

Full Length Research Paper

Participatory epidemiology and associated risk factors of foot-and-mouth disease in cattle in South Omo zone, South-Western Ethiopia

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Participatory appraisal was applied to determine the major cattle diseases and investigate the epidemiology of foot-and-mouth disease (FMD) in South Omo pastoral and agro-pastoral livestock production system. Furthermore, assessment of associated risk factors in particular concern to local production system was conducted by participatory appraisal. The participatory methods used were clinical observation, matrix ranking and scoring, proportional piling and seasonal calendar. The result of matrix ranking and scoring showed that hemorrhagic septicemia, contagious bovine pleuro pneumonia (CBPP), trypanosomosis, FMD, black leg and anthrax were the major diseases of cattle in South Omo zone. The finding of seasonal calendar indicated that incidence of FMD was found to be high during the dry season than cold dry season. The lowest incidence was reported during the rainy season. Similarly, contact of herds with wild animals increased during dry season than rainy season. Based on this finding participatory epidemiology was found to be an important approach in veterinary investigations and it can also be used besides to conventional approaches.

Key words: Foot-and-mouth disease (FMD), participatory appraisal, South Omo zone, cattle, risk factors.

INTRODUCTION

In Africa, the non-forested portion of humid zone and the sub-humid part of sub-Saharan Africa are the areas with the greatest opportunity for expanding crop and livestock production. In this part of Africa, the greater half of the ruminant population are reared (over 232 million heads of cattle and 343 million heads of sheep and goats) (FAOSTAT, 2005).

This huge continental resource plays multi-factorial roles in mixed crop-livestock farming system. Hence, it has been proved that livestock production through improved production strategies could play a significant role in the development of a sustainable and environmentally friendly agriculture in efforts to ensure food security, poverty alleviation and effective utilization of natural resources (Afework et al., 2004; Shaw, 2004).

Economical loss due to occurrence foot-and-mouth disease (FMD) is tremendous that occurred due to death of young animals, marked reduction in milk yield, abortion in advanced stage of pregnancy and reduced working ability of the animals, reduced quality and quantity of meat, reduction in fertility, loss of quality of semen in breeding bull, etc., and the disease also restricts the possible export of livestock and livestock products (Yadav, 2003).

The poor farmers are most sufferers by FMD, because of non-availability of vaccine (FAO and OIE, 2012) and lack of awareness about vaccination program (Singh et al., 1987). Furthermore, the economic losses due to FMD were more to the marginal farmers. In Ethiopia, outbreaks of FMD frequently occur in the pastoral herds (Sahle,

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2004). This is mainly due to lack of effective vaccine, absence of livestock movement control and absence of systematic disease surveillance and reliable epidemiological data. However, it is likely that the disease is under-reported due to comparatively high tolerance of local breeds to the clinical episodes of the disease (Leforban, 2005). Therefore, it seems that FMD is more prevalent and has been one of the major causes for considerable economic loss of the rural communities in Ethiopia. Providing veterinary services to the communities according to the western model has proven difficult due to lack of infrastructure and the veterinarian has limited experience in harsh environments of pastoral system. Thus, participatory approach methods become important in disease investigations and in implementing different disease prevention and control strategies in developing countries, particularly in working with rural and pastoral communities. This is also of paramount importance to draw the indigenous knowledge and reach experience of the communities on the diseases of their locality (Leyland, 1991).

Furthermore, there is extensive traditional or ethno-veterinary knowledge that pastoralists have been known to possess and on which they rely to diagnose or treat many diseases (Rufael et al., 2006). It is possible that the proper collection and analysis of data for diseases like FMD that are often under reported by conventional veterinary services. Therefore, data collection in pastoral areas can better be managed in participatory manners. Participatory rural appraisal (PRA) is a systematic data gathering activity carried out by a multidisciplinary team to reveal the unidentified facts about a community (Lelo et al., 1995). Veterinarians and livestock workers have used and are presently using a variety of PRA methods to investigate animal health problems (Catley, 1997). The tools include interviewing, scoring and ranking, and visualization such as seasonal calendars, maps, Venn diagrams and flow charts.

Therefore, this study is designed with the objectives to determine the mortality and morbidity of major livestock diseases as compared to FMD and to assess the perception and understanding of community about the disease in the area.

