

Participatory epidemiological study on the burden of rabies in animals and humans in three districts of Buno Bedele Zone, West Ethiopia

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Abstract

Rabies is one of the priority zoonotic diseases and a major public health challenge in Ethiopia. Dog plays an important role in the transmission of the disease to humans. With this point in mind, this study was conducted in selected districts of Buno Bedele Zone namely Bedele, Gechi, and Dabo Hana districts, Western Oromia regional state from December 2019 to April 2020. The objective of the study was to know the status and burden of rabies in the community using the participatory approach and retrospective record assessment from animal and human health facilities. Twelve interview meetings were conducted in 12 *Kebeles*, which involved 156 informants. In this survey authors learned that dogs were the species most affected by rabies followed by cattle, human, cat, equine, and shoats. Accordingly, rabies in dog had an average score of 64 out of 100 with a range of 50-80. Besides, rabies outbreak was frequently noted between June to October in the study areas. Slaughter and sharing of the meat for household consumption was the most common practice taken to salvage bitten cattle. As per the available record in the study area, the estimated rabies cases incidence was 1.75 bovines, 18 dogs, 2.37 equines, 2.28 cats, and 0.37 shoats per 10,000 animals annually. The annual average post-exposure rabies vaccinations records were 75, 39, and 63 in Bedele, Dabo Hana, and Gechi districts, respectively. On the other hand, the average annual rabies death in humans was 2.2, 1.4, and 1.8 in Bedele, Dabo Hana, and Gechi districts, respectively. In general, this study shows that rabies is a disease that worth serious attention in the study areas.

Keywords: Burden; Ethiopia; Participatory epidemiology; Rabies.

Introduction

Rabies is a viral disease that affects warm-blooded mammals. Globally, human mortality from endemic canine rabies was estimated to be 55,000 deaths per year and 56% of the estimated deaths occur in Asia and 44% in Africa (WHO, 2007). In developing countries, about 98% of rabies human cases occur from dogs, many of which are stray dogs (Ali *et al.*, 2013). Domestic dogs are the main cause of (>90%) human rabies in Africa. Once the symptoms start to appear, the disease ends almost all the time fatally (Tschopp *et al.*, 2015). It is a major public health problem in most parts of the developing world, where dogs play the main role as reservoirs and transmitters of the disease to humans. Traditionally dogs and to a minor extent cats are considered the main source of rabies but also wild animals are so (Esayas *et al.*, 2012).

The *Lyssavirus* (bullet-shaped RNA virus) causes rabies. It has two forms; furious and paralytic. Lipid solvents, low pH, and sunlight destroys the virus but it is resistant to some disinfectants. Rabies is transmitted only when the virus is introduced into a bite wound or mucous membranes. The transmission is based on the magnitude of the bite and the amount of virus in the saliva. The susceptibility to rabies infection depends on animal species, age, the strain of the virus, dose of the virus, and routes of exposure (Hemachudha *et al.*, 2002).

In Ethiopia, rabies is a well-known and serious illness that has been around for generations (Fekadu, 1982). Nationwide data on rabies are not available to reveal the actual magnitude of the problem. However, the distribution of vaccines to the various regions and the fragmented reports on human and animal rabies cases are strong indicators of the widespread nature of the disease in the country (Deresu *et al.*, 2010). Annually around 76 persons per million of the population have been getting anti-rabies post-exposure treatment in Ethiopia (Ramos *et al.*, 2015). An examination of the rabies situation in Ethiopia indicated that between 1990 and 2000, there were 2172 verified instances of animal rabies in and around Addis Ababa, and 73.5% of respondents said that dogs constitute a major source of the disease's spread among people (Ali *et al.*, 2010).

Rabies disease is becoming a big problem and social issue in Buno Bedele Zone, where yet there is no study conducted on the burden of rabies in the Zone. Be-

dele Regional Veterinary Laboratory Center received 2-3 rabies outbreaks reports annually. At the national level, the multi-sectoral Dog-mediated Rabies Prevention and Elimination strategy plan 2018-2030 has been developed and endorsed for implementation. This study aimed to assess the burden of rabies in animals and humans in study areas using the participatory epidemiology method and provide baseline information for the implementation of a rabies control and prevention strategy plan.

