

Demographic and Ecological Survey of Dog Population to Control Rabies Disease in Kolfe Karanio Sub City Addis Ababa, Ethiopia

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Abstract: The study was conducted from November 2014 to April 2015 in Kolfe-Keraneo sub-city, Addis Ababa with the objective of characterization of the demography of owned and stray dogs, identify dog ecology to control canine mediated rabies and understanding the distribution, structure and population density of stray and owned dogs. A total of 900 households were selected from 15 weredas of Kolfe Keraneo sub-city in Addis Ababa using a multi-stage cluster sampling method. Of the total households interviewed, 393 (44.7%) of them were known to own one or more dogs. Male dogs make up 405 (77.14%) of the total owned dogs. 93 (23.7%) of the dogs were kept in both outdoor and mixed system of dog keeping and they freely move from place to place and contribute to high dog bites in human beings and widespread occurrence of canine rabies. Among the interviewees, Christians make up 380 (96.7%) of the dog owning community and dogs are mainly utilized by them for guarding and companionship. During this study, 319 (81.2%) of the dog owners were reported to have been vaccinated their dogs against rabies and most of respondents 232 (72.72%) get vaccination service from private sector. Only 45 (11.5%) of the respondents deworm their dog against internal parasite. The results of this study indicate large population of dogs in the study area, therefore strong and coordinated rabies control program should be conducted.

Key words: Christians • Woreda • Muslim • Companionship

INTRODUCTION

Rabies is a deadly disease caused by a virus. It is the most serious zoonotic disease that someone might encounter [1]. Rabies is acute viral encephalitis transmitted by contact with the saliva of an infected carrier on broken skin. Throughout most of Africa and Asia, domestic dogs are main reservoir of rabies [2]. Rates of disease transmission depend on the density of the dog population and social behavior that determines the extent of contact. As recognized by World Health Organization, dog demography studies are key to addressing many of these knowledge gaps even more so as rapid changes in human and dog demographics have important implications for the dynamics and control of rabies [3].

Rabies is a major public-health problem in most of the parts of the developing world, where the dog plays a principal role as a reservoir and transmitter of the disease to humans [4]. In developing countries, the domestic dog

is the most important reservoir and vector of human rabies, accounting for 99% of exposures [5]. Rabies is also considered as a source of economic loss and, above all, hampers the movement of animals between different countries or regions [6].

In Ethiopia it is an important disease that has been recognized for many centuries [7]. In the Addis Ababa high rate of cases was well established with no decline in the annual number of confirmed rabid dogs in consecutive years [8]. In Addis Ababa dogs are the commonest domestic animal, the total dog population and the number of stray dogs are estimated to be 250, 000 and 120, 000 respectively [7].

The guidelines recommended that the planning of rabies control should include an assessment of the different sections of the dog population in terms of accessibility to vaccination and the appropriateness of culling measures [5, 9]. As such, understanding domestic dog ecology has been recognized as central to design of effective rabies control programs [10, 11]. In most of the

developing countries of Africa, Asia and Latin America, the major constraints to effective rabies control in dogs are economical and logistical, rather than technical, with poor infrastructure and inadequate resources hampering control programs [12].

Controlling rabies in urban dog populations is seen as a more cost-effective, long-term way to prevent human rabies than reliance on post exposure human treatment. To achieve control, knowledge of the epidemiology of rabies in dog populations has long been recognized as crucial [9]. Stray dogs that are not accessible to mass vaccination can reduce the coverage achievement, while public opposition to dog removal can lead to the failure of rabies control programs [1]. To answer these questions, well-designed dog ecology and demography studies are necessary. Such studies have proved useful in planning rabies control in Asia, Latin America and North Africa [12].

The demographic pattern emerging from dog populations of developing countries shows consistently high population turnover rates [11]. Understanding the demography of domestic dog populations is essential for effective disease control, particularly of canine-mediated rabies. Demographic data are also needed to plan effective population management [13].

