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Participatory Epidemiology of Cattle Diseases in Arba Minch Zuria District, Gamo Zone, SNNPR, Ethiopia: Particular Focus on Lumpy Skin Disease

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Abstract

A cross-sectional study was conducted from November 2019 to April 2020, in which participatory appraisal methods were applied to validate Arba Minch zuriya district farmers' existing veterinary knowledge on Lumpy Skin Disease (LSD) and to determine their perception on rank, morbidity, mortality and seasonality of the disease. The participatory methods used were matrix scoring, proportional piling, pair wise ranking, seasonal calendars and clinical observation. A total of 48 informants were included in the study to collect in-depth information. Accordingly, it was indicated that LSD was a much known disease by its "nodules on skin" clinical manifestation. Ranking using proportional piling based on the impact on livelihood revealed that LSD was the fifth most important disease prioritized in all kebeles ($W=0.638$; $P<0.05$). The study also showed that the relative prevalence rate (PE-morbidity) of LSD in all age groups was 4.75%. The Age-specific incidence showed that LSD had the highest incidence in calves and lowest in adult. The results of current study also revealed that LSD had 2.15% case fatality rate (PE-fatality). Mortality rate in different age groups indicated that LSD had the highest mortality in calves and lowest in adult. The analysis of matrix scoring indicated that skin lesion was most important sign for LSD ($W=0.370$; $P>0.05$). Seasonal calendar indicated that the incidence of LSD was found to be high during short rainy season (Bone) than long rainy season (Balgo)($W=0.771$; $P>0.05$). Thus, the concordance between informant groups, veterinary literatures and research works had proven that Arba Minch Zuria district farmers are knowledgeable about LSD. Hence, it is recommended that disease control intervention measures in the area should appreciate community involvement and should consider LSD as it was one of the important diseases and listed in all kebeles.

Keywords: Indigenous knowledge • Lumpy skin disease • Participatory epidemiology

Introduction

Livestock production is an integral part of the agricultural system in Ethiopia. Ethiopia has the largest livestock population in Africa, possessing more than 60.39 million cattle, 64.04 million small ruminants (31.30 million sheep and 32.74 million goats), 1.42 million camels and 11.31 million equines and 56.06 million chickens. This livestock sector has contributed considerable portion to the economy of the country, and still promising to rally round the economic development of the country. Livestock production remains crucial and represents a major asset among resource-poor small holder farmers by providing milk, meat, skin, and manure and traction force. In Ethiopia, livestock production contributes 40% of the agricultural Gross Domestic Product (GDP) and 20% of the total GDP without considering other contributions like provision of traction power, organic fertilizers and as means of transport. The contribution of livestock to the national economy particularly with regard to foreign currency earnings is through exportation of live animal, meat and skin and hides. Nevertheless, the overall livestock production constraints in Ethiopia are feed and water shortages, livestock diseases, low genetic potential of indigenous livestock and lack of marketing infrastructure. Livestock disease is the major constraints of productivity causing economic loses in Ethiopia by hundreds of millions of value per year. Domestic animals are often afflicted with various skin problems, some easy to cure others more complicated, and some even highly contagious to human handlers. Lumpy Skin Disease (LSD) is one of these many other diseases [1].

Lumpy Skin Disease is caused by the virus classified in Capripoxvirus of family Poxviridae. It is characterized by fever, nodules on the skin, mucous membranes and internal organs, emaciation, enlarged lymph nodes, edema of the skin, and sometimes death. Lumpy Skin Disease virus is thought to be

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primarily transmitted by biting and blood feeding arthropods that act as mechanical rather than biological vectors. Introduction of infected animals is the most likely way for LSD to enter in to a new area. Extensive livestock production system and utilization of communal grazing lands and watering points allows maximum chance to create favorable condition for introduction and spread of LSD infection. Lumpy skin disease is one of an emerging, notifiable, and list a disease. Economicaally, it is the second most significant cattle disease in Ethiopia. The disease affects cattle of all ages and breeds with a high morbidity and low mortality rate. The disease is currently endemic in most Africa countries and expanded to Middle East region. Reduced milk production, beef loss, abortion, infertility, loss of condition and damage to the hide are the significant economic problems caused by LSD (Center for Food Security and Public Health. Reduced market value of the animal is caused by the introductions of LSD into feedlots. The economic losses induced by LSD are due to reduction of wool quality and meat, culling and mortalities and cost of treatment and prevention of the diseases. The best chosen and effective approach for protection and control of LSD in endemic countries comes from prophylactic vaccination and is often that of ring vaccination carried out well in advance in at-risk areas [2].

