pediculosis (13.16%), myiasis (8.70%) and nutritional disorders (5.26%) were diagnosed as notable skin diseases infecting cats. Patterns of skin infections were recorded low during winter (<12.8%, October to December) compared to hot-humid spring and early summer (>17.21%, January to March). More than 52% of the cases were reported in male animals compared to the females (<47%) and infectious diseases were predominat over the nutritional and other non-infectious diseases. Results of this study reported the current scenario of the prevailing skin diseases in pet animals residing in this area. This study will help the veterinarians and pet owners to consider the scenario of these diseases for the better management and control in future.

1. INTRODUCTION

Dogs and cats are the most common household pets around the world, although there are many other vertebrates for example, rabbits, birds that share our household environment. People rear pet animals for physical, social, commercial, recreational purposes and for emotional well-being of children or owners. Rearing of pet animals were not so common in Bangladesh in recent past but nowadays people in cities are being more interested in rearing pet animals (Dohoo *et al.* 1998; Robertson *et al.* 2000). However, household pets play a direct role in transmitting some diseases in human and other domestic animals (Molyneux and David 2004;

Robertson *et al.* 2000). Animal bites and allergy from pets are the commonest health hazards, however, a diverse range of infections, including parasitic, bacterial, fungal and viral diseases are transmitted to humans from domestic pets (Geffray 1999; Dada *et al.* 1979; Kornblatt and Schantz 1980; Plaut *et al.* 1996). Lack of sufficient knowledge on standard management procedures of dogs and cats especially on vaccination, bathing and grooming etc. might enhance them prone to infections, for example, communicable diseases between the pet animals and owners (Sultana *et al.* 2016). Close association with pet animals may impose threat to public health as they harbor infective stages and causal agents of various transmissible diseases.

Skin appears as a natural barrier of the body that interfaces with the environment and hence prone to most infections. It serves as a first line of defense against external factors such as pathogens and also helps the body to maintain homeostasis through insulation, thermoregulation, sensation and production of vitamin D folates (Montagna 2012; Monteiro-Riviere 2010; Watson 1998). Skin disorders are the most commonly reported problems encountered by veterinarians in small animal medicine (Muller *et al.* 1989). Pet owners always desire to have pets with healthy fur from the point of aesthetic view. Dogs are commonly infested with a variety of ectoparasites making them miserable due to constant scratching and severe itching. Several studies have indicated that skin affections make up a significant proportion of the small animal caseload (Kumar *et al.* 2006; Sharma *et al.* 2015).

Fleas are known causes of dermatitis, or skin irritation in dogs and cats. Moreover, both fleas and ticks carry zoonotic diseases that can easily be transmitted through their bites. Furthermore, mites can cause irritation of the skin of dog, cats, rabbit and birds. Other types of skin diseases occur as a result of bacterial or fungal infections. These infections may appear as a complication of the primary irritating agent for example, flea or mite infestation. When skin integrity is broken due to cut, scratch, bite or constant licking secondary bacterial infection occur in most cases. Ringworm is an example of a fairly common fungal infection that causes easily identifiable ring-like patterns of scaly skin and hair loss. Grooming and bathing with a medicated shampoo regularly can help to keep these parasites from proliferating on pets, but doing these management practices humans are getting infections frequently from pets (Hill *et al.* 2006; Muller *et al.* 1989; Scott and Paradis 1990).

Although least-cost tools are available to diagnose most of the skin diseases, very limited reports of the disease pattern of the pets residing in this area is existing. Therefore, the aim of this study was to determine the prevalence of clinical dermatological conditions in pet animals (dogs, cats and rabbits) presented at SAQ Teaching Veterinary Hospital (SAQTVH) of Chattogram Veterinary and Animal Sciences University (CVASU) located in South-Eastern part of Bangladesh. Results of this study will help directly to the veterinary practitioners and pet owners to take bio-safety measures to reduce skin disorders in pet animals or their transmission to the pet animal handler or owners.

2. MATERIALS AND METHODS

Study area

Dog, cat and rabbits are the most common pets accompanied by the owners of Chattogram area. Shahedul Alam Quadery Teaching Veterinary Hospital (SAQTVH) of CVASU is one of the busiest pet animal patient dealing hospital in Bangladesh that has a high number of case loads everyday (>30). This hospital represents as one of the most effective teaching institution due to the diversity of the patients. Most of the pet owners of Chattogram are from city area where the hospital is based on. However, patients of other regions in Bangladesh are also referred to SAQTVH. In the present study, the pet animals presented to the SAQTVH with history of minimum one skin problems were selected for the current study.

Study period and patient selection

A total of 92 dogs, 38 cats and 21 rabbits (total 151 animals) were examined for skin disorders in the Pet Unit of SAQTVH during a period of six-months from October 2017 to March 2018 and included under the current study. The inclusion criteria of patients were based on owner's complaint of skin disorder, clinical signs and examinations, physical examination of specimens and laboratory diagnosis of specimens. Patient's species, gender and age were recorded for better classification and understanding of the diseases.

Diagnosis of dermatological cases

Epidemiological data

Epidemiological data determine the present and past prevalence and incidence of diseases and the probable risk factors responsible for the disease process (Frerot *et al.* 2018). During the present study we studied the published literature and articles that reported previous disease prevalence in the pet animals in Bangladesh. From the owners we have collected information on any previous similar or dissimilar skin infections, how frequently they get exposure to other pets of domestic or

stray origin, and how often they consult with vet dermatologist to achieve patterns of skin diseases in this area.