Dog ecology is essential in understanding the distribution, structure and population density of dogs and pattern of dog ownership in any given area [3]. Rabies epidemiology in the dog reservoir is directly associated with dog ecology; thus, better understanding of dog ecology would be useful for designing appropriate rabies control measures in the dog population [14]. Standard procedures for collecting and applying such ecological information were developed by WHO [10, 15].

Therefore, the objective of the study was:

- Characterization of the demography of owned and free roaming dogs in the sub city.
- Identify dog ecology to control canine mediated rabies in the sub city.
- Determine the distribution, structure and population density of dogs and the pattern of dog ownership in Sub city.

MATERIALS AND METHODS

Study Area: The study was conducted in Addis Ababa city administration, the capital of Federal Democratic Republic of Ethiopia, starting from November 2014 to

April 2015. The city covers an area of 530.14 km² and subdivided into ten sub-cities, from 10 sub-cities studies were conducted in Kolfe Keranio sub-city. This sub-city is one of largest sub-cities of Addis Ababa which is located west of central Addis Ababa and has population size of about half million. Addis Ababa lies at an altitude of 2, 300 meters above sea level and its geographical coordinates are 9° 2' 0" North, 38° 42' 0" East; latitude and longitude respectively [16].

Study Population: Data was collected from 900 household in Kolfe Keranio sub-city, Addis Ababa, by distributing questionnaires. The study group was selected by purposive and simple random sampling method.

Study Design: A cross sectional study was carried out to determine the demographic and ecological survey of dog population to control rabies in Kolfe Keranio sub-city, Addis Ababa using questionnaire and street count of free roaming dogs.

Sample Size and Sampling Techniques: Multi-stage cluster sampling technique was used to determine the demographic and ecological survey of dog population to control rabies in Kolfe Keranio Sub-city, Addis Ababa. Kolfe Keranio sub city was selected from ten sub cities of Addis Ababa because of there was high number of owned and stray dogs in Kolfe Keranio than other sub cities of Addis Ababa. Then, Kolfe Keranio was selected from ten sub cities of Addis Ababa using purposively and then from Kolfe Keranio fifteen weredas are selected and from each wereda four specific areas are selected randomly. the following parameters was used to calculate sample size: 95% level of confidence, 5% desired level of precision and with the expected prevalence of 50% in study area. The sample size was determined using the formula given in Thrusfield [17].

$$n = \frac{1.96^2 * P_{exp}(1 - P_{exp})}{d^2}$$

where,

n = required sample size

P_{exp} = expected prevalence

d = desired absolute precision

Based on the above formula mentioned, the minimum sample size was 384, but to increase precision, multiply the result by two and 15% of non-respondent rate was included, so the total sample size was 900.

Methodology: The method of data collection was done by after developing structured questionnaire, asking owners by household level by selecting four specific areas (zone) in each wereda by random selection in the sub-city and assigning two main streets in all weredas of the sub city, count number of dogs in that street in morning and afternoon in adjusted.

Data Management and Analysis: The raw data that were recorded from this study was entered in to Microsoft excel data base system and computation of descriptive statistics was conducted using STATA 11 software. Chi- Square (χ^2) test was used to calculate significant differences among proportions of variables.

RESULT

The study revealed that out of 900 households only 21 (2.3%) households were nonrespondents and from 879 respondents 393 (44.7%) of the households interviewed were found to own one or more dogs from which the total number of owned dog population in the study area was 525. Male dogs make up 405 (77.14%) of the total owned dogs. Of the 486 households visited and found not to have dogs, 293 (60.28%) are Muslims and they don't keep dogs due to their religion, the rest 193 (39.72%) are Christians and the most common response was that the household dog(s) had died in the recent past and a replacement was being sought and the other respondents claimed they did not keep dogs because they disliked them.

Out of 393 respondents which have dog 380 (96.7%) Christians and 13 (3.3%) Muslims owned dogs. From the total of 879 interviewees, individuals with high, medium and low economic status 50.2%, 48.5% and 31.3% owned dogs respectively (Table 1).

Dog keeping practices among Christians and Muslims and individuals shown in Table 2. Out of 393 respondents which have dog 273 (69.5%) have only one

dog, 259 (65.9%) of them keep dog mainly for guard duty, 300 (76.3%) of them keep dog indoor and 383 (97.5%) of them have separate house for dog.