MATERIALS AND METHODS

Study area

The study was conducted in two districts of South Omo zone, which are Dasanech and Hammer. The districts were selected from the existing districts of South Omo zone purposively; based on their geographical location, proximity to livestock market, huge ruminant population density, and possibility of contact with wild animals in nearby parks and sanctuary and to include different agro-ecologies of the zone. South Omo zone is located in South-West of SNNPR state, bordering with from east: Konso and Derashe Special districts of SNNPR state and Borena zone of Oromia regional state; North: North Omo and Kaffashaka zones; West: Sudan and Bench-maji zones; and South: Kenya. The zone covers an area of 22,000 km²,

and the area is inhabited by 14 ethnic groups, namely Ari, Banna, Hammer, Dasanech, Gngangatom, Kara, Kweegu, Mursi, Bodi, Malle, Tsemai, Arbore, Bacha and Dime (CSA, 2008). The study area is indicated in the map of Ethiopia (Figure 1).

Study animals and sampling technique

The study herds were selected from animal population in two districts of South Omo zone, Bennatsemay and Dasanech. From the selected districts, pastoral/peasant associations (PA) were selected randomly from the district's PA list. For this purpose, 10% of PA from the district was selected. From selected PA cattle herds were selected as primary sampling unit. Herd selection was implemented conveniently giving effort to include different herd sizes and composition in the PA. About 20% of cattle herds from the selected PA's were included in sampling. Individual animals from the selected herd were selected randomly and about 10% of animals in the herd were sampled to represent herd. The selected animals were observed for the clinical and chronic FMD.

Participatory appraisal of major livestock health problems were employed in each selected PA of the district. For every PA, which is considered as one community group, one appraisal was done.

Study design

Multistage sampling technique was employed to select study districts, PA, herd and sampling animal. Participatory appraisal method was applied to generate information on major cattle diseases and the epidemiology of FMD in the study area. The association regarding FMD in the area to contact history of wild life was thoroughly assessed. The participatory appraisal methods used were clinical observation, matrix ranking and scoring, proportional piling, pair-wise ranking and seasonal calendar.

Participatory disease appraisal

Clinical observation

Clinical observation of sick animals related to FMD was done during sample collection in order to cross check the perception of the communities with other participatory appraisal results. All sampling herds were visited for acute or chronic clinical signs. Clinical signs considered were vesicular to abrasion lesions in the oral cavity, lesions in inter-digital space, lameness and lesions in and around mammary glands and the teats, hair over growth and panting.

Matrix and pair wise ranking and scoring

Matrix scoring was conducted to understand the perception of community to major cattle diseases prevailing in the area. For this purpose, the selected community groups were made to select, rank and score the major five cattle diseases of the area. The ranking and scoring were done by matrix ranking and scoring and triangulated by pair-wise ranking and scoring. The ranking and scoring were done in eight community groups from eight selected PAs in Hammer and Dasanech districts of the study area. Group composition is made to include different community members by sex, age, skill, experience and social status for all participatory approaches done with groups.

Proportional piling

Proportional piling was employed in two districts, Hammer and Dasanech, representing different production system, to estimate the