Clinical history

Extensive vigilantly taken medical history is a powerful diagnostic technology (Summerton 2008). History taking and empathetic communication are two important aspects in successful physician-owner interaction. Gathering important information from the patient's medical history is needed for effective clinical decision making while empathy is relevant for patient or owner's satisfaction (Ohm *et al.* 2013). Acquiring a clinical history and interviewing an owner provides important information for determining a disease (Croft *et al.* 2015). Following animal identification by species, breed, age, sex and physiological status, onset and duration of illness, number of animals affected with similar signs, severity of illness, detailed management history and whether any treatment already provided or under consultation were taken as major clinical history.

Clinical signs

The owner or animal caretaker is the first person to consider a pet's signs and may choose at this point to engage with the health care system. Performing a clinical history and interviewing the owner, conducting a physical exam, performing diagnostic testing, and referring or consulting with other clinicians are all ways of accumulating information that may be relevant to understanding a patient's health problem (Croft *et al.* 2015). In the current study, the skin, hair coat, and other accessory integumentary organs were examined through distant and close direct or indirect inspection, direct and indirect (using stethoscope) auscultation to note down all presenting signs.

Clinical examination

Physical examination of patients included an analysis of many parts of the body, not just those suspected to be involved in the patient's current complaint (Davies and Rees 2010). Due to the growing emphasis on diagnostic testing, there are concerns that physical exam skills have been underemphasized in current health care professional education and training (Kassirer 2014; Kugler and Verghese 2010). However, most of the dermatological cases can be diagnosed through a thorough physical and laboratory examinations. We employed general and special physical examination techniques for example, inspection, auscultation, palpation and percussion techniques to examine physical signs. Combined approaches of general techniques such as parting of hair,

full-body combing were performed and whenever necessary magnifying glass was used to determine all skin lesions that were not possible to diagnose by taking clinical history and observing presenting signs alone.

Physical examination of specimens/lesions

Skin lesions and specimens such as hair, pus, abraded or avulsed skin were further assessed using organoleptic tests such as taking smell, observing volume, color, consistency, and texture. Any skin swelling was further accessed via subcutaneocentesis following aseptic surgical procedures. Allergic dermatitis was diagnosed by taking history of chronic illness and observing clinical signs of alopecia and reddened skin (Figure 2A) (Hensel *et al.* 2015). Typical scabies signs include intense pruritis with alopecia and scaly skin (Figure 2B) (Khoshnegah *et al.* 2013). Ticks were grossly observed (Figure 2C) or with the help of magnifying glass and larvae of fly were removed from maggot wounds (Figure 2D).

Laboratory examination

a) Microscopic examination of skin sample: Flea dirt was observed under magnifying glass or light microscope with low magnifications (40× or 100×, Figure 4C). Skin of the suspected part was pinched with thumb and fore-finger and the crest of the fold was scraped with scalpel blade until the blood oozed out. Scrapings were placed on glass slide and treated with 10% NaOH. Slide was then observed under light microscope (Olympus) to detect mite. Demodex sp. of skin mite was diagnosed as cigar-shaped live structure (Figure 4D). Ear swab was taken and observed under microscope to detect ear mite *Otodectes cyanotis* (Figure 4E).

b) Tape smear: *Malassezia pachydermatis* is a commensal yeast in low numbers in the external ear canals and superficial muco-cutaneous sites in dogs. The most useful and practical method of diagnosis of Malassezia dermatitis is cytologic examination (Mauldin *et al.* 1997; Hnilca 2011; Miller *et al.* 2013). Samples collected using acetate tape impression was stained with modified Wright stain (Diff-Quik) and evaluated under the microscope to ascertain the numbers of Malassezia yeast. If present, yeast organisms were often observed in clusters or adhered to keratinocytes (Figure 4B).

c) Wood lamp technique: Wood's lamp technique was performed in a dark room. Animal was brought under this ultraviolet light and characteristics apple green light was seen from fungus infected wool or hair (Figure 4A) (Ponka and Baddar 2012; Miller *et al.* 2013).

Statistical analysis:

The raw data was recorded using Microsoft Excel 2007 spread sheet. Confirmation of normal distribution of data sets was established using D'Agostino & Pearson normality test in Graph Pad Prism 7 statistical software. All the data sets from different groups have not passed D' Agostino & Pearson normality test and hence was compared and tested using non-parametric Kruskal-Wallis tests or Mann-Whitney tests. A p value of ≤ 0.05 was considered significant.

3. RESULTS AND DISCUSSION

In this study, we have examined a total of 151 cases of dogs, cats and rabbits with at least one complaint of skin conditions for a period of six-months to record prevalence of skin infections. Among the cases, ectoparasitic infestations of mite, flea, lice, fly and tick were predominant cases diagnosed in small pets. In regards to this, an Ethiopian study reported that at least one ectoparasite species was recovered from 97% of the dogs and 90.5% of the cats (Kumsa *et al*. 2019). Hill *et al*. (2006) also encountered the highest number of parasitic infestations followed by bacterial infections and neoplasia.

