International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
(A Peer Reviewed, Referred, Indexed and Open Access Journal)
DOI: 10.22192/ijarbs Coden: IJARQG (USA) Volume 9, Issue 11 -2022

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2022.09.11.005

Prevalence, public awareness and species identification of fleas, lice and ticks on domestic dogs in Jimma town, Oromia regional state, Ethiopia

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Abstract

A cross-sectional and questionnaire-based study was conducted in Jimma town from December 2017 to March 2018 to study the prevalence, and species composition and to assess public awareness of ectoparasitism. 384 dogs were randomly examined for the prevalence of ectoparasites, of which 365 (95.05%) dogs were positive for ectoparasites. In December, January, and February, a high prevalence of ectoparasites was recorded. Three flea species, *Ctenocephalides felis***,** (79.69%), *Ctenocephalides canis* (71.35%), and *Pulex irritans* (4.17%), two tick species, Ambylomma spp. (2.6%), and *Rhipicephalus sanguines* (10.42%), and two lice species, *Linognathus setosus*(7.81%), and *Trichodectus canis (2.6%),* were identified. *Ctenocephalides felis* occurred frequently, while *T. canis* was least frequent with respect to other species in the present study. There is no significant ($p>0.05$) variation in ectoparasite prevalence within the age group of the dogs infested by ectoparasites. However, there is a significant ($p<0.05$) difference in their distribution within the sex groups of the dogs. In this study, most of the respondents (90%) knew fleas were ectoparasites of dogs, but, 85% of the respondents were not aware of any zoonotic diseases of dogs that were related to them. This study found that ectoparasites are the most common problems for dogs in the area, and public awareness of zoonosis is low, necessitating serious control efforts to reduce infestation rates in dogs and raise community awareness of zoonotic diseases.

Keywords: Jimma; Dogs; Prevalence; Fleas; Ticks; Lice; Public awareness

Introduction

Ectoparasites infestation of dogs is very common, in varying forms and quantities, throughout the world, and these dogs harbor ectoparasites, which are a diverse group of arthropods belonging to the subclass Acari (ticks and mites) and the class Insecta (fleas and lice) [1, 2]. The feeding habits these arthropod parasites have a variety of effects on their hosts [3], and the extent of the lesion may also vary depending on the species infesting, the host's immunity, and the parasite's intensity to cause an effect [4]. Depending on the ectoparasite involved and host immune competency, infestation outcomes in a selection of clinical situations, from moderate to intense skin illnesses, cause important pruritic and non-pruritic skin problems [5, 6]. Apart from their direct effects, they act as reservoirs and transmitters of zoonotic diseases in areas where dogs lived with their owners. These ectoparasites are vectors of many types of bacterial, viral, or other parasitic pathogens that cause severe diseases in dogs, such as Babesia spp., Ehrlichia spp., Anaplasma spp., Rickettsia spp., Borrelia spp *and Yersinia pestis*, and they act as intermediate hosts of *filarids* and *cestodes*, which are the reason for critical diseases in dogs and people in contact with them and they form a potential risk to humans and other animals [5,6, 7, 8, 9, 10].

Ticks cause direct impact due to their blood-feeding habit, act as vectors for lots of pathologic agents and cause disease, and might additionally be responsible for tick paralysis because of poisonous injections as well. They may be liable for the transmission of infectious diseases like *borreliosis, rickettsiosis, babesiosis,* or parasitic diseases [11]. *Rhipicephalus sanguineus* infests domestic dogs in all degrees of the developmental stage; sometimes, ticks that have a preference for other animals may additionally parasitize home dogs. For instance, both the adult and immature stages of *Rhipicephalus appendiculatus* ideally parasitize farm animals, wild bovids, and goats, however, all cycles of development may additionally infest dogs [12].

Among species of fleas, *Pulexirritans*, *Leptosyllasegnis* (rat fleas), *Ctenocephalides canis,* and *Ctenocephalides felis* are the most typically reported species of fleas from dogs and cats [13]. The impact of a flea bite on the pet encompasses pruritus, flea allergy dermatitis (FAD), and other skin lesions and can serve as an intermediate host for the nematode *Acanthocheilone mareconditum* and the canine tapeworm *Dipylidium caninum*, each of which can parasitize humans [14].

Lice cause skin pruritis, which is more severe in Mallophaga, or chewing lice, which include H. spiniger and T. canis, than in Anoplura, or bloodsucking lice. Mallophaga feeds on the skin debris of the host and moves through the hair, while Anoplura is attached to the skin as they suck blood. Lesions such as crusts, alopecia, and excoriations can be found. Severe infestation with Anoplura can bring about anemia, specifically in younger animals [15].