Materials and methods

Study areas

The study was conducted from December 2019 to April 2020 in selected districts of Buno Bedele Zone namely Bedele, Gechi, and Dabo Hana, Oromia regional state, Ethiopia. Bruno Bedele Zone is located in the western part of Ethiopia at a 483 km distance from Addis Ababa found on the main highway to Gambella Regional state (Figure 1).

The livestock population of Bedele district is estimated to be 172,272 cattle, 27,931 sheep, 29,734 goats, 12,441 equines 97,279 chickens, 8,181 dogs, 7,667 cats. Participatory Disease Surveillance (PDS) study was done in Bedele town, Shobe, Yeballa, and Mirga Mute *Kebeles* (*Kebele* is a small administrative unit in Ethiopia) The livestock population of Gechi district is estimated to be 78,576 cattle, 22,428 sheep, 25,516 goats, 9,966 equines 44,962 chickens, 3,418 dogs, 1,852 cats. The livestock population of Dabo Hana district is estimated to be 78,576 cattle, 22,428 sheep, 25,516 goats, 9,966 equines 44,962 chickens, 3,418 dogs, 1,852 cats. A Participatory Disease Surveillance study was conducted in Kone town, Dahe, Lillo, and G/Amuma *Kebeles* (LRDO, 2019).

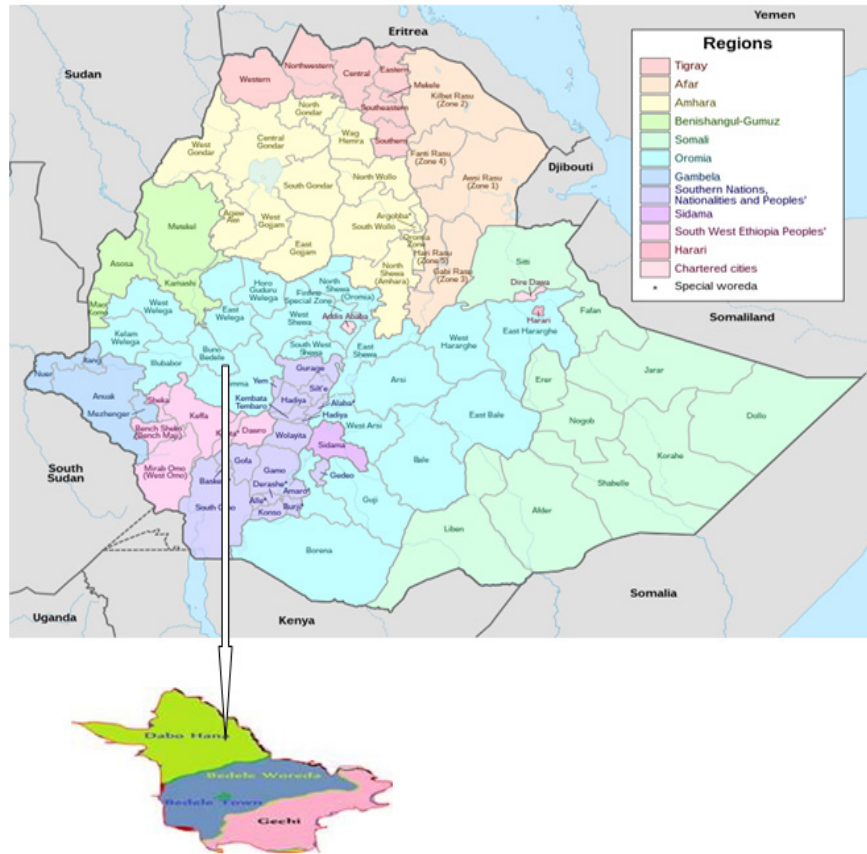


Figure 1: Map of study districts

Study populations

All dog and cat owners found in twelve *Kebeles* distributed in Bedele, Gachi, and Dabo Hana districts were considered as the study population. In all study areas, most dogs were roaming during the day and came back home at night. The most benefit obtained from dog keeping is guardian for crop fields and for homesteads from monkeys and baboons, which are the most predominant threat to their crops.