Ectoparasites are the commonest nuisance in pets

The highest percentage of dogs came to the hospital had flea infestation (25%) followed by allergic dermatitis (23.91%, Figure 1 & 3). Other skin diseases recorded were mange, pediculosis or lice infestation, myiasis or fly infestation with almost equal number of fungal infection and tick infestations. Findings of the present study was in consistent with an Ethiopian study where the pattern of skin conditions was fleas>ticks>lice (Kumsa *et al*. 2019). However, an Albanian study reported comparatively higher prevalence of tick (15.4%) than mange (0.9%) and flea (7.8%) (Shukullari *et al*. 2017). Another study comprising Sydney of Australia and Munich of Germany reported 40% prevalence of demodectic mange in dogs (Pinsenschaum *et al*. 2019). Tropical climatic condition of Bangladesh might have contributed to the commonest pest infestations in the pet animals.
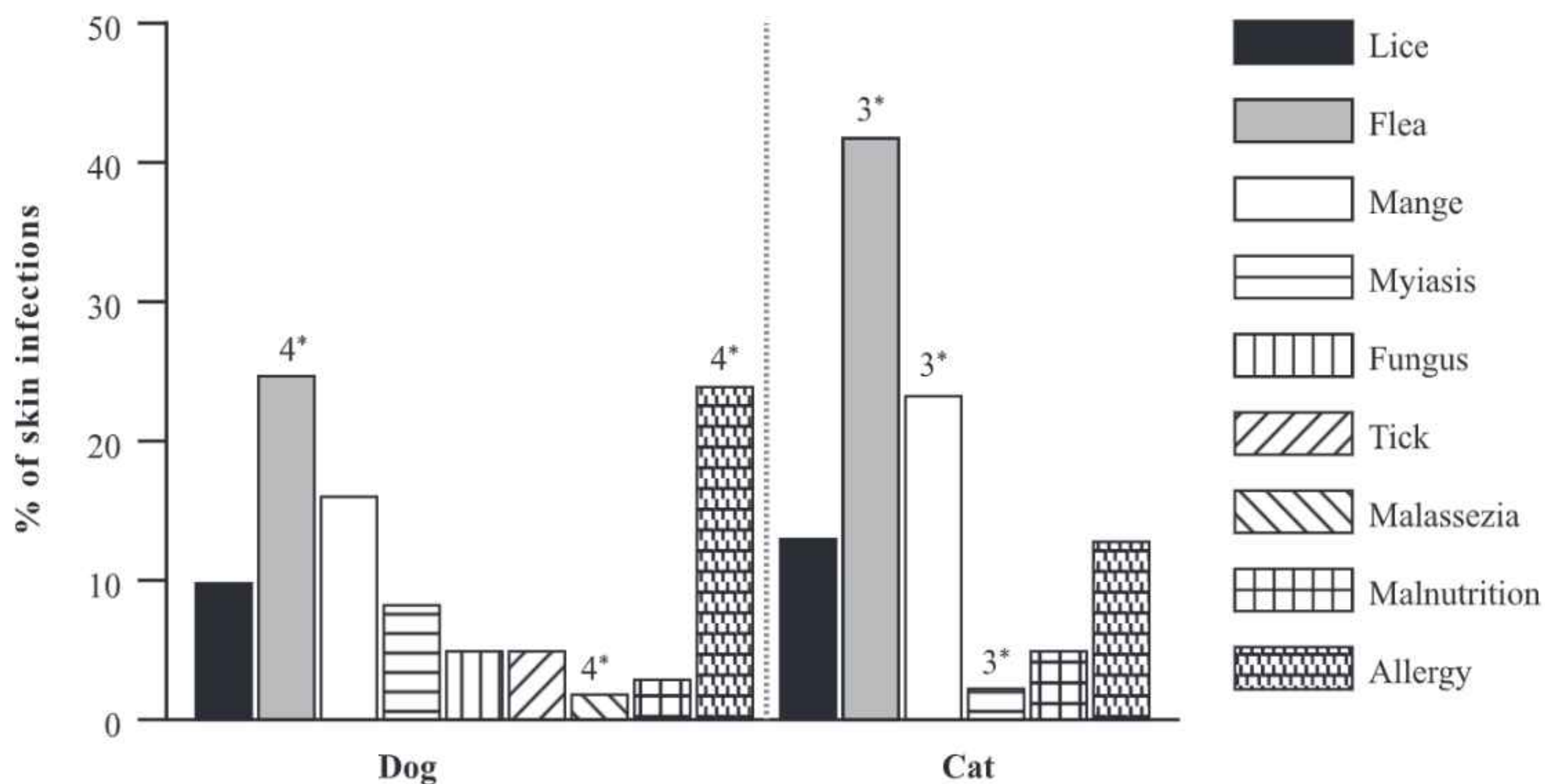

Figure 1. Flea infestation is the highest prevalence in dogs and cats. Graphs depict significantly higher percentages of cases of flea infestation in both dogs (p<0.0001) and cats (p<0.001) compared to the other skin conditions. However, allergic dermatitis in dogs (p<0.0001) and myiasis in cats (p<0.001) were the least common cases. Statistical differences were determined using Kruskal-Wallis test; ****p<0.0001, ***p<0.001.