Management of those ectoparasites in dogs is important not only for the animal's health and welfare, but also to protect humans from flea and tick infestations, which are known vectors of serious zoonotic infections, as visible infestations with fleas, lice, or ticks require treatment to prevent infection. Because of their serious effect on dogs, other animals, and humans, ectoparasitic infestations in dogs have received attention from several researchers internationally [16].The distribution, prevalence, and species composition of ectoparasites in dogs have been reported by several researchers across the world. So far, many studies have been performed on different species of animals in Ethiopia. However, only a few studies have been performed on the distribution, prevalence, public awareness, and species composition of ectoparasites in dogs in Ethiopia.

Therefore the major objectives of this study were:

- To estimate the prevalence and species of fleas, ticks, and lice on dogs in Jimma town and associated risk factors.
- To assess knowledge and attitude of dog owners regarding ectoparasites in dogs.

Materials and Methods

Study Area Description

The study was conducted from December 2011–March 2012 at Jimma Town, which is found in Oromia National Regional State. The town is located 352 km southwest of Addis Ababa at a latitude of about $7^0 13' - 8^0 56'$ North and longitude of about $35^0 52' - 37^0 37'$ East, and at an elevation ranging from 880 m to 3360 m above sea level. The study area receives a mean annual rainfall of about 1530 millimeters that comes from the long and short rainy seasons. The mean annual minimum and maximum temperatures are 14.4 and 26.70 °C, respectively, with dominant warm and humid weather conditions. The town has a total human population of 159,009, of which 80,897 were males and 78,112 were females [17]. According to reports of the Jimma zone livestock and fishery development office 2,016,823 bovines, 942,908 ovines, 288,411 caprines, 74,574 horses, 49,489 donkeys, 28,371 mules, and 1,488,848 chickens, with an unknown number of dog and cat populations.

Study Animals and Design

The study animals were domestic dogs of both sexes found in the study area. Ectoparasites were sampled by using a simple random technique during a house-to-house survey on randomly selected kebeles of dogs in Jimma town and visits to an open-air veterinary clinic found in the Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) compound. The dogs included in the study were randomly selected for examination**.** Dogs up to one year of age were classified as young, and those above one year of age were classified as adults [19].

Sample Size Determination

Since there was no record of previous prevalence in the study area, the sample size was determined by taking 50% of the expected prevalence using the formula described by [14]. Accordingly, a sample size of 384 dogs was considered for the study.

$$N=\frac{1.96^2 \times pexp\ (1\text{-}pexp)}{d^2}$$

Where, N=required sample size; P exp=Expected prevalence=95%; d=Desired absolute precision = 0.05

Ectoparasites Collection and Identification

Dogs were humanely captured and carefully handled and examined on the skin, in hair shafts, ears, and other locations for the presence of ectoparasites during regular examinations lasting 10–15 minutes. Ectoparasites were removed by combing or brushing the animals. The use of a plastic comb and white paper allowed for a thorough examination of the presence of ectoparasites. Live and adult ticks were removed from the animals manually by using forceps, while fleas and lice were brushed off the dogs' fur onto white sheets of paper using a brush and plastic comb, according to [14]. All ectoparasite species were identified under stereomicroscope, according to the identification keys [20].

Questionnaire Survey

A random selection of 100 dog owners was considered for the questionnaire survey. The questionnaire was designed to extract information that was relevant to determine the respondent's level of awareness.

Data Analysis and Management

The information gathered on those selected dogs was coded and entered into a Microsoft Excel spreadsheet to create a database. Before the analysis of the coded data, it was filtered, and STATA was be used for the analysis. A chi-square test was used to determine any significant associations between age and sex. In all analyses, comparisons with $p<0.05$ were considered statistically significant.

Results

Of the 384 dogs examined, 365 were positive for one or more types of ectoparasites with an overall prevalence of 95.05 (Table 1) ectoparasites identified in dogs were fleas (73.44%), single ticks (0.26%), single lice (0.52), the coexistence of flea and tick (11.98%), flea and lice (8.33%), and the coexistence of the three species (0.52%). Seven ectoparasite species were identified on the dogs during the study time (Table 2). *C. felis* was the most common parasite, with a prevalence of 79.69%, followed by *C. canis* (71.35%), *R. sanguines* (10.42%), *L. setosus* (7.81%), and *P. irritans* (4.17%), with an equal level of frequency (2.6%) with *Trichodectus canis* and Ambylomma species. With respect to sex, 320 (83.3 %) males and 65 (12.2%) females were infested with one of these ectoparasites. Concerning age groups, 93 (24.22%) young and 272 (70.83%) dogs were found to be infested. There is no significant ($p>0.05$) variation in ectoparasites' prevalence within the age group of the dogs infested by ectoparasites' parasites. However, there is a significant ($p<0.05$) difference in their distribution within the age groups of the dogs (Table 3). In all months of the study period, December (17.23%), November, (20.72%), January (21.62%), February, (20.88%), and March (14.6%) ectoparasites are collected from the dogs; however, a higher prevalence was recorded during the months of January and February (Table 4).

