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RESEARCH ARTICLE

Alopecia in dogs: Causes, Incidence and Clinical Signs with a Special Reference to Nutritional Alopecia

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Abstract

This study was conducted to evaluate the various causes and prevalence of various dermatological disorders that induce alopecia in dogs during the period from July 2019 to June 2021. Out of 485 from 2225 (21.7%) dog cases reported in clinic of Faculty of Veterinary Medicine, Zagazig University in addition to some private clinics in Zagazig, Cairo and El-Obour city. Dogs had different dermatological disorders with alopecia. Mange was the most common dermatological disorder followed by flea infestation then pruritus due to tick infestation, dermatitis, food allergic reaction, Nutritional alopecia dermatophytosis and pyoderma were the less common causes. Dermatological disorders were reported throughout the year but were more common in the summer (38.8%), spring (30.3%) and were less common in the autumn and winter (17.1%& 13.8%) respectively. The canines less than a one year were the ones who suffered the most (36.3% %). Alopecia affects (59.7%) of male dogs and 40.2 %of female canines. During the study period, epidemiological analysis of alopecia, data revealed an increasing skin disorder among dogs, which could be due to increased awareness among dog owners about their pets' health, an increase in the pet population, or the environment becoming more favorable for the various etiological agents of skin disorders causing alopecia. There was a significant decrease of Hb. content, PCV, RBCs and WBCs in dogs with nutritional alopecia. Nutritional alopecia occurs mainly due to deficiency of copper “Cu” and zinc “Zn”.

Keywords: Dogs, dermatological disorders, alopecia, mange.

Introduction

Skin is the biggest organ in the body, accounting for 15 to 25% of an animal's overall weight [1] and serving as the body's first line of defense. Skin has recently piqued the scientific community's curiosity. One of the most common health issues in dogs is skin illness.

Pet coat is essential for pet and his owner. Pet owners always desire to have pets with healthy fur. Dermatological disorders are one of the most important and commonly reported and hardest to resolve problems encountered by veterinarians in small animal medicine [2]. Skin affections make up a significant proportion of the small animal caseload [3-5]. Dermatological disorders make animals miserable due to constant scratching and severe itching.

Dermatological disorders are one of the most common and difficult-to-resolve concerns that veterinarians confront in small animal medicine [2].

Alopecia is one of the most common dermatological disorders. Alopecia refers to the loss of hair in regions where it was previously present, either partially or completely. Alopecia, or hair loss, can be generalized or localized. The old hair is replaced with new growth in around 6 weeks when a dog loses its coat once or twice a year. Indoor-only dogs with thick coats and long-haired breeds may shed more frequently [6].

Daily grooming and keeping the dog outside might help to reduce the annoyance caused by shedding. Some diseases as debilitating disorders, canine distemper, diabetes, and jaundice can cause general shedding. While some dogs shed and even have patchy coats as

the seasons change, alopecia is usually obvious [7]. Overall, hair loss around the eyes and lips, patches of baldness, and symmetrical hair loss that arises in the same pattern on both sides of the body are all indicators of alopecia in dogs. Crusting and inflammation of the skin, scaly skin, itching, and sores caused by scratching, discolored, dark, or grey patches of skin, bleeding surrounding hair loss sites might be noted [8].

Alopecia in dogs can be caused by a variety of disorders, including infections, nutritional deficits, and allergic reactions. Mange, a condition caused by mites, is one of the most frequent. It can cause severe hair loss as well as skin crusting [9].

Tick infestation is a common veterinary health concern in dogs and often seen in poorly nourished dogs in shelters and kennels but is diagnosed in well cared dogs too, primarily associated with under lying health issues [10]. Fleas and ticks display hematophagous activities, and some species consider as a vector. The most common causes of hair loss in dogs include trace elements deficiency as Cu and Zn. Commercial complete foods normally have the two elements in abundance as supplemental Zn and Cu are added. However, some home-prepared diets can be deficient in these elements [11]. Alopecia may be occurred due to allergic reactions which may be due to food or items in dog's environment. Bacterial skin infections or hot spots also cause alopecia. Ring worm cause circular patches of flaky, red, hairless patches. A complete history and physical examination are required for an accurate diagnosis of the reason of hair loss. The breed's susceptibility for congenital or genetic hair loss; the presence of external parasites, duration, and progression of alopecia; the presence or absence of itching; evidence of infection; and general health problems are all key aspects in the history. The goal of this study was to describe the incidence of different dermatological disorders that cause alopecia in dogs in order to explore for epidemiological factors that may be linked to their development.