Figure 2. Skin diseases diagnosed based on gross lesions. A) The signs associated with allergic dermatitis recorded were itching, scratching, rubbing, and licking specially around the face, paws, and underarms and associated with extensive reddening of skin (indicated by black arrow). B) Intense itching or scratching, skin rash, crust formation in the affected area and alopecia (indicated by black arrows) were used to diagnose mange in dogs. C) Ticks (indicated by white arrows) were identified as very small black dots, about the size of the watermelon seeds firmly to the ear, base of tail, paws and axilla of the dog. D) Maggot wounds were diagnosed with characteristic smell, irregular skin edges and presence of larvae (indicated by black arrow).

The present study observed the highest percentage of flea infestation (42.11%) in feline species followed by mange (23.68%), allergic dermatitis with lice infestation 13.16%, myiasis 8.70% and nutritional deficiency 5.26% (Figure 1&3). These finding are supported by an Ethiopian study where flea infestation was reported as the highest (88%) followed by tick (13.1%) (Kumsa *et al.* 2019). The authors of the same study also observed that the overall frequency and count of ectoparasites was higher in dogs than cats which are consistent with the present study. Most of the pet cats in Bangladesh meet and play with neighboring and other stray cats that might have contributed to the higher prevalence of ectoparasitic infestations.
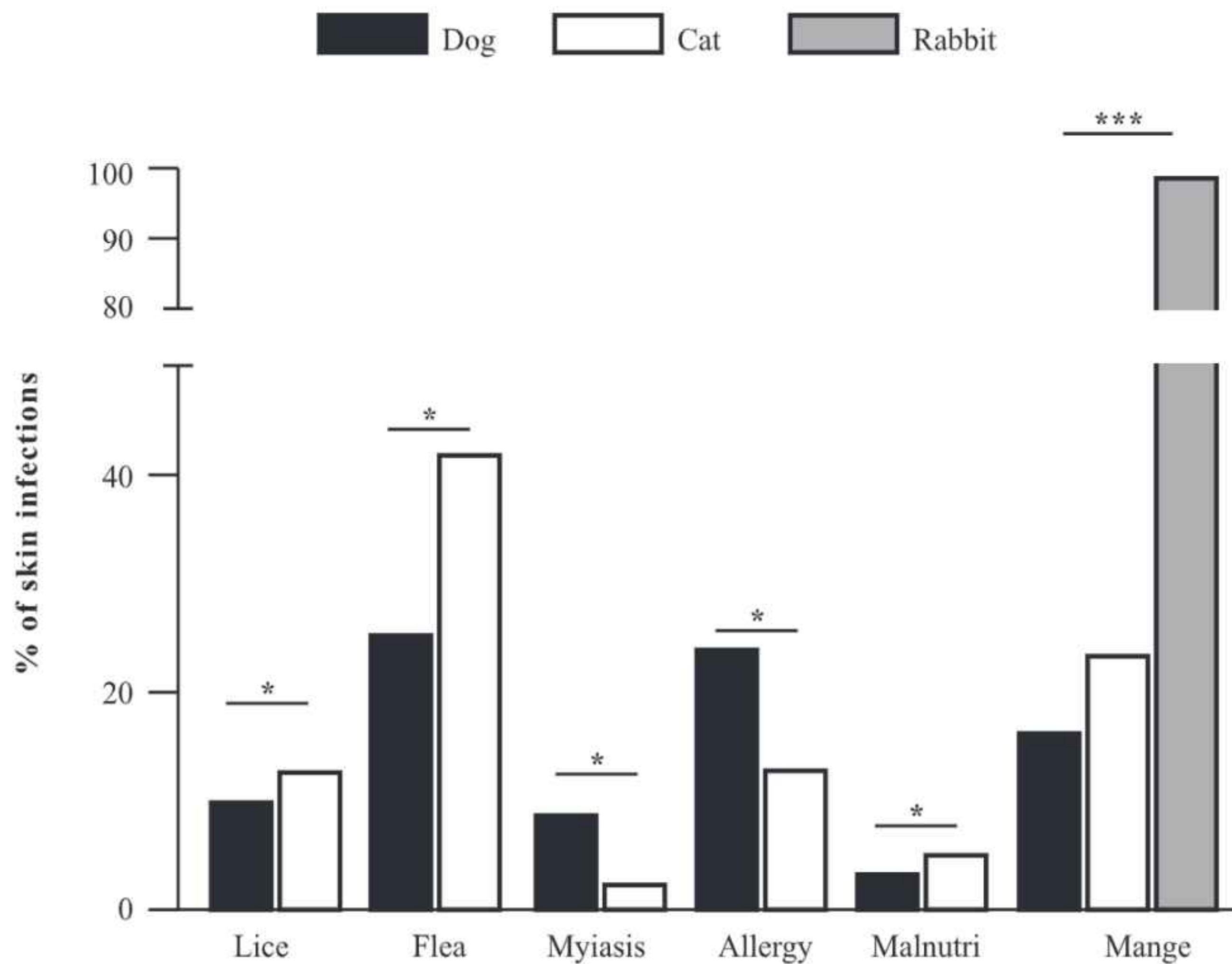
Figure 3. Major skin infections in pet animals. Irrespective of animal species, mange was reported in the highest number of patients (p<0.001) followed by flea infestation (p<0.05), allergic dermatitis (p<0.05) and lice infestation (p<0.05). Animals suffering from nutritional deficiencies were observed very low number (p<0.05) compared to the other skin diseases. All rabbit cases examined for skin diseases were diagnosed with mange (p<0.001). Statistical differences were determined using Mann-Whitney test except the last panel which was analysed using Kruskal-Wallis test; ***p<0.001, *p<0.05.