Table 1: Overall prevalence of ectoparasites on dogs by sex and age

Ectoparsite			Overall			Overall
	Male (%)	Female (%)	Prevalence	Young (%)	Adult (%)	Prevalence
Fleas	64.84	8.6	73.44	54.4	19.04	73.44
Lice	0.52	-	0.52	0	0.52	0.52
Ticks	0.26	-	0.26	0	0.26	0.26
Ticks+fleas	10.16	1.82	11.98	9.9	1.9	11.98
Fleas+lice	7.03	1.3	8.33	6.25	2.08	8.33
Lice + Flea + Tick	0.52	-	0.52	0.26	0.26	0.52
Total	**83.3**	**12.2**	**95.05**	**70.83**	**24.22**	**95.05**

Table 2: Frequencies and percentages of ectoparasites identified

Ectoparasites	Frequency	Percentage
Ctenocephalides canis	274	71.35
Ctenocephalides felis	306	79.69
Pulex irritans	16	4.17
Ambylomma spp.	10	2.6
Rhipicephalus sanguine	40	10.42
Linognathus setosus	30	7.81
Trichodectus canis	10	2.6
Total	**365**	**95.05**

Table 3: A chi square analysis of ectoparasites between sex and age of dogs

Variable	Classification	No of positive	Prevalence (%)	P-value
Sex	Male	320	83.3	0.04
	Female	45	12.2	
Age	Young	93	24.22	0.77
	Adult	272	70.83	
Total		**365**	**95.05**	

Table 4: Overall prevalence across the months

Month	No of examined	No of positives	Prevalence (%)
December	70	66	17.23
November	83	80	20.72
January	87	83	21.62
February	84	80	20.88
March	60	56	14.6
Total	**384**	**365**	**95.05**

In assessing the awareness of the public, out of 100 respondents, 62% responded that they are accustomed to keeping the dogs in the confined house in the compound, while the rest (38%) of the respondents) mentioned that dogs move everywhere in the city. Regarding zoonotic diseases, 15 % of the owners in the area are aware of the human health risks of dog ectoparasites. Unfortunately, their awareness was only for skin diseases; none of them had awareness of dog ectoparasite diseases specifically. 6% of respondents mentioned skin diseases. 66% of respondents reported having regular contact with their dogs, which is one method of transmitting zoonotic diseases. 34% of respondents had no regular contact with dogs. Fleas (10%) are among the most reported species of ectoparasites by respondents. None of the respondents mentioned whether lice are infesting the dogs or not.

In the area, 50% of the respondents care for their dogs in one of the ways or by combining the methods that they may think of as protecting ectoparasites, like washing dogs, cleaning the kennels with hot water, or disinfecting with organophosphates bought from a veterinary clinic or pharmacy. The interval of time ranges from twice per week to once per month. According to information obtained from animal health workers in the area, none of the respondents use anti-helminth treatment; they do not bring dogs to the clinic for parasite infestation; rather, they bring dogs to the clinic for infectious diseases, particularly rabies, and canine distemper.

Discussion

In this study, seven species of ectoparasites were isolated from dogs found in Jimma town, which may indicate ectoparasites are major challenges for the dogs with regard to health, use, and performance, and also the transmission of zoonotic diseases in the area. The prevalence of 95.05% was recorded in the current study. The highest prevalence of different species of dog ectoparasites observed in the current study may be due to favorable climate conditions in the area for the biology of these parasites, which is in close agreement with reports by [21, 22].

However, it is higher than most of the previous reports from different parts of the world, It was revealed that this difference is most probably attributed to differences in environmental conditions, the season of studies, management, geographic location, and immunity of dogs, and different diagnostic techniques employed [23].

Fleas frequently occurred in dogs in the present study, which agrees with most of the reports from various parts of the world, [24] Gondar, Ethiopia, [25] Greece, [26] Iran, and [2] Costarica, were the most commonly occurring flea species in dogs [26, 27, 23], which is in agreement with the present study. However, *C. canis* is the dominant species, as reported by [28] and also in England and Australia by [13]. The higher prevalence of *Ctenocephalides felis* than *Ctenocephalides canis* is due to this species' greater adaptability to various environments around the world, as described [14].