Material and Methods

Ethical approval

The research procedures were approved by the Ethics Committee of Egyptian Veterinary Medicine Authority.

Animals

During the study period from July 2019 to June 2021, 485 out of 2225 clinical sick cases were admitted to the clinic of the Faculty of Veterinary Medicine, Zagazig University, Egypt in addition to some private clinic in Zagazig city, Cairo and El- Obour city. Dogs weighing 7-15 kg and aged 3 months to 3 years. Ten apparently healthy dogs were used as control group for comparison in case of nutritional alopecia. Clinical symptoms of a dermatological disorders were detected in the dogs. Skin concerns included readily removed hair, alopecia with or without itching, skin parakeratosis and eczema. Owner name, dog name, age, sex, breed, pregnancy and parturition in female instances, type of diet, vaccination and previous treatment, shampoo used, and grooming, itching, otitis, or ear licking were all on the questionnaire for each studied dog. The dates of commencement, as well as particular clinical indications, are all covered. The dog's skin as well as its overall health will be examined during the physical checkup. The pattern and distribution of hair loss should be observed. The hairs will be checked to see if they are being shed or broken off from the hair follicle. The data was studied in order to discover the epidemiological trend that causes alopecia in dogs. Many skin scraping samples were collected from the periphery of active lesions with a sharp scalpel until a modest amount of blood was leaking.

All examined dogs have a specific dermatological examination. We examined the skin for symptoms of secondary infections or parasites, performed skin scrapings, and combed the hair coat for fleas, mites, and lice. Skin scrapings and materials collected during combing were kept and forwarded to a lab for analysis.

Blood samples

Two blood samples were taken from each dog by puncturing the saphenous vein or cephalic vein using hypodermic needles after clipping the hair in the area of puncture followed by disinfection with ethyl alcohol 85%. The first blood sample (about one ml) was taken into a clean, dry and labeled EDTA tube for the hematological parameters [12].

The second sample was taken (about 7 ml of blood) without anticoagulant. The sample was left to clot at room temperature for about 2 hours in standing position, then the sample

was centrifuged at 3000 rpm for 10 minutes, for obtaining clear sera. Serum trace elements " Cu, Fe and Zn ' determined by atomic absorption spectrophotometer "Model 210 VGP" using special kits which supplied by Buck Scientific Co. USA according to the method described by Brown and Taylor [13].

Skin scraping samples

The scraped material was transferred to a test tube containing a 10% sodium hydroxide "NaOH" solution, submerged in a water bath at 60°C for 15 minutes, centrifuged for roughly 10 minutes, and the sediment examined microscopically to confirm or rule out the existence of mange or ring worm [14].

Stool examination

Stool samples were taken from the rectums of the dogs under investigation and analyzed by direct smear test for the existence of internal parasites as described by Houston and Radostits [14].

Statistical analysis

The obtained data are presented as mean ± S.E. The data were analyzed using t-test to test for significant differences between control and animals with vagal indigestion. The differences in means were considered statistically significant at $P < 0.05$ according to Feldman *et al*. [15].

Results

During the three-year study period, a total of 2225 canine cases were brought to the Faculty of Veterinary Medicine at Zagazig University and some private clinics In Zagazig, Cairo and El- Obour city. Local and diffuse alopecia affected 485 of the dogs (21.79 %).

Clinical signs

The observed clinical signs included hair was easily separated causing alopecia in a limited or broad area, which was occasionally accompanied by pruritis. Itching causes scaling, excoriations, and skin damage in some situations. Highly irritating and pruritic papular eruption, skin thickening, erythema, alopecia, exudation with crust formation, and subsequent bacterial infection with pustules were also recorded as shown in (Figures 1 and 2).

Figure 1: Mange in adult male German Sherpherd, one year old dog (a), a cigar- liked shape of *Demodex canis* (b), flea infestation in German Sherpherd, 8-month-old (c) and tick infestation in Husky male 1.5-year-old (d).

Figure 2: Edema and erythema in the face of Husky female 8 months old dog due to allergic food reaction (a), dermatitis in white German Sherpherd male one year old (b), nutritional alopecia in German Sherpherd female 1.5-year-old dog (c) and Superficial folliculitis. Multiple areas of alopecia and erythema" Pyoderma" in Rottweiler 14-month-old male dog (d).

Incidence of alopecia in examined dogs

In this study, 95 dogs were suffered from demodectic mange (19.6%), followed by pruritus caused by flea infestation (82) in 16.9%, and tick infestation (70) in 14.4%. In 55 cases, alopecia was caused by a lack of trace components. Pyoderma was the least common cause, with only 22 instances reported over the course of the two-year research as shown in (Table 1).