Dermatophytosis is a cutaneous infection, caused by several types of keratophilic fungi. It represents a serious and common contagious skin disease in dogs and cats. The significance of this disease for pet owners is based on the zoonotic potential. The prevalence varies with climate and local dermatophyte infestation. The most common infection in dogs and cats are caused by the genera Microsporum and Trichophyton (Boehm and Mueller 2019). In the current study, we have diagnosed 5.34% canine cases positive to dermatophytes using wood lamp technique (Figure 1 & 2A). Wood lamp examination is an effective tool to clinical diagnosis of

Microsporum sp. of fungus (Ponka and Baddar 2012). The World Association of Veterinary Dermatology (WAVD) recommended Wood's lamp examination of skin that has good positive predictability in diagnosing fungal infection (Moriello *et al.* 2017). Monod *et al.* (2014) reported most of the inflammatory skin and hair infections were caused by dermatophytoses. In a study in India, 20.93% dogs and 37.33% cats were reported to be positive for dermatophytes by direct examination (Debnath *et al.* 2016). Both Microsporum and Trichophyton have zoonotic significance (Monod *et al.* 2014; Debnath *et al.* 2016).
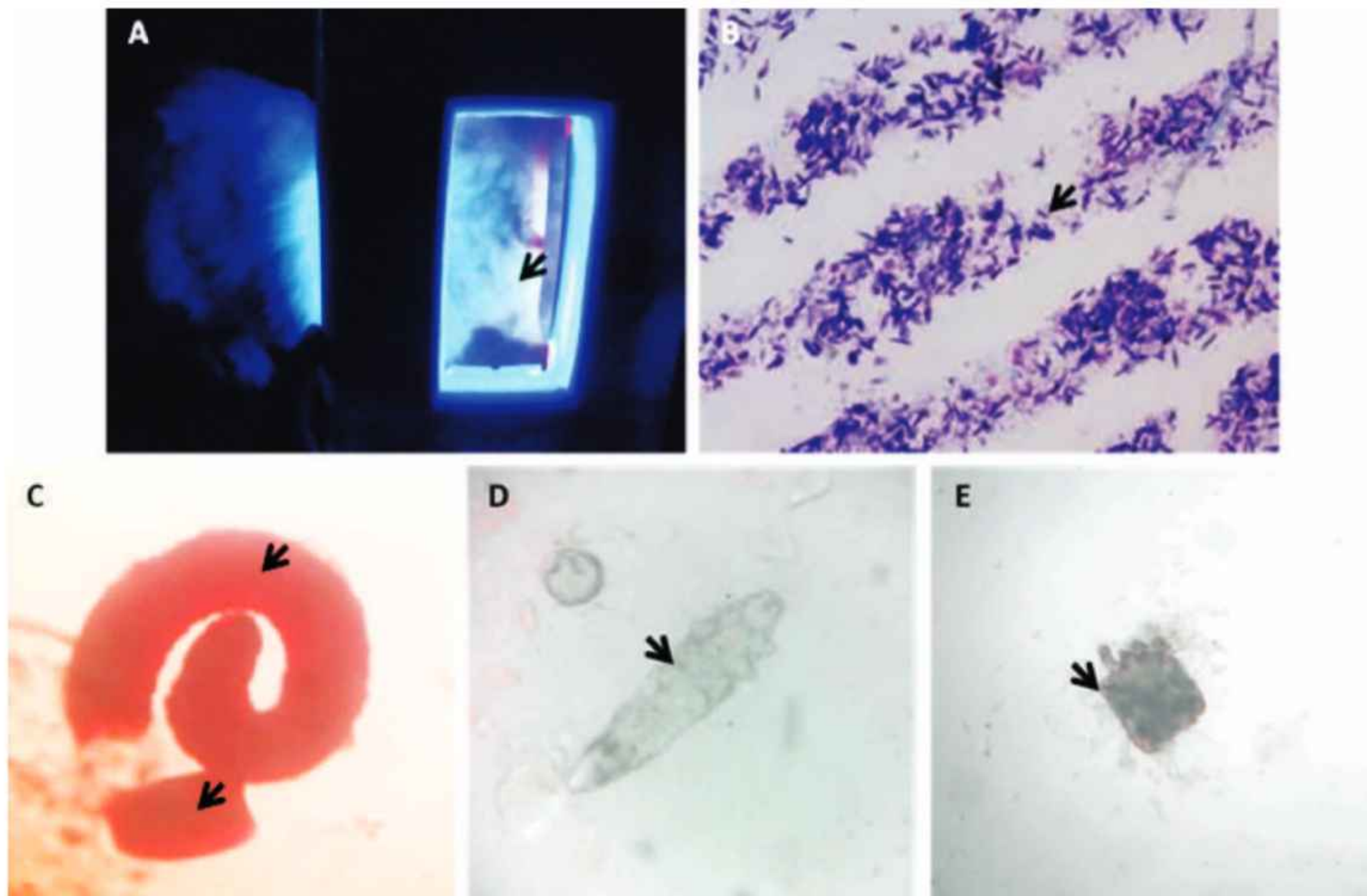
Figure 4. Wood lamp and microscopic examination of skin samples. A) *Microsporum canis* species of fungus was detected using wood lamp where apple-green illumination on skin lesions was positive. B) Stained tape smear of the skin lesion revealed Malassegia species of fungus under light microscope. C) Flea dirt is flea faeces or blood that the flea has sucked out of the pet and was diagnosed as dark clumps. D) Demodex species of mite was diagnosed as cigar shaped live structure under low magnification. E) Sarcoptes species of mite was identified as tiny live animal similar to 'small tortoise on its back' under light microscope. All findings are indicated as black arrow(s). Magnification is 100×.