SOUTH OMO ZONE

Southern Nations Nationalities Peoples Regional State

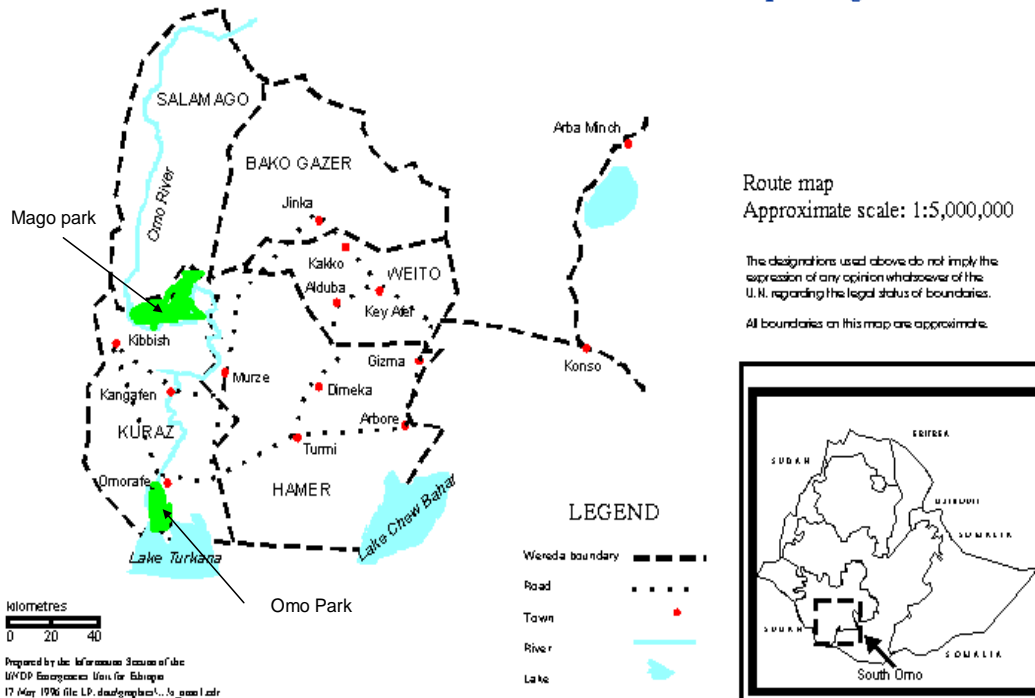


Figure 1. The study area, South Omo zone.

relative incidence and mortality caused by the five most important cattle diseases during the past one year, identified in matrix pairwise ranking and scoring earlier. Informant groups from selected PAs of each district were requested to classify the animals into different age groups and were classified into 3 categories. One age category of less than 1 year of age, between 1 and 4 years, and above 4 years. Then every informant group was allowed to maintain a pile of 100 stones for each age group. Then they were asked to separate proportion of pile representing sick animals from total herd for each age categories. This was done for major five diseases identified in matrix scoring and ranking for the last one year. Furthermore, the proportion of stones representing dead animals from sick animals was separated from the proportion of piles of stones representing sick animals. These were done separately for each age groups and different diseases to avoid confusion. Then, the piles of stones representing sick and dead animals from various diseases on different age groups were calculated to determine the incidence and mortality of various diseases in the area.

Seasonal calendar

Seasonal calendars were used to determine the seasonal occurrence of FMD. Seasonal calendar of FMD and contact of cattle to wild animals were done in eight community informant groups from eight PA of Dasanech and Hammer districts. The different seasons of the year were categorized according to the pastoralist's division category in four categories as long rainy season, ranging from March to May; cold dry season, ranging from June to August; short rainy season, ranging from September to November; and long dry season, ranging from December to February.

RESULTS

Clinical observation

Nine sick animals with acute clinical signs were observed during the study period in 2 outbreaks, 1 in Bori PA of Bennatsemay district and another in Lalla PA of Hammer district. Both outbreak cases were reported at the end of the drought season. In both Pas, cattle with clinical FMD cases were reported that they were kept in Mago National Park and were brought to the homestead. Chronically sick animals from FMD were reported to be attacked by hyenas and other predators in the park area, because these animals cannot escape due to lameness and weakness by the disease and feed shortage aggravated by drought.

Common clinical signs observed in acutely affected animals from FMD were vesicular to abrasive lesions in the oral cavity, frothy discharge from the mouth, lesion in the interdigital space and on the teats. Shade seeking and standing inside and not willing to come out of watering points is a typical feature of the disease, according to the pastoralist's knowledge. Young animals usually die due to FMD virus infection.

However, the common cause of death of FMD infected adult cattle was an attack by predators in South Omo zone. According to pastoralist's observation, those animals which survived acute FMD showed overgrowth of

hair, dullness, isolation from the herd, standing under shade during hotter hours of a day and reduced milk production.

Matrix/pair wise ranking and scoring

The summarized major five diseases of cattle identified and prioritized by four pastoralist informant groups, in four PAs in Dasanech district were contagious bovine pleuro pneumonia (CBPP), septicemic pasteurellosis, anthrax, FMD and black leg. CBPP and septicemic pasteurellosis were found to be more important than other diseases due to their high case fatality rates in Dasanech district. The result in Hammer district showed that septicemic pasteurellosis, trypanosomosis, black leg, CBPP and FMD are among the most important disease in the district. Septicemic pasteurellosis scored 2 times more important than trypanosomosis and black leg, but 6 times more important than CBPP and FMD. In this district, community groups ranked the major diseases according to the losses incurred by the diseases. This indicates that the knowledge of community to major diseases in the area is good and they well explained the disease problems prevailing in their locality.

Proportional piling

The summarized mean number of sick and dead cattle from the major diseases in Dasanech and Hammer districts are shown in Table 1. The summarized occurrence (age specific) of major diseases of cattle in Dasanech district was found to be 5.6 (3 to 8%), 3.3 (0 to 6%), 2.6 (0 to 5%), 2.3 (2 to 3%), and 1.3 (0 to 3%) for CBPP, septicemic pasteurellosis, anthrax, FMD and black leg, respectively.