Seasonal, age and sex Incidence

Although skin affections were reported throughout the year, the majority of instances occurred in the summer, followed by spring, autumn, and finally winter (Table 2). Mange and pyoderma cases reached the peak during the summer season. The most common incidences of pruritus and flea allergic dermatitis occurred during the summer season.

Highest occurrence of skin disorders was observed in dogs below one year of age (Table 3) followed by dogs of 2-4 years of age. Diseases such as dermatophytes and eczema were more in dogs of less than one year of age where demodectic mange and flea allergy and was more in dogs of 1-2 years of age, and 2-4 years of age respectively. Among the skin disorders-affected dogs, maximum number was of males (59.7%) as shown in (Table 4).

There was a significant decrease of Hb. content packed cell volume, RBCs and WBCs in alopecia affected group in comparison with the control animals (Table, 5). In nutritional alopecia there was a significant decrease of Cu, iron and Zn than in control dogs (Table, 6).

Table 1: Incidence of different skin lesions causing alopecia in examined dogs

Skin disorders	No of affected animals	%
Mange "*Demodex canis*"	95	19.6%
Flea infestation	82	16.9%
Tick infestation	70	14.4%
Food Allergic reaction	63	12.9%
Dermatitis	60	12.3%
Nutritional deficiency	55	11.3%
Dermatophytosis	38	7.8%
Pyoderma	22	4.5%

Total No of examined animals is 485

Table 2: Seasonal pattern of skin diseases causing alopecia in examined dogs

Skin disorders	Season								Total
	Winter		Spring		Summer		Autumn		
	No.	%	No.	%	No.	%	No.	%	
Mange "*Demodex canis*"	12	12.6%	29	30.5	42	44.3	12	12.6	95
Flea infestation	7	8.5%	28	34	34	41.5	13	16	82
Tick infestation	7	10	25	35.7	30	42.9	8	11.4	70
Food Allergic reaction	13	20.6	16	25.4	19	30.2	15	23.8	63
Dermatitis	10	16.7	15	25	20	33.3	15	25	60
Nutritional deficiency	10	18.1	17	30.9	18	32.7	10	18.3	55
Dermatophytosis	5	13.2	12	31.6	14	36.8	7	18.4	38
Pyoderma	3	13.6	5	22.8	11	50	3	13.6	22

Table 3: Age-wise number of cases of skin diseases causing alopecia in examined dogs

Skin disorders	Age						Total
	Below year		1-2 years		2-4 years		
	No.	%	No.	%	No.	%	
Mange "*Demodex canis*"	26	27.4	24	25.3	45	47.3	95
Flea infestation	30	36.5	28	34.2	24	29.3	82
Tick	20	28.6	25	35.7	25	35.7	70
Food Allergic reaction	33	52.4	15	23.8	15	23.8	63
Dermatitis	30	50	16	26.7	14	23.3	60
Nutritional deficiency	10	18.2	24	43.6	21	38.2	55
Dermatophytosis	15	39.5	13	34.2	10	26.3	38
Pyoderma	12	54.6	5	22.7	5	22.7	22

Table 4: Sex wise number of cases of skin diseases causing alopecia in dogs

Skin disorders	Sex				Total
	Male		Female		
	No.	%	No.	%	
Mange "*Demodex* canis"	59	62.1	36	37.9	95
Flea infestation	51	62.2	31	37.8	82
Tick infestation	43	61.4	27	38.6	70
Food Allergic reaction	34	54	29	46	63
Dermatitis	39	65	21	35	60
Nutritional deficiency	32	58.2	23	41.8	55
Dermatophytosis	20	52.6	18	47.4	38
Pyoderma	12	54.5	10	45.5	22

Table 5: Hematological parameters in Dogs under investigation

Parameter	Control group	Alopecia affected group	P- value
Hb.	12.69 ± 0.484	10.62 ± 0.220	< 0.001
PCV	37.11 ± 0.947	31.70 ± 0.660	< 0.001
RBCs	5.976 ± 0.209	4.400 ± 0.142	< 0.001
WBCs	10.93 ± 0.247	9.480 ± 0.213	< 0.001
MCV	79.25 ± 1.916	69.40 ± 5.546	0.150
MCH	27.18 ± 0.746	25.34 ± 1.647	0.542
MCHC	34.22 ± 0.351	28.14 ± 2.698	0.164