However, since the country has no a well-designed control strategy and even if the animal health authorities undertake vaccination campaigns when outbreak is reported, LSD has now spread to almost all the regions and agro ecological zones. According to district veterinary office, a clinical case of LSD had been reported in Arba Minch Zuria district. The kebele animal health workers also noted that the economic losses due to this disease had also been seen in this area. These loses are associated with decreased milk production, weight loss, poor growth, and skin damage. Though there are no specific LSD treatments, expenses incurred by farmers for medication for secondary bacterial infection are an important headache of animal owners in the area (Arba Minch Zuria Livestock and fishery resource office. LSD outbreaks have been occurred in different regions of Ethiopia from 2000-2007. The disease occured in Amhara and Oromia Regions in 2000/2001, Oromia and Southern Nations Nationalities and People (SNNP) regions in 2003/2004 and in 2006/2007 it occurred in Tigray, Amhara and Benishangul regions. Sero-prevalence studies reported that LSD had a prevalence of 6%, 11.6%, 27.9% and 28% in southern Ethiopia, Southern Range land, Wolliso town and north Ethiopia, respectively. Higher herd prevalence was recorded in Afar (51%) and Tigray (37%) regions. LSD causes high economic losses. According to Gari et al. (2011) the estimated financial cost in LSD infected herds for local zebu was to be USD 6.43 (5.12-8) per head and USD 58 (42–73) per head for HF/crossbred cattle. Another study also showed that the average cost of a single ox dying from LSD was calculated as 9,000 Ethiopian birr (ETB), equivalent to US$ 477.7. LSD is among the well-known animal diseases impairing the Ethiopian farming community to get optimal benefit from their livestock. It is not only bottlenecks for the livestock sector developments in Ethiopia but also threatens food security and exacerbates poverty (Abebe, 2018). Due to the endemic nature of LSD; the country is facing serious difficulties in exporting live cattle and their products. In addition, this situation contributes a negative impact on the national economic growth through the loss of meat and milk production and poor quality of skin and hides [3].

Materials and Methods

Description of study area

The study was conducted in Arba Minch Zuria district of Gamo Zone in the Southern Nation and Nationality Peoples Regional State (SNNPRS). The study area was selected based on its potential on livestock population and prevalence of the problem. The district is located at about 500 kilometers south of Addis Ababa and 272 km to the west of regional capital (Hawassa). The area is situated with an astronomical location of roughly 5°70"-6o21"N latitude and 37°31"-37°67"E longitude lines in Great Rift Valley and bordered on the south by Segen zone, on the west by Bonke district, on the north by Dita and Chencha districts, on the northeast by Mirab Abaya district and on the east Oromia region. According to Central Statistical Authority (CSA), (2015), the district has a total area of 1681.72 sq.km with the population of 164, 529 and consists of 18 kebeles. The area receives 800-1200 mm of rainfall annually, and it has an average of 26°C-38°C temperature, with an altitude of 1200-3310m above sea level. The study area experiences bimodeal rainfall with main rainy season from June to September and the short rainy season is from February to April. Climatically, the district is classified in to three ecological zones i.e. Dega (temperate), Woina-dega (sub-temperate) and Kola (tropical) which comprise 30.1%, 41.44%, and 28.46% respectively.

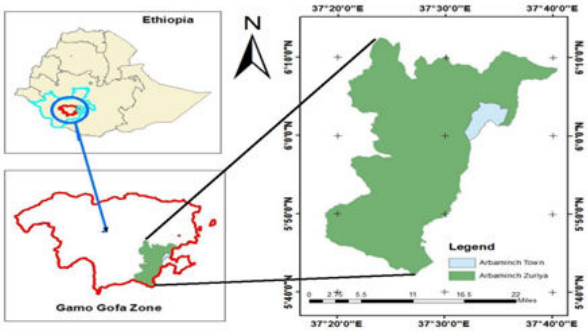

Figure 1. Location of the study areas.

