World Journal of Veterinary Science

ISSN: 2689-5951

Research Article

Assessment of the Prevalence and Risk Factors of Ectoparasite Infestation in Dogs with Regular Dipping History in Morogoro Urban and Peri-Urban In Tanzania

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Abstract

A cross-sectional study assessing the prevalence and risk factors associated with ectoparasites infestation among dogs with regular dipping history was conducted in Morogoro urban, Tanzania. A simple random sampling method was used to obtain 60 dog attendants from where one dog was purposefully sampled, making up 60 animals. Questionnaires were used to collect social demographic information of dog attendants and the biodata of the dogs. Dogs' skin was examined for the presence of ectoparasites and pathological lesions by palpation and scrubbing with a brush to recover fleas and ticks and a scalpel blade to recover mites. Scrubbed materials were dropped into a petri dish containing 10% formalin to fix and identify ectoparasites by a bright light microscope on microscopic slides. The prevalence of ectoparasite in dogs was 71.7%. Several dogs with infection had poor body conditions (26.7 %) and poor skin scores (11.7%). The dominant skin lesions on infested dogs were erythema (20%) and a mixture of erythema and alopecia (13%). Dominant ectoparasites were fleas (36.7%), ticks (21.6%), and a mix of both (26.7%). The infestation was three times higher in dogs sheltered in houses cleaned without disinfectants, fifteen times higher in dogs accommodated in houses made of wooden or soil floors, and five times higher in the mongrel breed of dogs.

In conclusion, the study revealed a high prevalence of ectoparasite infestation in dogs with regular dipping history. Dogs accommodated in houses made of wooden or soil floors, and in houses cleaned without disinfectants and mongrels breed were at higher risk of ectoparasites reinfection.

Keywords: Prevalence: Regular dipping; SUA; Ectoparasites; Morogoro; Dogs

Introduction

The prevalence of ectoparasite infestation in dogs continues to be high despite the high efforts invested in dipping of the animals to kill the infesting parasites. Ectoparasites such as ticks, fleas and mites do live and feed on the host skin the action which causes some detrimental health effects on the animals [1]. Ectoparasites have a range of animal species that they infest including cattle, sheep, goats, pigs, dogs, cats, and poultry [1,2]. While, some of the ectoparasites (mostly lice) are species-specific; others such as ticks and fleas infest a wide range of hosts [1,2]. The common ectoparasites that infest dogs are ticks, fleas, mites and lice [2]. Heavy ectoparasites infestation in dogs can lead to several detrimental health disorders including anemia, hypersensitivity, irritability, dermatitis, skin necrosis, loss of weight, secondary infections, focal hemorrhages, and block age of or if ices such as ears and inoculation of toxins [1]. Moreover, some ectoparasites of dogs can transmit zoonotic diseases to humans. Examples of zoonotic disease-transmitting ectoparasites include some types of fleas that are potential vectors for *Yersinia pestis* that cause plague in humans [3]. The common fleas of dogs are *Ctenocephalides felis* and *Ctenocephalides canis* [4]. The common tick species that infest dogs include those from the general *Amblyomma*, *Rhipicephalus* and Haemaphysalis [5]. Examples of mites that infest dogs are *Demodex canis*, *Otodectes cynotis*, and *Sarcoptes scabiei*. Sarcoptic mange is one of the skin diseases that dogs can transmit to humans [6]. It is a highly contagious disease caused by Sarcoptes scabiei var canis and is transmissible to humans [6]. The controls of ectoparasites in sub-Saharan African countries including Tanzania have not been successful enough to reduce the prevalence of ectoparasite infestation in dogs. The reason could be due to negligence of some aspects in the ectoparasites control strategies employed. Good results in the management of ectoparasites in domestic animals are said to be promisingly attainable only when both the chemical and mechanical control methods are employed concurrently [7]. The chemical methods involve regular dipping of the animals in pesticides [7,8], or the use of pesticide-containing collars [9,10] to remove and repel the ectoparasites. The mechanical method involving sanitation of the environments surrounding the animals eliminates a possible source of re-infection after dipping [11,12]. The endemic nature of ectoparasite infestation in domestic animals is said to be partly attributable to ignoring the importance of environmental sanitation to kill the parasites residing in the house accomodating the animals.