Risk factors of canine atopic or allergic dermatitis includes urban environment, being male, being neutered, receiving flea control and being allowed on upholstered furniture (Harvey *et al.* 2019). The current study observed 23.91% dogs and 13.16% cats were suffering from this hypersensitivity reactions (Figure 1, 2A & 3). Supporting these findings, Scott and Paradis (1990) found allergic dermatitis as one of the most commonly diagnosed dermatological problems. The present study observed the lowest number of cases of Malassezia infection (2.17%) followed by nutritional deficiencies. This finding is opposed by Mason (1991) who recognized Malassezia dermatitis with increasing frequency over the past 15 years. Limitations of the lab diagnostic facilities might be a reason for lower frequencies of this yeast infection diagnosis in the present study.

The present study observed that all the rabbit patients presented to the hospital with at least one complaint of skin conditions all were positive to mite infestations (Figure 1). A previous study on rabbit farms in Muktagacha area of Mymensingh reported 56.09% of mange with no tick or flea infestation (Faruque *et al.* 2008). Extensive clinical and laboratory examinations are suggested to get more skin conditions of rabbits.

Hot season is an important risk factor to skin diseases

In this six-month study, we observed significantly higher (p<0.05) occurrence of dermatological cases in January to March (69%) compared to prevalence recorded in October to December (31%). An Albanian study supported the present findings and stated that dogs examined during spring, summer and autumn had a significantly higher (p<0.001) risk of infestation than dogs examined during winter (Shukullari *et al.* 2017). Hot humid climate has direct and indirect effects on the epidemiology of important livestock pathogens, with a particular focus on parasitic infestations (Skuce *et al.* 2013).
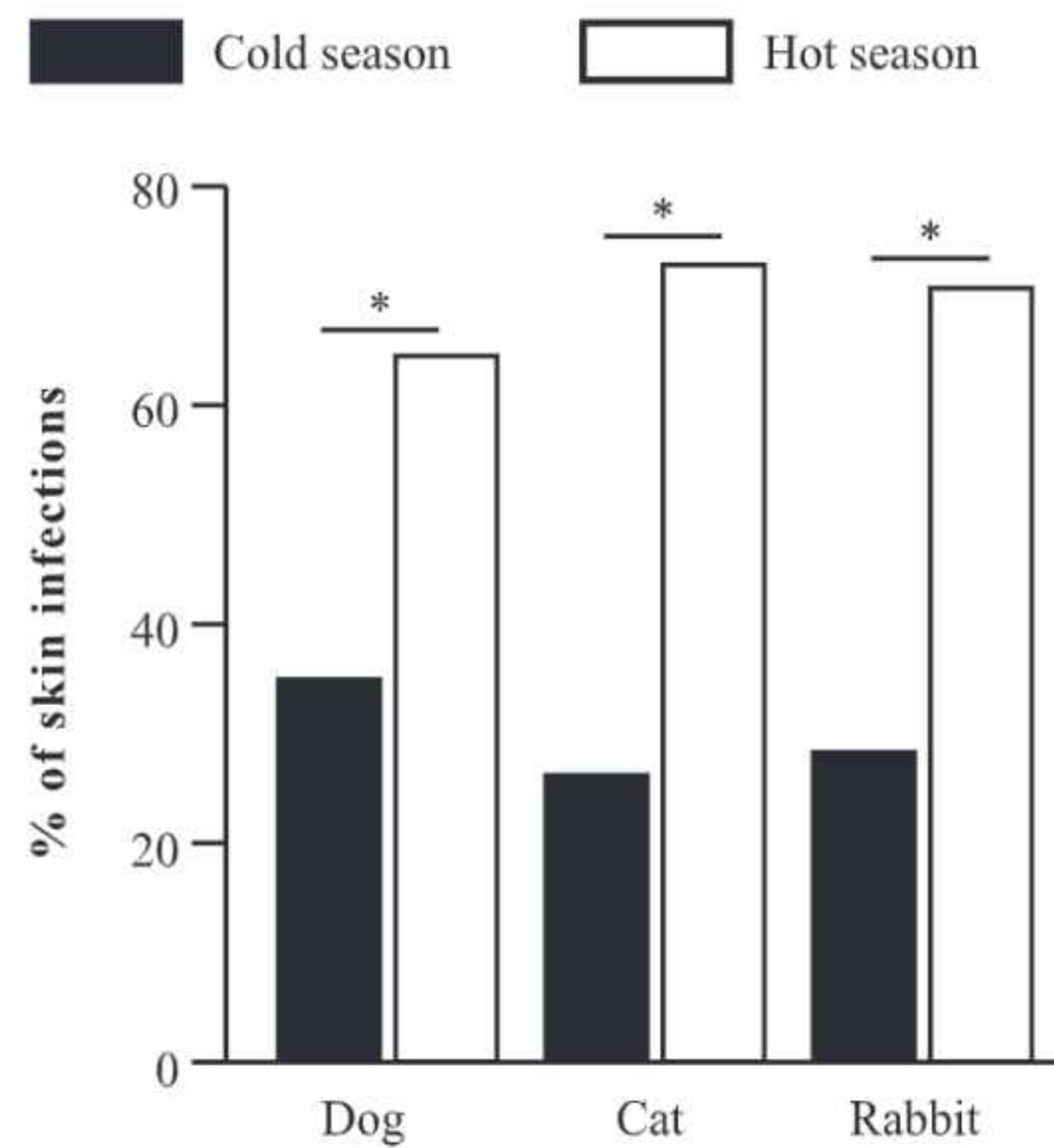
Figure 5. Pet animals are more prone to skin infections during hot humid seasons. In all pet species (p<0.05) hot and humid weather induces susceptibility to skin infections compared to dry winter seasons. Statistical differences were determined using Mann-Whitney test; *p<0.05.