Study design

Standard Participatory Diseases Surveillance tools such as simple ranking, proportional piling, and matrix scoring were applied to generate evidence during facilitated discussion. The simple ranking was used to identify animal susceptibility and assess awareness of society on rabies by writing variables on a card, proportional piling to identify and rank major dog diseases using 100 beans, and matrix scoring using 30 beans to rank seasonal occurrence of rabies. The variation in scoring proportional piling was also captured by recording the difference between the highest and lowest score ranges. Data were collected from case books of veterinary clinics and human health centers to triangulate the information generated via participatory epidemiology.

Methodology

A total of 12 PDS interview meetings each containing 10-15 informant members were conducted in three districts and a total of 156 participants were involved in three districts. Four *Kebeles* (3 rural *Kebeles* and one town *Kebele*) were identified in each district to conduct PDS interviews. Community informants purposively identified those residents who own dogs. Each interview meeting lasted 2-3 hours. The PDS exercises were facilitated by two experts (one moderator and one record-keeping person). Variables: in the simple ranking (susceptibility of animals, comparison of cultural and vaccine (post-exposure prophylaxis), decision practice of rabid animal), proportional piling (major dog diseases), and matrix scoring (seasonal occurrence of rabies).

Data analysis

Collected data were managed in Microsoft Office Excel, summarized in tables, percentages, and descriptive analysis to describe central tendency (average) and ranges (Catley, 2005). In the simple ranking, the most frequently occurring variable (Mode of central tendency) was used and ranked 1st, 2nd, 3rd, and 4th. For proportional piling 100 beans were used, and the scores for each variable were added up and divided by the number of interviews (PDS) to obtain the average score. In matrix scoring, 30 beans were used in each Peasant association to score the seasonal occurrence of rabies. In each Peasant association, 30 beans were divided and scored by farmers based on the incidence of rabies cases in four seasons a year- spring, winter, autumn, and summer. Accordingly, from four Peasant associations of each district 120 scores of beans were recorded.

Results

Participatory interview outputs

The number of informants in the 12 PDS interview meetings was 156 (29 females and 127 males) inhabitants in 12 *Kebeles* (9 rural and 3 town *Kebeles*). Informants responded that dogs are the species most affected by rabies followed by bovine, human, cat, equine, and shoat (Table 1).

Table 1: Simple ranking of livestock susceptibility to rabies

Affected Species	PDS interview												Mode	Rank
	Dabo Hana District (PA)			Gechi district (PA)				Bedelle district (PA)						
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th		
Dog	1	1	1	1	2	2	1	2	2	2	2	1	1	1
Bovine	2	2	2	2	3	1	3	3	3	1	1	2	2	2
Human	3	4	4	3	1	3	2	1	1	3	3	3	3	3
Cat	4	3	3	4	5	4	5	4	4	4	4	4	4	4
Equine	6	5	5	5	4	5	4	5	5	6	5	5	5	5
Shoat	5	6	6	6	6	6	6	6	6	5	6	6	6	6

Informants indicated that food animals suspected of rabies infection were slaughtered and the meat was distributed among the community for consumption (Vernacular name called Kircha). When high-value farm animals were suspected of rabies case, informants responded that treating with cultural medicine ranked the second alternative because they believe that cultural medicine can cure even after the animal start to show clinical disease. Restraining suspected animals under a tree or around the homestead and taking them to a veterinary clinic were ranked third and the fourth decision that the community practice (Table 2). They prefer to give cultural medicine to humans bitten by a rabid animal because most informants believe that cultural medicine has a better remedy than post-exposure prophylactic vaccine (PEP).

Table 2: Simple ranking of informants' practices against suspected rabies-infected humans and food animals

Informants' awareness of rabies	PDS interview												Mode	Rank
	Dabo Hana District(PA)			Gechi district (PA)				Bedelle district (PA)						
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th		
Human PEP Vaccine vs cultural medicine														
Cultural medicine	2	2	1	2	2	1	1	1	1	1	1	1	1	1
PEP Vaccine	1	1	2	1	1	2	2	2	2	2	2	1	2	2
The decision against suspected rabid food animals														
Slaughter and eat meat	1	1	2	1	2	2	1	1	2	1	2	1	1	1
Give cultural medicine	2	2	1	3	3	1	3	2	3	2	1	2	2	2
Restraining in one place	3	4	4	2	1	3	2	3	1	3	3	3	3	3
Take to the veterinary clinic	4	3	3	4	4	4	4	4	4	4	4	4	4	4

List of dog diseases and severity score

Informants identified dog diseases in their area and they scored rabies the top disease followed by mange mites, endoparasite, and fleas. The average score for Rabies was 64 with a range from 50-80 piles. The second dog disease was "Mange mites" with an average score of 20 and the range was from 0-40. Ticks and fleas were the least important among listed dog diseases (Table 3).