Selection of informants

Household and key informant was selected purposively based on willingness of the livestock owners to participate in the study, livestock rearing experience and their social value which were essential to collect in-depth information on a number of issues. The optimum and manageable size of household and key-informants recommended in the Participatory Disease Surveillance (PDS) interview are assumed to be 10-15 persons and thus, 12 informants were determined in each selected kebeles and a total of 48 informants were included in the study. Community groups such as traditional leaders, farmers, community animal health workers, and kebele dwellers with other occupations who raise cattle were included as informants [4].

Study methods

Participatory epidemiological study was conducted from October 2019 to May 2020. Participatory appraisal tools were used to collect

all the required data and information in each kebeles. One of these tools was Semi-Structured Interviews (SSI), which was used to collect general background information on perceptions of the LSD. SSI was also used extensively in connection with other participatory epidemiological tools such as: clinical observation, matrix scoring, proportional piling, pair-wise ranking, and seasonal calendar.

Semi-structured interviews (SSI)

Background information was collected and the results were discussed with the participants using questions through the use of SSIs. The informant groups were specifically probed more on the disease of interest (LSD) with regard to the seasonal occurrence, impact (morbidity and mortality) and age group affected. During the course of the interview, probing questions were used to validate and gather more details on the topics and to improve the quality of information gathered. Probing questions were also be used to verify the internal consistency of information. Triangulation of the appraisal information with secondary data sources from district veterinary clinics and expert opinion were conducted to validate the information.

Proportional piling

Proportional piling was employed to identify and rank the five most important cattle diseases and to estimate relative morbidity and mortality caused by these diseases during the past one year. Before performing the proportional piling, informants were asked to classify the animals into different age groups. First, informant groups distribute proportion of pile 100 counters according to the impact each disease had on their livelihood to rank the five most important cattle diseases. Then, informant groups were asked to separate proportion of pile 100 counters to show sick and healthy animals during the last year. This result into sick and healthy piles of counters. Next, informants distributed the sick pile of counters for the five diseases and then separated in to animals surviving and animals dying. Matrix-scoring was used in community meetings to assess the ability livestock keepers to clinically diagnose cattle diseases (including LSD) and to determine whether keepers associated LSD with clinical signs. The five most important diseases were placed along the X-axis of the matrix. The indicators (clinical signs) were illustrated along the Y-axis of the matrix. Informants were asked to use a total of 25 counters to rate each sign based on how commonly it is seen in each disease. Pairwise ranking was used to understand the relative importance of diseases by comparing individual cattle diseases with each cattle disease one by one and through probing, to understand the impact of different diseases. The names of cattle diseases were written vertically (y-axis) and horizontally (x-axis). For each pair of diseases (x, y), participants were asked which disease was more important.

Seasonal calendar: Temporal variations in disease occurrence are a common aspect of epidemiological investigation. Seasonal calendars are a useful method for understanding local perceptions of seasonal variations in disease incidence. Seasonal calendars were used to determine the seasonal occurrence of LSD. The different seasons of the year was categorized according to the community's division category. Local names of the diseases were written on pieces of papers and placed along the Y-axis. The informants were then given 30 counters and asked to show the relative occurrence of each disease in each season.

Clinical observation: Clinical observation is an important part of the triangulation process in participatory epidemiology. Visual observation of LSD infected cattle was done in clinics and in villages in order to triangulate the participatory appraisal results with perception of the communities

Data management and analysis

The ordinal data obtained from the PE tools was stored in Microsoft Excel 2013 and exported to SPSS version 21 for analysis. A nonparametric statistical tests, Kendall's coefficient of concordance (W) and Friedman's rank test were used. Kendall's coefficient was measure of agreement between informant groups on the data obtained from proportional pilling, disease matrix scoring and seasonal scoring. Kendall's coefficient of concordance measures using values between 0 (no agreement) and 1 (complete agreement). Agreement are may be weak (W<0.26), moderate (W between 0.26 and 0.38) and good (W>0.38). Friedman's rank test was used to assess the agreements between informant groups on the data obtained from pairwise ranking.

Results

Types of livestock and their rank

The informants in all study area declared that the types of livestock reared in the study area were cattle, sheep, goats, donkey, and chicken. Then each kebele informants were ranked the livestock based on their perception of abundance and economic value for their livelihood.