More to the above findings, the present study recorded predominant cases of skin infections in male patients (53%) compared to female (47%). In dogs, there was no significant differences between male and female (p>0.05, results not shown). In case of cats and rabbits, males were infected more 57.89% and 52.38% than that of female 42.10% and 47.61% respectively. Shukullari *et al.* (2017) reported that the gender is an important predisposing factor for ectoparasitic infestation in Albanian dogs. However, Sokol and Galecki (2017) opposed it and stated that keds were more prevalent in female (38.0%) than in male (33.2%) Polish dogs. Further studies involving large number of sample size is suggested to verify the gender as potential risk factor for ectoparasitic infestations in pet animals. Advanced studies are required to investigate the role of these ectoparasites in transmission of zoonotic pathogens to humans and animals in Bangladesh.

4. CONCLUSIONS

Skin disease is one of the horrible nuisances faced by the pet owners as many of them get infected from their beloved pets. The current study summarizes that most pets have at least one skin conditions predominantly of fleas, mites and allergy that are mostly happening during summer. By providing basic data on the infestation with ectoparasites and other skin infections in client-owned, veterinary-cared-for pets from Chattogram, the results

of this study should emphasize the need of an increase of attention to ectoparasites by both veterinarians and dog owners.

5. REFERENCES

Boehm, T., and R. S. Mueller. 2019. Dermatophytosis in dogs and cats - an update, Tierarztl Prax Ausg K Kleintiere Heimtiere, 47: 257-268.

Croft, P., D. G. Altman, J. J. Deeks, K. M. Dunn, A. D. Hay, H. Hemingway, L. LeResche, G. Peat, P. Perel, S. E. Petersen, R. D. Riley, I. Roberts, M. Sharpe, R. J. Stevens, D. A. Van Der Windt, M. Von Korff, and A. Timmis. 2015. The science of clinical practice: disease diagnosis or patient prognosis? Evidence about "what is likely to happen" should shape clinical practice, BMC Med, 13: 20.

Dada, B. J., D. S. Adegboye, and A. N. Mohammed. 1979. A survey of gastro intestinal helminth parasites of stray dogs in Zaria, Nigeria, Vet Rec, 104: 145-146.

Davies, R. H., and B. Rees. 2010. In praise of the physical examination. Include "eyeballing" the patient, Bmj, 340: c291.

Debnath, C., T. Mitra, A. Kumar, and I. Samanta. 2016. Detection of dermatophytes in healthy companion dogs and cats in eastern India, Iran J Vet Res, 17: 20-24.

Dohoo, I. R., W. N. McDonell, C. S. Rhodes, and Y. L. Elazhary. 1998. Veterinary research and human health, The Canadian Veterinary Journal, 39: 548.

Faruque, M. R., S. U. Bhuiyan, S. S. U. Ahmed, and Y. E. Chowdhury. 2008. Prevalence of skin diseases of rabbit, Int J Ani & Fis Sci, 1: 119-121.

Frerot, M., A. Lefebvre, S. Aho, P. Callier, K. Astruc, and L. S. Aho Glele. 2018. What is epidemiology? Changing definitions of epidemiology 1978-2017, PLoS One, 13: e0208442.

Geffray, L. 1999. Infections associated with pets, La Revue de medecine interne, 20: 888-901.

Harvey, N. D., S. C. Shaw, P. J. Craigon, S. C. Blott, and G. C. W. England. 2019. Environmental risk factors for canine atopic dermatitis: a retrospective large-scale study in Labrador and golden retrievers, Vet Dermatol.

Hensel, P., D. Santoro, C. Favrot, P. Hill, and C. Griffin. 2015. Canine atopic dermatitis: detailed guidelines for diagnosis and allergen identification, BMC Vet Res, 11: 196.

Hill, P. B., A. Lo, C. A. N. Eden, S. Huntley, V. Morey, S. Ramsey, C. Richardson, D. J. Smith, C. Sutton, and M. D. Taylor. 2006. Survey of the prevalence, diagnosis and treatment of dermatological conditions in small animals in general practice, Vet Rec, 158: 533.

Hnilca, K. A. 2011. Small Animal Dermatology: A Color Atlas and Therapeutic Guide (Elsevier Saunders).