Table 3: List of major dog diseases and severity scores using proportional piling scores

Dog diseases	Vernacular name	PDS interview													
		Dabo Hana District (PA)				Gechi district (PA)				Bedele district (PA)					
		1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	Ave	Range
Rabies	Dhukuba Saree	71	75	65	70	80	60	50	80	53	50	50	60	64	50-80
Endo parasite	Qooqsaa	7	15	20	18	0	5	0	5	30	24	0	25	12	0-30
Mange	luqqisaa	16	10	0	12	15	25	30	0	0	16	40	0	20	0-40
Flea	Tafkii	6	0	15	0	5	10	20	15	17	10	10	15	10	0-20

Seasonal occurrence

All focused group discussion teams scored seasonal occurrence of rabies using matrix scoring. Accordingly, rabies outbreak occurrences from higher to lower order were: Summer 156 (43.3%), Spring 107 (29.7%), Autumn 55 (15.3%), and Winter 42 (11.7%) (Table 4).

Table 4: Seasonal occurrence of rabies outbreaks using matrix scoring

Districts	Seasons			
	Winter (Bona)	Autumn(Arfaasaa)	Summer(Ganna)	Spring (Birraa)
Bedele	13	21	51	35
Dabo	17	15	47	41
Gechi	12	19	58	31
Total	42	55	156	107

The PDS teams responded that rabies outbreak occurrence was commonly in the big rainy season from June to October and less common in the dry season from December to March (Figure 2).

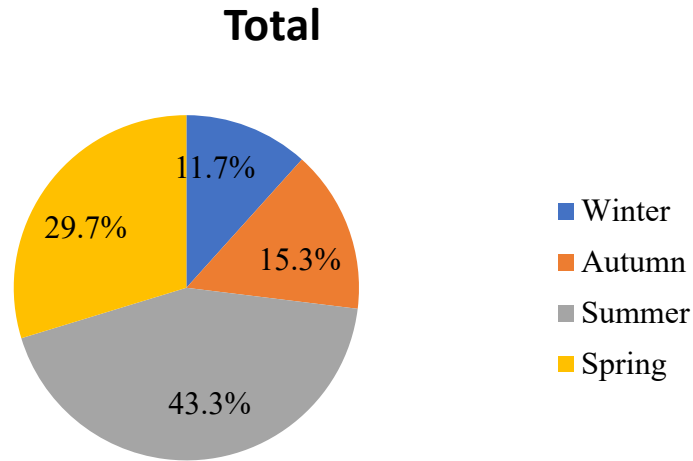


Figure 2: Seasonal rabies occurrence scores

Recorded data from veterinary clinics

Recorded data of suspected rabies cases from the year 2015-2019 indicated that estimated rabies cases of 1.75 bovines, 18 dogs, 2.37 equines, 2.28 cats, and 0.37 shoats had been recorded per 10,000 animals annually (Table 5). However, there was no laboratory confirmation for any of the recorded cases.

Table 5: Suspected rabid animal cases data from veterinary clinics from 2015-2019

District	Five years of suspected rabid animal cases					Total
	Bovine	Shoat	Equine	Dog	Cat	
Bedele	136	5	19	65	7	232
Dabo	97	3	14	51	4	169
Gechi	89	6	11	44	5	155
Total	323	14	45	162	12	556

Recorded data from human health centers

Annually 75, 39, and 63 post-exposure rabies vaccines were provided for dog-bitten humans in Bedele, Dabo Hana, and Gechi districts, respectively. Of

the 892 humans vaccinated with the post-exposure prophylactic vaccine, 62% (553/892) were male and 38% (339/892) were females (Table 6). On average annually 4.33, 5.27, and 3.50 human rabies deaths per 100,000 people were recorded in Bedele, Dabo Hana, and Gechi districts, respectively (Table 6).