The prevalence of ectoparasites infestation in dogs has continued to be high in Tanzania [13,14] and elsewhere in the world [15-17]. The use of pestcides involving dipping the animals in pesticides has been the mainstay strategy of ectoparasites control in dogs in several major cities in Tanzania including Morogoro Municipality. The reason for the continued high infestation rates of ectoparasites in dogs depite

Citation: Mwangengwa LM, Rhanga S. Assessment of the Prevalence and Risk Factors of Ectoparasite Infestation in Dogs with Regular Dipping History in Morogoro Urban and Peri-Urban In Tanzania. World J Vet Sci. 2023; 4(1): 1019.

Publisher Name: Medtext Publications LLC

Manuscript compiled: Apr 22nd, 2023

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the regular dipping of the animals in efficacious acaricide need to be studied. Therefore, the current study assessed the magnitude of ectoparasites infestation and the likely risk factors influencing the persistent nature of ectoparasites infestation in dogs in a study done in Morogoro municipality, Tanzania.

Materials and Methods

Study area

The study was conducted in Morogoro urban; Tanzania at the Sokoine University of Agriculture animal hospital's dipping facility. The dipping facility is very popular and serves dogs from different parts (Wards) of Morogoro urban and peri-urban. The facility is highly preferred by dog owners from the urban and peri-urban ward of Morogoro region because of its closeness to the University animal hospital where other animal services like deworming and vaccinations are provided. The dipping process is scheduled once a week every Saturday.

Study population

All the dog keepers who came to dip their animals at the University dipping facility and were willing to participate were eligible for this study. Moreover, all the dogs brought for dipping at the University dipping facility were eligible for the study under the assumption that none of the animals were suffering from any other debilitating diseases.

Study design

A cross-sectional study design determined the prevalence of ectoparasite infestation and the risk factors influencing the persistent nature of ectoparasite infestation in dogs. The study was done from 1st November to 30th December 2022.

Sampling technique

The human participants and the dogs involved in the current study were selected by simple random and purposeful sampling techniques respectively. Factors such as the age, sex, size, and breed or health status of the animals were not considered during the animal sampling process. After every two dog's attendant, the third person was nominated for an interview and one dog from the same participant was purposefully selected as a study sample. Therefore Sixty (60) dog owners or attendants who brought the animals for dipping at the SUA dipping facility were sampled randomly for an interview and one dog from each participant was sampled purposely making a total of 60 dogs for this study.

Determination of the pesticide effectiveness

To rule out the probability of the pesticide being the possible cause of sustained ectoparasites infestation in the regularly dipped dogs, the effectiveness of the acaricide using for dipping at the SUA dipping facility was assessed. The SUA dipping facilities use Amitraz as the dipping pesticide at a ratio of 10mls of the pesticides and 10 liters of water (1 ml/1 L). The effectiveness of the acaricide was assessed as follows; the fleas or ticks from the skin of the infested animals were scrubbed and collected in test tubes. Then, ten adult ticks or fleas were separately submerged in the amitraz or distilled water-containing tubes where they were maintained at 27°C temperature, 80 mmHg to 85 mmHg relative humidity for 10 minutes [18]. At the end of the treatment duration mortality rate of the fleas or ticks was assessed. The mortality percentages for both ticks and fleas submerged in acaricides were 100% while that of the control (submerged in water) was 0% indicating that the pesticide used at the SUA dipping facility was effective enough.

Data collection

The structured questionnaires were employed as tools for collection of information related to the animal's age, breed, sex, feeding, housing, body condition, skin condition, and dipping frequency. Other information gathered included the demographic characteristics of dog keepers like sex, age, resident wards, number of dogs kept, and time of experience in keeping the dogs.

The physical examination process of the animals involved visual observation and palpation of the skin for possible ectoparasites and pathological lesions. The skin areas without lesions were scrubbed with a brush and areas with alopecia and or erythema were scrapped further with a scalpel blade. The materials brushed and scrapped from the skin were collected into a petri dish containing 10% formalin to uncover the potential infesting ectoparasites. The type of ectoparasites was identified visually and then through a bright light microscope on a microscopic slide. The dogs infested with any type of ectoparasites were considered positive.

Data analysis

Data analysis employed the Statistical Package for Social Sciences (SPSS) version 20. Descriptive analysis was carried out for the frequencies of social demographic data of personnel participants, and clinical data of the dogs. The chi-Square test analyzed the potential association between ectoparasite infestations and several potential risk factors such as the age, breed, sex of the dogs and the managemental related factors such diet, dipping frequency, type of shelter, and cleanliness of the animal's house. Also, the Chi-square test analyzed the potential association between skin score and factors such as the type of infesting ectoparasites, age, breed, and sex of the dogs. Factors revealed to have significant association by the chi-squared test were analyzed further by the logistic regression models.