The result of this study also showed that dog keeping practice varied among individuals with different economic status and 96.9% of individuals with high and 84.9% of individuals with medium economic status keep their dogs indoor as compared to individuals with low economic status (10.0%). Moreover 94.3% of individuals with high and 86.6% of individuals with medium economic status vaccinate their dogs against rabies, whereas only 38.6% of individuals with low economic status vaccinate their dog. The only disease that dogs were vaccinated was rabies and there was significant ($p=0.000$) difference between level of economic status and rabies vaccination being higher in those with high (94.3%) and medium (86.6%) economic status (Table 3).

Of the 393 households having dogs surveyed that 319 (81.2%) vaccinate their dogs against rabies. There was considerable variation in vaccination period in the respondents 176 (55.2%) of respondents vaccinate their dogs per 6 month intervals, 123 (38.6%) vaccinate their dogs annually and 20 respondents (6.3%) vaccinate their dogs when service available. Most of respondents 232 (72.72%) get vaccination service from private sector were the rest 87 (27.27%) get service from government.

A large proportion 257 (65.39%) of the surveyed dogs were fed on household leftovers and waste while 34 (8.9%) were fed on raw animal product food, 23 (5.8%) fed on cooked animal product and the rest 79 (20.1%) use all option.

In all categories, there were more male 405 (77.14%) than female 120 (22.8%) dogs; the overall male/female sex ratio was estimated to be 3.4. Dog owners did nothing to control dog breeding. Of the 120 female dogs sampled, none of them had been spayed or sterilized. The questionnaire data on the fate of female puppies born was showed that almost all of respondents 95.8% (115/120) having female dogs keep them and rest less than 4.2% (5/120) abandon them.

Table 1: Dog keeping with respect to religion and economic status in Kolfe Keranio sub-city

Factors	No. interviewed	No. having dog	%	χ^2	P-value
Religion					
Christian	573	380	66.3	310.88	0.000
Muslim	306	13	4.2		
Economic status					
Low	224	70	31.3	22.21	0.000
Medium	338	164	48.5		
High	317	159	50.2		
Total	879	393	44.7		

Table 2: Dog keeping practice among Christians and Muslims in Kolfe Keranio sub-city

Factors		Christian		Muslim		Total		χ^2	P-value
		No	%	No	%	No	%		
No. of dogs	1 dog	262	68.9	11	84.6	273	69.5	1.45	0.228
	2 or more	118	31.1	2	15.4	120	30.5		
Purpose of keeping	Companionship	34	8.9	1	7.7	35	8.9	18.44	0.001
	Guard	249	65.5	10	76.9	259	65.9		
	Both	97	25.5	2	15.4	99	25.2		
Keeping practice	Indoor	288	75.8	12	92.3	300	76.3	2.00	0.367
	Outdoor	22	5.8	0	0.0	22	5.6		
	Mixed	70	18.4	1	7.7	71	18.1		
Separate house	Yes	370	97.4	13	100.0	383	97.5	0.35	0.554
	No	10	2.6	0	0.0	10	2.5		
Knowledge of human risk	Yes	280	73.7	10	76.9	290	73.8	0.07	0.794
	No	100	26.3	3	23.1	103	26.2		
Dog washing	Yes	230	60.5	10	76.9	240	61.1	1.42	0.233
	No	150	39.5	3	23.1	153	38.9		
Dog house cleaning	Yes	348	91.6	12	92.3	360	91.6	0.01	0.926
	No	32	8.4	1	7.7	33	8.4		
Feces disposal	Yes	301	79.2	4	30.8	305	77.6	16.97	0.000
	No	79	20.8	9	69.2	88	22.4		
Deworming	Yes	42	11.1	3	23.1	45	11.5	1.79	0.181
	No	338	88.9	10	76.9	348	88.5		
Rabies vaccination	Yes	307	80.8	12	92.3	319	81.2	1.09	0.296
	No	73	19.2	1	7.7	74	18.8		
Total		380	100.0	13	100.0	393	100.0		