Table 6: Some serum trace elements in dogs under investigation

Parameter	Control group	Alopecia affected	P- value
Cu mmol/l	17.17 ± 0.820	11.27 ± 0.658	< 0.001
Iron mmol/l	20.27 ± 0.816	17.89 ± 1.278	0.002
Zn mmol/l	26.97 ± 3.177	11.04 ± 0.972	< 0.001

Skin scrapping was negative in all causative category of alopecia except in mange cases "+ve revealed *Demodex canis*, the mite is shaped like a cigar with eight legs as shown in (Figure 1). In dermatophytosis, microscopical examination of hair and scales revealed endothrix and exothrix spores and hyphae of dermatophytes indicated positive dermatophytosis. Stool examination revealed that examined dogs were free from internal parasites

Discussion

Skin diseases affect 15 to 25 %of dogs, according to previous research [2, 3] The increasing trend in dermatological disorders found in this study could be attributed to current knowledge in diagnosis of skin disease, an increase in the number of pets, increased pet owner awareness (about skin disorders and may transfer to the human in addition it makes the pet miserable), or a change in climate conditions. Mange is a frequent skin disease that can be fatal in dogs [16]. It is an inflammatory condition characterized by the presence of enormous numbers of *Demodex canis* in the skin [17]. The condition is caused by mites multiplying in the hair follicles and sebaceous glands. *Demodex canis* is a commensal mite that lives on the surface of dogs' skin [18].

This condition is thought to be the result of a unique immunosuppression that permits the mites to reproduce [18]. Demodicosis can be localized or generalized. All normal dogs have *Demodex canis* in their hair follicles. Because the dog's immune system keeps the mite population low. The mite population explodes in puppies and young dogs with immature immune systems, as well as those dogs with damaged immune systems, causing hair to fall out and the dog to scratch, lick, or bite the skin, causing it to become red and sometimes generating scabs [16].

Demodicosis most commonly affects the skin around the eyes, feet, chest, and belly, but it can also affect the entire body. When the skin is damaged, bacteria can enter and produce a secondary illness. Puppies, on the other hand, may be more vulnerable due to contact with siblings. Although, according to Oluchi [19] and Robert [20], significant infestation is more prevalent in adults.

Demodectic mange infestation was observed to affect just 5.95 % of affected dogs Kumar *et al*. [4]. Shyma and Vijayakumar [21] found 51.92 % of instances of canine demodicosis, while Shirk [22] recorded 21.2 %. Skin disorders prevalence appears to be region-specific and influenced by geo-climatic factors.

Tick infestation is a major veterinarian health concern in dogs, and it is most commonly seen in undernourished dogs, it can also be seen in well-cared-for dogs [10]. Animals grew restless and rubbed their bodies against the walls and scratched themselves on hard things, causing alopecia, pruritis, and scales [23]. A severe anemia might result from

a significant infestation. Tick saliva can also lower the host's local immune system, allowing infection to take place. This may cause the animal to scratch at the area incessantly, creating further irritation [10].

In numerous nations, flea infestation is the most common ectoparasite in dogs and cats [24]. Its infestation can result in acute itching, self-inflicted damage, and even life-threatening illnesses such as anemia. Flea allergic dermatitis is a serious illness that affects some animals. Erythema, itching, excoriation, crusting, and pustules are the most prevalent clinical symptoms.

Any aberrant clinical response associated with the eating of food or its additives is referred to as an adverse food reaction [25]. Pruritus and edema are the most common symptoms, which mostly affect the face, perineum, and ears. Allergy—allergic eczema is thought to be caused by a reaction in the skin caused by certain meals, particularly those heavy in protein. According to Hensel [26], a cutaneous food response causes severe itching, excoriation, and baldness. In dogs, skin inflammation (dermatitis) is generally accompanied by redness (erythema), itching (pruritis), and hair loss (alopecia) and the creation of dandruff (scurf). The nutritional alopecia found in this study was ascribed to a shortage in trace elements such as Cu, which is required to maintain the disulphide groups that enable cross linking within the hair fiber [27].

In terms of season predominance, dermatological problems were shown to be more common in the summer, particularly during hot, humid conditions. Dimri and Sharma [28] observed the highest number of instances of skin disorders during the hot and humid months of the year, which is similar to the findings of this study. The current study's findings are nearly identical to Kumar *et al.* [4]. The monthly ambient temperature had a positive link with several skin ailments. The most common incidences of pruritus and flea allergic dermatitis occurred during the summer months. Skin problems were most common in dogs under one year of age, followed by dogs between two and three years of age.