Classification of terms

Regular dipping was taken as dipping of the animals two times or more per month. Yong dogs were those aged ≤ 2 years and old dogs were those aged >2 years [19]. The body score of dogs was rated as good for animals with a body score of ≥ 3 and poor for animals scored <3 [20]. Animals were diagnosed to have skin lesions in the presence of alopecia, erythema, or both otherwise skin lesion were considered absent [20]. Skin score was rated as good when there was no visible alopecia, or erythema and poor when alopecia or erythema, or both were present [20,21]. The level of infestation was rated as mild when there was no alopecia or erythema associated with the infestation, moderate in infestation accompanied by mild alopecia and erythema, and severe in infestation accompanied by extensive alopecia, erythema and pruritus [21].

Results

Demographic information of the respondents

A total of 60 recruited respondents were from the urban and peri-urban wards of Morogoro region (Table 1). The young personnel (56.7%) and males (96.7%) participants were more involved in bringing the dogs for dipping and the majority (68.3%) of respondents had at least three years of experience in keeping the dogs. Moreover, many dog keepers (80%) were keeping more than one dog at their homes and the dominant diet supplied to the animals was homemade food (84.3%). The houses used by many respondents to keep their dogs were made of wooden wall while having wooden or soil floor

and roofed with iron sheets (Table 1). None of respondents reported to shelter their animals outdoors. Also, the majority of the respondent (60%) reported having no specific person assigned for dog care, with any willing person at home being able to take the role. Furthermore, many respondents (83.3%) reported cleaning the dog's house without using disinfectants. Also, all interviewed dog keepers dipped their animal at least two times a month with the maximum being four times.

Table 1: Social demographic characteristics of attendants who brought their dogs for dipping at the SUA dipping facility.

Parameter	Percent
Gender	Male=96.7%
	Female=3.3%
Age of owner	Adult (≥ 18 years)=43.3%
	Young (≤ 17 years old)=56.7%
Location of dog owners	Bigwa=8.3%
	Boma=8.3%
	Chamwino=18.3%
	Kichangani=6.7%
	Kihonda=3.3%
	Kilakala=18.3%
	Magadu=3.3%
	Mazimbu=5%
	Mbuyuni=5%
	Mindu =6.7%
	Mlimani=13.3%
Number of dogs kept	1 dog=20%
	>1 dog=80%
Duration of keeping dog/ dogs	<3dogs=31.7%
	>3dogs=68.3%
Feeding	Homemade=88.3%
	Homemade and leftovers=5%
	Homemade and commercial=3.3%
Type of dog housing	Roofed and concrete floor=38.3%
	Roofed and wooden or soil floor=61.7%
Cleaning with disinfectants	Yes=13.3%
	No=86.7%
Who takes care of the dog	Owner=28.3%
	Attendant=6.7%
	Anybody=65%
Purpose of keeping the dog (s)	Business=6.7 %
	Home security=86.7%
	Pet=5 %
	Hunting=1.7%

Biodata and clinical information of the sampled dogs

Most of the dogs brought for dipping were mongrels and majority of dogs had ages equal to or below one year (Table 2). Several of the infested animals had poor body conditions and poor skin scores (Table 2 and Figure 1). The dominant ectoparasites found on the body of the infested dogs were fleas, ticks, and a mixture of both fleas and ticks (Table 2). No mites were observed in dogs in the current study. The dominant pathological skin lesions were erythema and a mixture of erythema and alopecia (Table 2).

Clinically, the overall prevalence of ectoparasite infestation in dogs was 71.7% (Table 2) and was high even in dogs dipped 4 times per month (Table 3).

The factors revealed by the chi-squared test to be associated with ectoparasite infestation in dogs were the management and dog-related factors. Management related factors included the type of houses sheltering the dogs, and the cleanliness of the dog's house. Factors related to the animals were the breed of the dogs whereby mongrels with ectoparasite infestation were more relative to the mixed breed of dogs (Table 3). However, factors such as type of infesting ectoparasites and age, sex, and breed of the dogs were not significantly associated with poor skin scores of the infested dogs (Table 4).