Table 3: Dog keeping practice among individuals with different economic status

Factors		Low		Medium		High		Total		χ^2	P-value
		No	%	No	%	No	%	No.	%		
No. of dogs	1 dog	58	82.9	115	70.1	100	62.9	273	69.5	9.19	0.010
	2 or more	12	17.1	49	29.9	59	37.1	120	30.5		
Purpose of keeping	Companionship	2	2.9	14	8.5	19	11.9	35	8.9	18.44	0.001
	Guard	61	87.1	104	63.4	94	59.1	259	65.9		
	Both	7	10.0	46	28.0	46	28.9	99	25.2		
Keeping practice	Indoor	7	10.0	139	84.8	154	96.9	300	76.3	231.44	0.000
	Outdoor	21	30.0	0	0.0	1	0.6	22	5.6		
	Mixed	42	60.0	25	15.2	4	2.5	71	18.1		
Separate house	Yes	62	88.6	162	98.8	159	100.0	383	97.5	27.59	0.000
	No	8	11.4	2	1.2	0	0.0	10	2.5		
Knowledge of human risk	Yes	37	52.9	132	80.5	121	76.1	290	73.8	20.10	0.000
	No	33	47.1	32	19.5	38	23.9	103	26.2		
Dog washing	Yes	9	12.9	109	66.5	122	76.7	240	61.1	86.85	0.000
	No	61	87.1	55	33.5	37	23.3	153	38.9		
Dog house cleaning	Yes	40	57.1	163	99.4	157	98.7	360	91.6	131.53	0.000
	No	30	42.9	1	0.6	2	1.3	33	8.4		
Feces disposal	Yes	70	100.0	144	87.8	91	57.2	305	77.6	67.99	0.000
	No	0	0.0	20	12.2	68	42.8	88	22.4		
Deworming	Yes	1	1.4	16	9.8	28	17.6	45	11.5	13.35	0.001
	No	69	98.6	148	90.2	131	82.4	348	88.5		
Rabies vaccination	Yes	27	38.6	142	86.6	150	94.3	319	81.2	104.30	0.000
	No	43	61.4	22	13.4	9	5.7	74	18.8		
Total		70	100.0	164	100.0	159	100.0	393	100.0		

Table 4: The data collected from street count and sites where stray dogs confined

Wereda	Street 1(Average count)	Street 2(Average count)	Site where free roaming dogs confined
01	38.0	16.5	On waste removal area and street
02	18.5	6.0	On waste removal area and street
03	12.5	16.0	On street
04	24.0	20.0	Waste removal area
05	17.0	10.0	On waste removal area and street
06	20.0	17.0	On street
07	9.0	13.0	On street
08	32.5	8.5	On waste removal area and street
09	19.0	5.5	On street
10	28.0	4.5	On waste removal area and street
11	13.0	28.5	On waste removal area and street
12	11.0	20.0	On waste removal area and street
13	9.5	21.0	On waste removal area and street
14	10.5	9.5	Waste removal area
15	20.0	19.5	On waste removal area and street
Total	282.5	215.5	

Only 45 (11.5%) of the respondents deworm their dog against internal parasite while the majority of respondents 348 (88.5%) did not deworm their dogs against parasite. The majority of the surveyed dogs 356 (67.8%) were local breeds, while 53 (10.09%) were crossbreeds and 116 (22.09%) exotic breeds. During this study an average of 249 dogs were counted from two main streets of each wereda in the sub-city (Table 4).

DISCUSSION

This study revealed that from the total 879 households interviewed 393 (44.7%) of the households were found to own one or more dogs. From 393 households which owned dogs, 380 (96.7%) were Christians and dogs are mainly kept by them for guarding and companionship whereas 13 (3.3%) were Muslims and they keep dogs only for guarding purpose. The reason for less number of dogs owned by Muslims is may be due to the religious principle that prohibits handling and owning dogs (They call dogs 'Nejassa')? this finding was in agreement with Eshetu *et al.* [18].

The result of this study showed the primary purpose of keeping dogs in the study area was for guard duty accounting 65.9% and only 8.9% of respondents keep dog as a companionship and the rest 25.2% keep for guard duty and companionship. Those households who rear dogs for joy purpose keep mostly exotic breeds.