Livestock ranked based on estimated number						
No	**Livestock species**	**Shara**	**Shele**	**Elgo**	**Wezeqa**	**Mode**
1	Cattle	1	1	1	1	1
2	Sheep	5	4	5	4	4
3	Goat	3	2	4	3	3
4	Donkey	4	5	3	5	5
5	Chicken	2	3	2	2	2
Livestock ranked based on economic importance						
1	Cattle	1	3	1	1	1
2	Sheep	5	4	5	4	4
3	Goat	3	1	2	2	2
4	Donkey	2	5	4	5	5
5	Chicken	4	2	3	3	3

Table 1. Types and rank of livestock based on population and importance.

Table 1 shows there was slight variation in the perception of the informants across the kebeles on the rank of livestock species based on estimated number and economic importance. Taking a value represented by the greatest number of farmers (mode or the most

frequent observed data), the informants were ranked based on the highest population size as cattle, chicken, goats, sheep, and donkey and ranked based on the economic value as cattle, goat, chicken, sheep and donkey.

Pairwise ranking

To the best of informant's knowledge, five major cattle diseases were indicated in the selected kebeles under the current study and the overall best rated five priority diseases (most frequently occurring diseases) that affected cattle in the study area in the previous year were Trypanosomiasis, FMD, Pneumonia Blackleg, and LSD (Table 2).

Cattle diseases	Study kebeles			
	Elgo	Shara	Shele	Wezeqa
	Rank of cattle disease importance			
Splenomegaly 0		0	5	0
FMD	2	3	0	3
Trypanosomiasis	5	5	3	5
Blackleg	3	2	2	4
LSD	1	1	1	2
Fascioliasis	0	0	4	0
Conjunctivitis	0	0	0	1
Pneumonia	4	4	0	0

Table 2. Relative importance of cattle diseases in the study area using pairwise ranking.

Disease morbidity rate

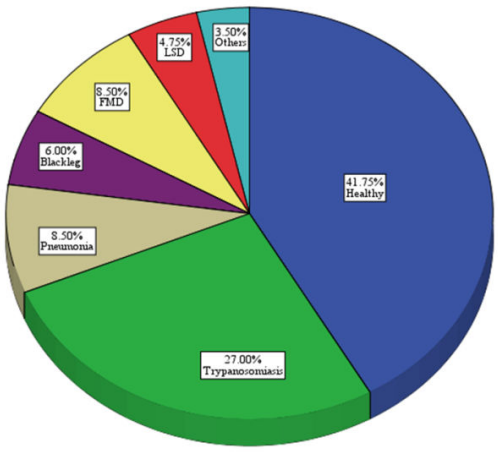

Figure 1. Informant's perception on morbidity of the five diseases of all age groups age-specific morbidity.

The farmers from selected study kebeles of Arba Minch zuria district were categorized cattle in the same age groups but name them differently (Table 3).

Age group (years)	Vernacular name		
	Elgo and Wezeqa	Shele	Shara
0-2 (Calves)	Galo	Watole	Mare
2-3 (Weaner)	Oka	Mara	Usi
3-4 (Young)	Uze /Ufano/Saba	Mirgo/ Uze (Female)	Gofano
>4 (Adult)	Mis/Miz	Korma	Gofano

Table 3. Local name of the four cattle age groups.

LSD incidence in specific age groups as estimated by the informants were illustrated. According to the result of proportional pilling exercise done by farmers, LSD had the highest incidence in calves and lowest in adult.

Disccusion

The ranking of livestock species in estimated number and economic value as indicated above, cattle were highly important for the livelihood of the rural people in the study area. Therefore, any development strategies of agricultural system in the study area should address the health problems of cattle. Cattle population was the highest in number than other livestock species in the study areas which might be due to suitable environment for cattle production and availability of feed resource. For rural community, cattle are source of food (milk and meat), cash income and keep as a capital asset. This result was in agreement with study result from Lalibela district. However, the result was in disagree with finding in Afar region, in which the highest population size was ranked goats, sheep, cattle, camel, donkey and chicken, and the priority ranking on the economic value from the highest to the least was goats, camel, cattle, sheep, donkey and chicken. Small ruminants made by far the greatest contribution to livestock-based livelihoods in all Afar pastoral community. The arguments to rank goats as a top priority in Afar region were might be due to goats can resist drought more than cattle; can give birth two times in a year; goats area quick source of money for the family expenditure. Sheep, cattle, goats, chicken and donkeys were identified as the common livestock species kept in the amongst Maasai pastoralists in Kenya which were also differ from the present study result. Reasons given for the higher preference for sheep in the area might include better drought tolerance, reproduced frequently and steady production of milk [5].