Concerning age-related dermatological diseases, ringworm can affect dogs of all ages, although it is most common in puppies, senior dogs, and dogs with weakened immune systems. Males made up the majority of the canines with skin problems (59.7%). Our results come in agreement with that of Kumar *et al*. [4]. Despite, Molla *et al.* [29] reported that females have a higher incidence than males due to a decline in their immunity, similar to human females. In light of this observation, people in the region prefer male dogs over females because of their muscline look, better vigor and no fuss of unwanted pregnancies.

The percentage of mange, and pruritus due to tick infestation and dermatitis was 62.1% and 61.4% and 65 % respectively in male dogs. Our findings are consistent with the findings of different workers [4, 30].

This alteration in hematological picture is attributed to the role of trace elements in hematopoiesis and immunity as recorded by Beigh *et al.* [31]. The decrease in Hb. content and PCV % which were observed in this study may be attributed to the deficiency of Cu and Fe as proved by serum biochemical analysis due to the important role of Cu and Fe in hematopoiesis. The decreased serum Cu, Fe and Zn level in nutritional alopecia may reflect the importance of theses trace elements in health of the skin and its fur. Parasitological examination revealed that the dogs were free from internal parasites which indicate that the alopecia is due to other causes rather parasitic infestation.

According to the findings, dermatological problems are common in dogs, according to the findings. Comprehensive planning and strategy creation are required for the control of skin affections in dogs.

Conclusion

Dermatological problems in pets are quite prevalent. Bathing less frequently, regular brushing and combing to keep the hair and skin clean, keeping affected animals in cool, dry, well-ventilated places, free from flies and other insects, and keeping the animal free of internal parasites, particularly fleas, lice, ticks, and harvest mites are all general measures for

controlling this problem. In most situations, using mild lotions, ointments, and dusting powders to relieve itching and encourage healing is beneficial. It is necessary to apply comprehensive planning and formulation of strategies for the control of skin affections in dogs. Further studies are required to understand the nature and of different causative agents and their resistance pattern against commonly used drugs.

Conflict of interest

Authors declare, there is no conflict of interest.

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الملخص العربي

الصلع في الكلاب: أسبابه، حدوثه وعلاماته السريرية مع إشارة خاصة إلى تساقط الشعر التغذوي

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أجريت هذه الدراسة لتقييم الأسباب المختلفة وانتشار الاضطرابات الجلدية المختلفة التي تسبب تساقط الشعر في الكلاب خلال الفترة من يوليو 2019 إلى يونيو 2021. ولقد تم الابلاغ عن 485 حاله من اصل 2225 (21.7٪) حالة من الكلاب في عيادة كلية الطب البيطري ، جامعة الزقازيق بالإضافة إلى بعض العيادات الخاصة بالزقازيق والقاهرة ومدينة العبور. الكلاب لديها اضطرابات جلدية مختلفة مع تساقط الشعر. كان الجرب هو أكثر الاضطرابات الجلدية شيوعًا يليه الإصابة بالبراغيث ثم الحكة بسبب الإصابة بالقراد والتهاب الجلد ورد الفعل التحسسي للطعام والصلع الناتج من سوء التغذية والشعر سهل الانفصال والصلع بدون حكة بسبب نقص التغذية وتقيح الجلد على التوالي في تناقص الترتيب كانت الأسباب الأقل شيوعًا. تم الإبلاغ عن الاضطرابات الجلدية على مدار العام ، ولكنها كانت أكثر شيوعًا في الصيف (38.8٪) والربيع (30.3٪) وكانت أقل شيوعًا في الخريف والشتاء (17.1٪ و 13.8٪) على التوالي. كانت الكلاب التي تقل عن عام واحد هي الأكثر معاناة (36.3٪). اصاب الصلع (59.7٪) من ذكور الكلاب و 40.2٪ من إناث الكلاب. خلال فترة الدراسة والتحليل الوبائي لاضطراب تساقط الشعر "الثعلبة" ، كشفت البيانات عن ازدياد الاضطرابات الجلدية بين الكلاب واتجاه متزايد لاضطرابات الجلد في الكلاب ، والتي يمكن أن تكون بسبب زيادة الوعي بين أصحاب الكلاب حول صحة حيواناتهم الأليفة ، زيادة عدد الحيوانات الأليفة ، أو أن تصبح البيئة أكثر ملاءمة للعوامل المسببة لاضطرابات الجلد التي تسبب تساقط الشعر. كان هناك انخفاض معنوي في الهيموجلوبين.و المحتوى من كرات الدم البيضاء، كرات الدم الحمراء ، في الكلاب المصابة بالصلع لاسباب غذائية. يحدث الصلع الغذائي بشكل رئيسي بسبب نقص النحاس و الزنك .