Table 6: Post-exposure vaccination recorded data from health centers

Health center	Post-exposure vaccination												Suspected deaths			
	2015		2016		2017		2018		2019		Total		Total	M	F	Total
	M	F	M	F	M	F	M	F	M	F	M	F				
Bedele	38	23	26	14	46	23	57	43	61	48	228	151	379	7	4	11
Dabo	15	11	32	12	27	15	25	19	23	18	122	75	197	5	2	7
Gechi	34	18	41	21	41	24	49	24	38	26	203	113	316	6	3	9
Total	87	52	99	47	114	62	131	86	122	92	553	339	892	18	9	27

Discussion

Twelve interview meetings comprising 156 informants were conducted in 12 *Kebeles*. Dogs were the species most affected by rabies. Rabies was the most common dog disease with an average score of 64 and 50-80 range scores. The most common months of rabies occurrence were from June to October. Animal rabies cases were estimated at 1.75 bovines, 18 dogs, 2.37 equines, 2.28 cats and 0.37 shoats had been recorded per 10,000 animals annually. The annual average post-exposure rabies vaccinations records were 75, 39, and 63 in Bedele, Dabo Hana, and Gechi districts respectively. Also, the average annual rabies death in a human was 2.2, 1.4, and 1.8 in Bedele, Dabo Hana, and Gechi districts respectively.

The current study showed dogs were the highest rabies-affected animals followed by bovine, human, cat, equine, and shoat. This could be because dogs serve as crop guards from Monkey and Baboon where they could be exposed to infected foxes in the study areas. At night, dogs stay outdoor as a home guard and were exposed to the risk factors of rabies more than other domestic animals, which is in agreement with Jemberu *et al.* (2013). This study showed that rabies occurred commonly in the big rainy season from June to October and fewer scale outbreaks from December and March. This might be due to the high movement of stray dogs in search of food and breeding season which bring

together several dogs and exacerbate the spread of the infection. This finding is in agreement with the previous reports who found the seasonal occurrence of rabies outbreaks between July and September (Moges, 2015; Helao *et al.*, 2019).

Slaughtering and sharing rabies suspected food animals for consumption was the most common practice. No rabies cases, nevertheless, were reported from individuals who consumed suspicious cattle. This might be due to the lack of public awareness about the potential risk of rabies transmission through the handling of infected animal carcasses in the study areas, which is in agreement with WHO (2012). When butchering and preparing the flesh of rabid cattle, people do not use personal protective equipment, and even they are regarded as being culturally protected from contracting rabies. There had not been any human case of death occurred due to consumption of rabid cattle meat which is in agreement with WHO (2018) that showed no human cases have been documented following the consumption of cooked meat from a rabid animal. However, butchering or eating rabid animal meat may potentially transmit rabies.

Most PDS teams ranked cultural medicine as better than post-exposure prophylactic vaccination and thought that cultural medicine was more accessible and easy to administer, which they believe can protect animals and humans after exposure. This agrees with the reports of Aga *et al.* (2015). Ali *et al.* (2010) also reported that 58.3% of the respondents had a strong belief in traditional medicine for rabies prevention and treatment.

Rabies exposure was more common in males (62%) than females (38%). This could be due to the socio-cultural difference among societies. According to Teklu *et al.* (2017), females typically carry indoor tasks such as cooking and child-care; while males typically carry out outdoor tasks like ploughing, crop harvesting, and livestock keeping. This is also true in the current study locations.

Conclusions

This study assessed the status and burden of rabies in three districts of the Buno Bedele zone using the PDS technique and triangulation of five years of recorded data. The study identified major dog diseases and rabies was the most common dog disease. Dogs were the species most affected by rabies followed by

bovine, human, cat, equine, and shoat. It indicated a high incidence of suspected rabies cases in humans and livestock, which might significantly affect the livelihood of the society. A big knowledge gap of rabies diseases in society regarding the transmission, quarantining of suspected cases, the decision taken to the suspected animal, post-exposure vaccine, and cultural medicine was observed. Five years of recorded data of suspected animals from veterinary clinics showed a high occurrence of rabies disease. In addition, five years of recorded data of post-exposure rabies vaccinations from health centers showed high human exposure to rabies disease. In general, this study showed that rabies was an important zoonotic disease in the area and needs special public health awareness. The prevailing traditional salvaging practice of infected cattle and the reduced preference for post-exposure vaccine over traditional medicine is detrimental and demands serious public health awareness intervention.

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