Other studies reported that sheep and goats had a higher advantage than other livestock in Sekota and Ziquala districts. This was probably due to these districts are semiarid with the harsh environment in which this species were expected to found predominantly than other livestock species. Table 2 indicated that the vernacular name and informant's perception on clinical sign of the same diseases were slightly varied from one kebele to another. The variation of vernacular name between kebeles was may be due to difference in language, which was Gamogna had been spoken in Shara and Shele; and zeyisegna had been spoken in Elgo and Wezeka. The reason behind the difference in clinical sign for the same disease was probably the difference in level of understanding and in depth observation of signs by the community. Some diseases were reported all across the kebeles, but other diseases were

specific to one or two kebele (s). These were also might be due to informant's ability of reminiscence during Semi Structured Interview (SSI). LSD was a much known and diagnosed disease by its "nodules on skin" clinical manifestation and was one of the diseases listed in all kebeles of the study area. In addition to multiple nodular lesions on the skin, lacrimation, erected hair, lameness, depression and reduction in milk yield were clinical manifestations declared by informants.

Ranking using proportional piling based on the impact on livelihood revealed that LSD was prioritized fifth in all kebeles. The disease was ranked third by Borana pastoralists. This was might be due to unrestricted movement of animals across borders- a common pastoralist ways of life, which was one of the predisposing factors that had a great role in maintenance of arthropod vector and transmission of the virus. Additionally, sharing of the same grazing and watering points were might be facilitated the spread of the disease in Borana area. Some studies reported that animals having a frequent contact with other animals at communal grazing and watering points are more at risk to acquire LSD. Contagious Bovine Pleuropneumonia (CBPP), Foot and Mouth Disease (FMD), LSD, Blackleg and Mastitis were the five common cattle diseases prioritized by Borana pastoralists. According to the finding of the major five diseases of cattle identified and prioritized in Dasanech district were Contagious Bovine Pleuro Pneumonia (CBPP), septicemic pasteurellosis, anthrax, FMD and black leg; and in Hammer district were septicemic pasteurellosis, trypanosomosis, black leg, CBPP and FMD. Maasai pastoralists of Kenya identified Malignant Catarrhal Fever (MCF), East Coast Fever (ECF), FMD, CBPP and AAT as five most prevalent diseases that affected cattle in their area. Cattle diseases according to their importance in Erzurum province were FMD, Blackleg, Brucellosis, Icterus and Anthrax and in Pakistan mastitis, FMD, internal parasites, hemorrhagic septicemia were ranked as major bovine health issues. This variation was might be due to difference in disease distribution as a result of agro climate effect and low treatment success rate.

Conclusion and Recommendations

There were very limited studies conducted using participatory methods in our country and effectiveness of this method still remains a question for researchers and for decision making. The present study was tried to show the practical importance of participatory epidemiological study in digging out root level information about LSD and the study also set out to investigate the knowledge of farmers on rank, morbidity, mortality and seasonality of LSD. The study revealed that the concordance between kebeles, veterinary literatures and research works had proven that farmers in Arba Minch district has knowledge about the common diseases affecting their cattle, such as LSD, they can identify clinical signs and diagnose diseases. Most of the informants were able to diagnose diseases with pathognomonic signs than with non-specific signs. Participants mentioned LSD as the fifth most important cattle disease in the study area in terms of impact on livelihoods. This research comes up with the findings that based on informant's scope of knowledge, LSD had 4.75% PE-morbidity and 2.15% PE-case fatality. The results of the seasonal calendar showed that LSD was more prevalent during short rainy season.

Existing veterinary knowledge among the rural farmers were enormous, and more tasks to be done to allow them to actively participate in the process of sharing their indigenous knowledge on disease outbreaks. Therefore, Participatory appraisal methods are useful in the process of digging out this knowledge and in control of cattle diseases such as LSD and also the findings of this study provide baseline data for regional LSD surveillance program in the country.

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