This study showed 257 (65.39%) of the surveyed dogs were fed on household leftovers. Most people feed their dogs with leftover of food after they feed. While 34 (8.9%) were fed on raw animal product food, they bought offal's and head of animals from abattoir and butcher houses and feed their dogs, 23 (5.8%) of respondents fed

on cooked animal product and the rest 79 (20.1%) use all option. Owners left their dog to scavenge of household leftovers, animal products from any accessible source and garbage by themselves. This increase number of free roaming dogs in the city and which predispose to rabies.

This study also showed all respondents are not aware of spaying (ovarian hysterectomy) of female dogs which is important to control the population of dogs which in turn has influence on rabies control. This may be due to lack of awareness about spaying and lack of veterinary service with reasonable price.

This study revealed 300 (76.3%) dog owners keep their dogs tied (indoor) during the whole day. However, only 93 (23.7%) of the households keep their dogs outdoor and indoor (mixed) and 22 (5.6%) of the owned dogs are kept in outdoor. Those dogs that kept in both mixed and outdoor system were freely move from place to place and contribute to the transmission of the disease and widespread occurrence of canine rabies in the study area. It is advisable to keep dogs in the indoor system and vaccinate them against rabies. The indoor keeping system is very important in restricting the movement of dogs outside of their residences and also prevents contact between dogs.

This study showed that the larger majority 319 (81.2%) of the dog owners interviewed vaccinate their dogs against rabies regularly while only 74 (18.8%) do not vaccinate their dogs. This result is higher than the findings of [18], this due to increased awareness of people to vaccinate their dog from time to time. Most of the respondents 232 (72.72%) get vaccination service from the private sector whereas the rest 87 (27.27%) get service from government veterinary clinics. This is due to the fact that private practitioners vaccinate dogs door to door and

this makes easy access to get service in the area. Only 45 (11.5%) of the respondents deworm their dog against internal parasite. This shows most of respondents do not give priority for treating the internal parasites. This shows most respondents do not give priority to treating internal parasites of dogs as compared to rabies vaccination. This is may be due to lack of awareness about dog-related parasitic zoonosis.

The presence of large number of uncontrolled dogs was strongly stressed and immediate integrated action was suggested to be undertaken to control and prevent the occurrence of the rabies. Some respondents reported as there was high number of stray dogs in their surroundings which were confined in waste removal area and on street. During the study period, from two main streets of all wereda an average count of 249 was recorded. This indicates there was high number of stray dogs in sub-city, which can lead to bite and possibly transmit rabies. Dogs at home should be provided with adequate food every day otherwise they may run away and roam around in search of food thus becoming easily attacked by rabid dogs. Later when they come back home again they can pose a serious danger of transmitting the disease to their owners who are not well aware of the contact that their dogs had with other rabid dogs.

CONCLUSION AND RECOMMENDATIONS

From the current study it can be concluded that there are many dogs in the study area and the main reason of keeping dogs is primarily for safeguarding and companionship. Christians keep dogs more than the Muslims in Addis Ababa because in Muslims the religious principle prohibits handling and owning dogs. Moreover the community (dog owners) have knowledge how rabies is transmitted (by dog bite) to humans and they also know the method of control (vaccination). However, there is no regular deworming of dogs and most inhabitants are not aware of the dangers about dog related parasitic zoonosis. Due to lack of awareness and unavailability of service in the study area none of the female dogs owned were not spayed and this resulted in high fecundity which results in the increased dog population.

Therefore based on the above findings the following recommendations are forwarded:

- Regular vaccination campaigns should be practiced in the study area.
- Although there is a certain level of awareness about rabies in the public, further public education are still

essential. Posters, newspapers, radio and television announcements should be used for health education to create awareness among the community.

- Strategic deworming of dogs should be implemented in the area to control parasitic zoonosis.
- The breeding control program must be in the area in order to a balanced dog population by creating awareness about spaying in the area. A successful pilot rabies control program in Addis Ababa could serve as a model to cover nearby towns and other urban and rural areas in Ethiopia.

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