Table 2: Biodata and clinical information of the sampled dogs that attended the SUA dipping facility

Parameter	Percent
Age of dog	Adult=41.7%
	Young=58.3%
Sex of dog	Male=55%
	Female=45%
Breed	Mongrel=83.3%
	Mixed=16.7%
Dipping frequency	2 times per month=6.7%
	3 times per month= 10%
	4 times per month=83.3%
The overall prevalence of ectoparasites	71.70%
Body condition score	Good=73.3%
	Poor=26.7 %
Skin condition	Good=88.3%
	Poor=11.7%
Skin pathological lesions	Present=33.3%
	Absent=66.7%
Type of skin pathological lesion	Alopecia and erythema=13.3%
	Erythema=20%
	No=66.7%
Type of ectoparasite	Fleas=30%
	Ticks=18.3%
	Fleas and ticks=23.3%
	Absent=28.3%
Level of infection	Mild=43.3%
	Moderate=18.3%
	Severe=5%

Logistic regression analysis revealed further that, ectoparasite infestation was three times higher in dogs sheltered in houses cleaned without disinfectants, fifteen times higher for dogs living in houses made of wooden or soil floor and five times higher in the Mongrel breed of dogs (Table 5).

Discussion

The current study indicated that, despite the regularity of dipping history several dogs were evidently infested with ectoparasites at a degree ranging from mild to severe. Infact, the prevalence of ectoparasite infestation in the studied dogs of Morogoro urban and periurban were as high as that reported previously by Swai et al. and Muhairwa et al. [13,14]. Moreover, the revealed effectiveness of the acaricide used for dipping was an indication that there were other factors contributing to the endemic nature of ectoparasite infestation in dogs. Therefore it is suggested in the study that the use of dipping in acaricides is on its own not efficient enough to control ectoparasites in dogs. Better results in prevention and control of ectoparasites in domestic animals is probably achievable only when both the mechanical and chemical control methods are involved in the intervention process [8,11,12]. While the chemical method helps to remove the ectoparasites from the animal's body [8], the mechanical method prevents the re-infection coming from the shelters surrounding the animals [11,12]. However, many dog owners are very likely concentrating more on the acaricide dipping while ignoring the aspect of environmental sanitation to control the other potential source of re-infestation. The current study revealed a high risk of ectoparasite infestation in dogs living in houses not cleaned with disinfectants. The reason could be that, a dog house not cleaned with disinfectants continues to harbour the ectoparasites in the vicinity area hence being the source for re-infestation. Also, wooden or soiled floors are difficult to clean and disinfect properly and thus are very likely to continue hosting the ectoparasite even after the cleaning process hence explaining why ectoparasites infestation in dogs was fifteenth times higher in those sheltered on wooden or soil floors. The higher prevalence of ectoparasites infestation in mongrels

Table 3: Chi-square test assessing the association between ectoparasites infestation and managemental and dog's related factors.

Crosstabulation of Ectoparasite infestation and Dipping Interval						
		Dog's Dipping Interval				
		2x per month	3x per month	4x per month	Chi-square	P-value
Infected	No	0 (0%)	2 (33.3%)	15 (30%)	1.724a	0.422
	Yes	4 (100%)	4 (66.7%)	35 (70%)		
	Total	4 (100%)	6 (100%)	50 (100%)		
Crosstabulation of Ectoparasite infection and types of shelter						
		Shelter of the Dogs				
		Roofed and concrete floor	Roofed and soil floor	Roofed and wooden floor		
Infected	No	14 (60.9%)	0 (0%)	3 (9.1%)	19.590a	<0.001
	Yes	9 (39.1%)	4 (100%)	30 (90.9%)		
	Total	23 (100%)	4 (100%)	33 (100%)		
Crosstabulation of Ectoparasite infestation and Sex of dogs						
		Sex of the Dogs				
		Female	Male			
Infected	No	8 (29.6%)	9 (27.3)		0.041a	0.533
	Yes	19 (70.4%)	24 (72.7%)			
	Total	27 (100%)	33 (100%)			
Crosstabulation of Ectoparasite infestation and Age of the dogs						
		Age of the Dogs				
		Adult	Young			
Infected	No	6 (24%)	11 (31.4%)		0.396a	0.37
	Yes	19 (76%)	24 (68.6%)			
	Total	25 (100%)	35 (100%)			
Crosstabulation of Ectoparasite infestation and Breed						
		Breed of the Dogs				
		Mixed	Mongrel			
Infected	No	6 (60%)	11 (22%)		5.926a	0.024
	Yes	4 (40%)	39 (78%)			
	Total	10 (100%)	50 (100%)			
Crosstabulation of Ectoparasite infestation and cleanliness						
		Clean with Disinfectants				
		Yes	No			
Infected	No	10 (100%)	7 (14%)		30.353a	<0.0001
	Yes	0 (0%)	43 (86%)			
	Total	10 (100%)	50 (100%			

Table 4: Chi-square test assessing the association between dog skin score and the ectoparasites types and dog's related factors.