Kassirer, J. P. 2014. Imperatives, expediency, and the new diagnosis, Diagnosis (Berl), 1: 11-12.

Khoshnegah, J., A. R. Movassaghi, and M. Rad. 2013. Survey of dermatological conditions in a population of domestic dogs in Mashhad, northeast of Iran (2007-2011), Vet Res Forum, 4: 99-103.

Kornblatt, A. N., and P. M Schantz. 1980. Veterinary and public health considerations in canine roundworm control: a survey of practicing veterinarians, J Am Vet Med Assoc, 177: 1212-1215.

Kugler, J., and A. Verghese. 2010. The physical exam and other forms of fiction, J Gen Intern Med, 25: 756-757.

Kumar, S., R. Khurana, N. K. Rakha, and R. S. Khokhar. 2006. Epidemiological pattern of various skin disorders in dogs, Indian J. Vet. Res, 15: 1-14.

Kumsa, B., Y. Abiy, and F. Abunna. 2019. Ectoparasites infesting dogs and cats in Bishoftu, central Oromia, Ethiopia, Vet Parasitol Reg Stud Reports, 15: 100263.

Mason, K. 1991. Dermatitis associated with Malassezia pachydermatis in 11 dogs, J Am Anim Hosp Assoc, 27: 13-20.

Mauldin, E. A., D. W. Scott, W. H. J. Miller, and C. A. Smith. 1997. Malassezia dermatitis in the dog: A retrospective histopathological and immunopathological study of 86 cases (1990–1995), Vet Dermatol, 8: 191-202.

Miller, W. H., C. E. Griffin, and K. L. Campbell. 2013. Muller & Kirk's Small Animal Dermatology (St. Louis (ed.), Elsevier: Missouri).

Molyneux, and H. David. 2004. Neglected" diseases but unrecognised successes–challenges and opportunities for infectious disease control, The Lancet, 364: 380-383.

Monod, M., M. Fratti, B. Mignon, and F. Baudraz-Rosselet. 2014. [Dermatophytes transmitted by pets and cattle], Rev Med Suisse, 10: 749-753.

Montagna, W. 2012. The structure and function of skin, Elsevier.

Monteiro-Riviere, N. A. 2010. Structure and function of skin, Toxicology of the skin (New York, Informa Healthcare USA Inc).

Moriello, K. A., K. Coyner, S. Paterson, and B. Mignon. 2017. Diagnosis and treatment of dermatophytosis in dogs and cats.: Clinical Consensus Guidelines of the World Association for Veterinary Dermatology, Vet Dermatol, 28: 266-e268.

Muller, G. H., W. K. Robert, and W. S. Danny. 1989. Small animal dermatology IV (WB Saunders: Philadelphia).

Ohm, F., D. Vogel, S. Sehner, M. Wijnen-Meijer, and S. Harendza. 2013. Details acquired from medical history and patients' experience of empathy--two sides of the same coin, BMC Med Educ, 13: 67.

Pinsenschaum, L., D. H. L. Chan, L. Vogelnest, K. Weber, and R. S. Mueller. 2019. Is there a correlation between canine adult-onset demodicosis and other diseases?, Vet Rec.

Plaut, M., E. M. Zimmerman, and R. A. Goldstein. 1996. Health hazards to humans associated with domesticated pets, Annual review of public health, 17: 221-245.

Ponka, D., and F. Baddar. 2012. Wood lamp examination, Can Fam Physician, 58: 976.

Robertson, I. D., P. J. Irwin, A. J. Lymbery, and R. C. A. Thompson. 2000. The role of companion animals in the emergence of parasitic zoonoses, International journal for parasitology, 30: 1369-1377.

Scott, D. W., and M. Paradis. 1990. A survey of canine and feline skin disorders seen in a university practice: Small Animal Clinic, University of Montréal, Saint-Hyacinthe, Québec (1987-1988), The Canadian Veterinary Journal, 31: 830.

Sharma, R., K. Hussain, S. Chhibber, M. Kumar, and N. Sharma. 2015. Allergic Dermatitis Occurrence Pattern in Canine of Jammu Region, India, Journal of Animal Research, 5: 533.

Shukullari, E., D. Rapti, M. Visser, K. Pfister, and S. Rehbein. 2017. Parasites and vector-borne diseases in client-owned dogs in Albania: infestation with arthropod ectoparasites, Parasitol Res, 116: 399-407.

Skuce, P. J., E. R. Morgan, J. van Dijk, and M. Mitchell. 2013. Animal health aspects of adaptation to climate change: beating the heat and parasites in a warming Europe, Animal, 7 Suppl 2: 333-345.

Sokol, R., and R. Galecki. 2017. Prevalence of keds on city dogs in central Poland, Med Vet Entomol, 31: 114-116.

Sultana, R. N., A. Husna, A. S. Uddin, R. N. Yesmin, Y. Sabina, A. T. M. Badruzzaman, I. M. Sadikul, N. Monira, and A. K. Jahengir. 2016. Prevalence of diseases in pet animals at Dhaka city of Bangladesh, Annals of Veterinary and Animal Science, 3: 1-5.

Summerton, N. 2008. The medical history as a diagnostic technology, Br J Gen Pract, 58: 273-276.

Watson, T. D. G. 1998. Diet and skin disease in dogs and cats, The Journal of Nutrition, 128: 2783S-2789S.