This study also revealed the prevalence of lice and ticks on dogs in Jimma Town. *Rhipicephalus sanguineus* was reported as among the most prevalent ticks in Brazil by [10] and in Iran by [29] and in many tropical countries, which is in line with my finding. *Ixode sricinus* and *Dermacentor* reticulates are the most common ticks in Europe [30], and a significantly reduced spread of *Rh. sanguineus* (6.25%) and (7.14%) was observed in the Erzerum region of Turkey [31], and in Iran by In Albania, an increased spread of infestation for *Rh. sanguineus* (23.8%) was reported by [22, 2] Costarica. The highest prevalence of 100% for *Rh. sanguineus* in examined dogs was reported in northeast Brazil, which was very contradictory to my finding, this difference was most probably attributed to variation in agroecology, time of the study, and management factors [32].

The prevalence of *Trichodectes canis* in in this study was lower than that previously reported (13%) by [2], by (6.8%) [22], by (41.3%) [29], and higher than the (1%) report of [38] in Korea, this may be due to variation in agroecology, duration of the study, animal management in various areas, and diagnostic methods employed [32].

The infestation rate by overall ectoparasites was higher in males than females. This is in agreement with previous studies [32, 34, 23], and it could be attributable to behavioral factors specific to females such as less socializing during pregnancy rather than any sex predisposition. However, this is in contrast with the results of a similar study in Turkey, where the infestation was more prevalent among females because of their confinement in certain heavily infested areas, therefore, frequent re-infestations will occur [31]. In my study, there was no significant difference (>0.05) between age groups of dogs, which is in contrast with [23], in which he reported a higher percentage of infestation was observed in younger animals, which has been attributed to the lack of acquired immunity in puppies compared to adult dogs.Although the study was performed in an urban area where environmental conditions are considered less favorable for the survival of ectoparasites than in rural areas, the town is surrounded by a forest, and therefore stray dogs can easily be exposed to ticks [10, 6].

In this study, a higher prevalence of ectoparasites was recorded in January (21.62%) and February (20.8%). This is most probably due to the presence of a small amount of rain during these months, which are considered short rainy seasons in most parts of Ethiopia and are conducive to the development and survival of ectoparasites.

Conclusion and Recommendations

This study demonstrated that dog ectoparasites are more prevalent in the study area, particularly fleas and lice. It also indicated that awareness among people toward the ectoparasites of dogs is very limited. The relative frequency and prevalence of these ectoparasites in the area may have problems for animals and humans at this point; regular checking of parasites is an important concern to control arthropods and arthropod-borne diseases.

Based on the above conclusions, the following recommendations are suggested:

- Further study about the parasite infestation and distribution of ectoparasites in dogs in various seasons is good so as to select and implement control systems with regard to public and animal health.
- The study of the prevalence of parasitic diseases in dogs should be a continuous task, with the most important aim to establish control measures.
- Veterinarians and public health officers should work to advance regular and effective parasite control and aware people in general of the potential danger of zoonotic parasites.

Ethical Consideration

Ethics approval was not required for this study. This study involved dogs only for tick, flea, and lice collection to observe the infestation level, and the collected ticks, fleas, and lice were used for identifying their species. The dogs' owners were informed about the purpose of the study, risks, and benefits in accordance with the level of their understanding in order to provide complete information, including the duration of the study and tick, flea, and lice sample collection to be conducted from the dogs.

Availability of Data

The ticks, fleas, and louse samples used during the study are kept at the College of Veterinary Medicine and Agriculture, Jimma University, Ethiopia. All supporting datasets for this study are accessible from the author upon request.

Conflict of Interests

The authors declare that they have no conflicts of interest.

Acknowledgements

The authors would like to thank their families for their endless support and encouragement. Thanks also go to animal owners and the Jimma University, College of Veterinary Medicine and Agriculture, and Parasitology Laboratory staff.

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Quick Response Code	Website: www.ijarbs.com Subject: Veterinary Sciences
DOI:10.22192/ijarbs.2022.09.11.005	

How to cite this article:
Tamrat Tadesse, Dese Kefyalew, Geremew Haile Lemu, Adugna Chalchisa, Yacob Hailu Tolossa. (2022). Prevalence, public awareness and species identification of fleas, lice and ticks on domestic dogs in Jimma town, Oromia regional state, Ethiopia. Int. J. Adv. Res. Biol. Sci. 9(11): 35--43.
DOI: http://dx.doi.org/10.22192/ijarbs.2022.09.11.005