Crosstabulation of Sin Score and type of infesting ectoparasite						
		Type of Ectoparasite				
		Fleas	Fleas and ticks	Ticks	Chi-suare	P-value
Skin Score	Good	17 (94.4%)	10 (71.4%)	10 (90.9)	5.157a	0.217
	Poor	1 (5.6%)	4 (28.6%)	1(9.1%)		
	Total	18 (100%)	14 (100%)	11 (100%)		
Crosstabulation of skin score and age of the dog						
		Age of the Dogs				
		Adult	Young			
Skin Score	Good	24 (96%)	29 (82.9%)		2.444a	0.122
	Poor	1 (4%)	6 (17.1%)			
	Total	25 (100%)	35 (100%)			
Crosstabulation of skin score and breed of the dog						
		Breed of the Dogs				
		Mixed	Mongrel			
Skin Score	Good	10 (100%)	43 (86%)		1.585a	0.259
	Poor	0 (0%)	7 (14%)			
	Total	10 (100%)	50 (100%)			
Crosstabulation of skin score and sex of the animal						
		Sex of the Dogs				
		Female	Male			
Skin Score	Good	24 (88.9%)	29 (87.9%)		0.015a	0.614
	Poor	3 (11.1%)	4 (12.1%)			
	Total	27 (100%)	33 (100%)			

compared to the mixed breed of dogs was probably due to the large number of mongrels enrolled in the study. However, the other reason could be that mongrels breeds of dogs are probably more neglected by dog owners compared to improved or mixed breeds of dogs. Elsewhere it has been shown by Bryson et al. [8] that ectoparasites infestation were more common in local breeds of dogs mostly kept by the resource poor individuals in North-West province of South Africa . Moreover, the current study revealed an association between the type of house floor, the breed of the dogs, and the cleanliness of the dog's house with ectoparasite infestation in dogs. Related results have been shown in the study of [20] where the breed of dogs and several other managemental related factors were significantly associated with

Table 5: Logistic regression analysis for risk factors associated with ectoparasite infection persistence in the studied dogs (n= 60) attending the dipping facility at SUA, Morogoro, Tanzania.

		95% Confidence Interval		
Risk Factors	OR	Lower	Upper	P-value
Cleanness				
Clean without disinfectants	3.3182	1.2821	22.2573	0.03
Clean with disinfectants	0.14	0.0704	0.2783	0.0783
Housing				
Roofed and concrete floor	0.0567	0.0133	0.2412	0.00017
Roofed and wooden or soil floor	15.4	3.6717	64.5907	0.00006
Breed of Dogs				
Mongrel	5.3182	1.2711	22.2503	0.04
Mixed breed	0.188	0.0449	0.7867	0.0403

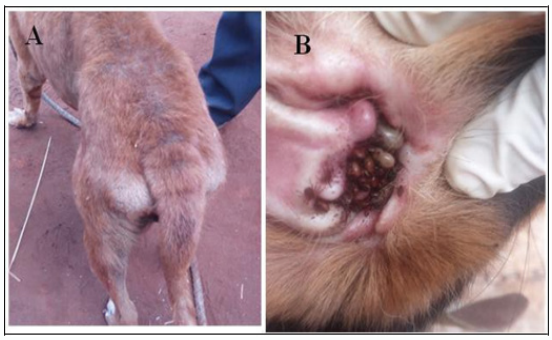

Figure 1: Photograph A shows a representative dog with a poor skin score characterized by extensive alopecia. Photograph B shows a representative dog with a mass of ticks and fleas in a severe mixed infection.

ectoparasites infestation. However, the current study revealed that the type of infesting ectoparasites and dog-related factors such as age, sex, and breed were not significantly associated with poor skin scores of the infested dogs.

Conclusion

The prevalence of ectoparasites infestation in dogs was shown to be high despite the regular dipping schedule followed by dog owners. Other factors besides dipping were shown to be the potential cause for the continued high prevalence of fleas and tick infestation in the dogs attending the dipping facility. Houses made of wooden or soil floors, cleaning the animal house without disinfectants were shown to be the possible factors contributing z significantly to the persistent nature of ectoparasite infestation in dogs. Also mongrels breed of dogs were at higher risk of ectoparasite infestation probably due to neglegency from the dog owners. Therefore owners of dogs should be educated on the importance of good husbandry practices in keeping their dogs including the use of suitable houses and the use of disinfectants in cleaning the dog houses for sustainable ectoparasite management in dogs.

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