The summarized mean number of cattle affected and died from the major disease in Hammer district in the last one year according to proportional piling is as shown in Table 1. The occurrence (age specific) of major diseases of cattle in this district was 5.3 (3 to 7%), 4.0 (3 to 5%), 3.0 (1 to 5%), 2.0 (2%), and 1.6 (1 to 3)% of septicemic pasteurellosis, trypanosomosis, black leg, CBPP and FMD, respectively.

Seasonal calendar

Summarized seasonal calendar for FMD and contact with wildlife in Dasanech and Hammer districts are as shown in Table 2. The incidence of FMD was found to be high during the dry season than cold dry season. The lowest incidence was reported during the rainy season. The informants also have stated that seasonal cattle movement occurs frequently during the dry season in search of good pasture and water, which also is directly associated to contact wild animals in these districts. This

pattern of seasonal movement (mainly in the dry season) also determines contact between different herds of domestic animals, and it is exacerbated by limited water sources.

The occurrence of FMD was found to be higher during the dry season followed by cold dry season in both districts. In Dasanech district, FMD occurs throughout the year but in Hammer district there were no FMD cases in the long rainy season. The seasonal occurrence of FMD in Dasanech and Hammer districts were indicated in Figures 2 and 3. Furthermore, the association of contact pattern of cattle to wild animals and the occurrence of FMD in cattle in Dasanech and Hammer districts using seasonal calendar as shown in Figures 4 and 5. The association in Hammer district was by far linearly associated than that of Dasanech district which could be due to the fact that the contact to wild animals in Hammer is more regular in that the animals migrate in search of pasture and water thereby making regular contact to wild animals as compared to Dasanech where they migrate to long distances but not directly linked to parks and sanctuaries and thus the contact to wild animals is not regular.

DISCUSSION

This study indicated that FMD was the fourth most important cattle health problem and an emerging disease in South Omo zone. The descriptions by most of the cattle owners showed that they well know most of the clinical presentations of the disease. Indeed most of the signs listed for FMD were consistent with what is indicated in different reports (Catley et al., 2001, 2004; et al., 1994). In Ethiopia, similar signs have been reported in pastoral cattle of Afar (Tadesse, 2003), Somali (Eshetu, 2003) and Oromia (Rufael et al., 2008) regional states.

The higher district level occurrence of the disease was observed in Hammer district than that of Dasanech. This could be due to the fact that higher contact pattern of domestic animals to wild animals and also their high migratory pattern in Hammer as compared to Dasanech district which are not as migratory and not as such huge wild ruminant population bordering the district. The higher prevalence of disease in Hammer could be accounted due to the fact that this district is a center for cattle market facilitating contact among cattle from different sources and this area is border transit for transporting animals for draft power from the potential livestock producer areas like Dasanech and Gnagatom areas, to mixed crop livestock producer areas like Debub Aari and Malle districts.

There is strong association of contact pattern to wild animals to domestic animals with the occurrences of FMD in the cattle. This finding is in agreement with the reports of Macaulay (1963) and Hedger (1981) who observed that many species of wild animals have been reported as having been infected with FMD virus and

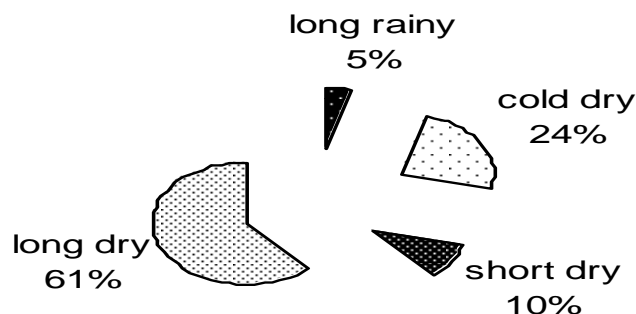
Table 1. Summarized age specific occurrence and mortality rates of major cattle diseases in Hammer and Dasanech districts by proportional piling.

District	Health status by age	Septicemic pasteurellosis	Trypanosomosis	Black leg	CBPP	FMD	Total
Hammer	Sick age less than 1	3	3	1	2	3	12
	Sick age 1 to 4	7	5	5	2	1	20
	Sick age above 4	6	4	3	2	1	16
	Died age less than 1	0	2	0	1	1	4
	Died age 1 to 4	2	1	2	0	0	5
	Died age above 4	3	0	0	0	0	3
	Healthy age less than 1	97	97	99	98	97	488
	Healthy age 1 to 4	93	95	95	98	99	480
	Healthy age above 4	94	96	97	98	99	484
	Subtotal	305	303	302	301	301	1512
Dasanech	Sick age less than 1	3	0	0	2	0	5
	Sick age 1 to 4	6	6	5	2	3	22
	Sick age above 4	8	4	3	3	1	19
	Dead age less than 1	0	0	0	1	0	1
	Dead age 1 to 4	2	3	2	0	1	9
	Dead age above 4	3	1	0	0	0	4
	Healthy age less than 1	97	100	100	98	100	495
	Healthy age 1 to 4	94	94	95	98	97	478
	Healthy age above 4	92	96	97	97	99	483
	Subtotal	305	304	302	301	301	1516
Total		610	607	604	602	602	3028

Table 2. Summarized seasonal calendar of FMD and contact of cattle to wild animals in Dasanech and Hammer districts.

District	Local seasonal category	Long rainy	Cold dry	Short rainy	Long dry
Dasanech	FMD occurrence	1	5	2	13
	Contact to wild animals	0	2	4	8
Hammer	FMD occurrence	0	4	4	12
	Contact to wild animals	2	3	6	15

FMD occurrence in Dasanech by season

**Figure 2.** Seasonal occurrence of FMD in Dasanech district.

FMD occurrence in Hammer by season

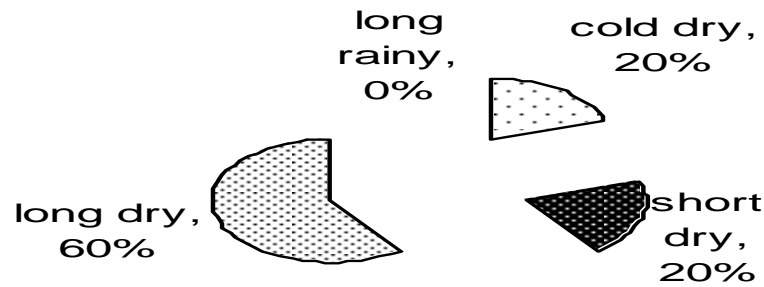


Figure 3. Seasonal occurrence of FMD in Hammer district.

Association of FMD and contact to wild animals, Dasanech

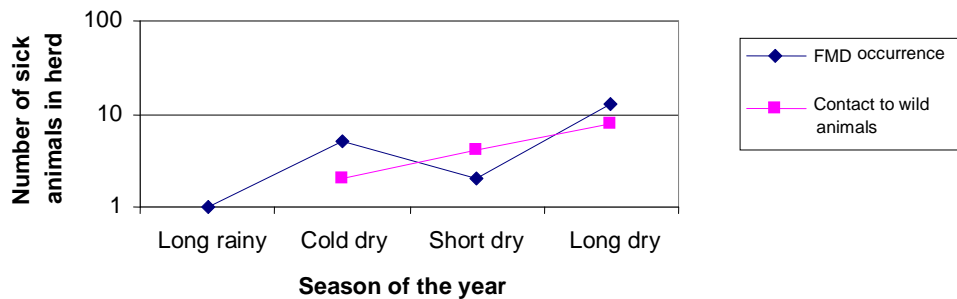


Figure 4. Contact pattern associated to FMD occurrence in Dasanech district.

Association of FMD and wild life contact, Hammer

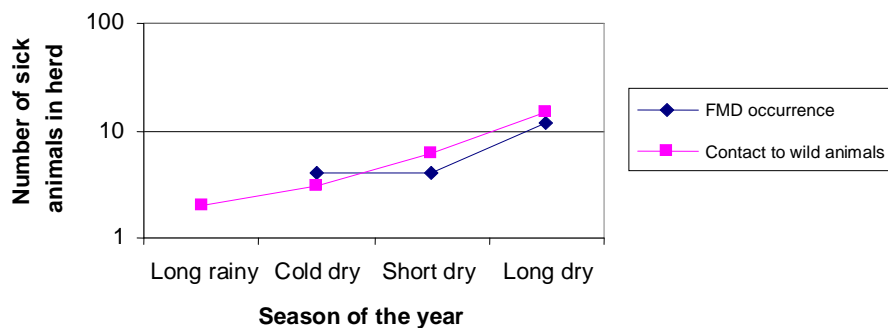


Figure 5. Contact pattern associated to FMD occurrence in Hammer district.

Furthermore, the serotypes circulating in South Omo zone could be different from those identified in other areas of the country and/or vaccinal strains available in Ethiopia, thus determining the serotypes in South Omo zone is of a primary step to be done for the control of FMD.

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