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Participatory Epidemiological Study on Major Livestock Diseases in Selected Districts of Korahay and Dollo Zones in the Somali Region, Ethiopia

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ABSTRACT

Livestock play a crucial role in the livelihood of pastoral communities in Ethiopia's Somali Region, but their productivity is hindered by widespread endemic and transboundary diseases. A participatory epidemiological study, conducted from June 25 to July 30, 2025, in five districts of the Korahay and Dollo zones, aimed to identify and prioritize major livestock diseases, assess seasonal trends, and understand community perceptions. Participatory methods such as focus group discussions, proportional piling, pairwise scoring, matrix scoring, and seasonal calendaring were used, involving livestock owners, herders, local veterinary personnel, and community leaders. Among livestock species, goats were ranked as the most important, followed by sheep, camels, cattle, and donkeys. The top five livestock diseases identified were Contagious Caprine Pleuropneumonia (14.2%), Peste des Petits Ruminants (13.0%), Hemorrhagic Septicemia (12.0%), Sheep and Goat Pox (11.0%), and Trypanosomiasis (9.8%) respectively. The study revealed a high and statistically significant agreement ($W = 0.886$, $p < 0.001$) across the five districts regarding the prioritization of major livestock diseases, indicating consistent perceptions throughout the study areas. CCPP and PPR were perceived as the most severe and transmissible, particularly during the summer season, due to livestock congregation around water sources. SGP and Trypanosomiasis peak in the spring and autumn seasons, respectively, while Hemorrhagic Septicemia occurs mostly in the winter. The main challenges identified by the community were animal disease as the top priority, followed by drought, limited access to veterinary services, and scarcity of feed and water resources. The study recommended the setup of mobile veterinary clinics, seasonal vaccination campaigns targeting CCPP and PPR, integrated participatory and conventional disease diagnosis, water harvesting for fodder production, pastoral education on biosecurity, collaboration with neighboring regions to control cross-border diseases, and the integration of livestock health programs. The study highlights the effectiveness of participatory epidemiology in guiding community-based solutions to livestock health challenges in pastoral areas of Ethiopia's Somali Region.

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Introduction

Background of the Study

In the Somali Region of Ethiopia, pastoral and agro-pastoral communities depend heavily on livestock for their livelihoods and food security. These communities rely on animals for social value, milk, meat, and income. However, livestock productivity and sustainability are frequently challenged by the occurrence of transboundary and endemic diseases [1]. Diseases such as peste des petits ruminants (PPR), contagious caprine pleuropneumonia (CCPP), and foot and mouth disease (FMD) pose significant threats to livestock health in the region [2,3].

Conventional disease surveillance methods are often inadequate in pastoral areas due to weak infrastructure, the mobility of communities, and limited veterinary services [4]. In such contexts, participatory epidemiology (PE) has emerged as a powerful tool. It allows local knowledge and perceptions to be integrated into disease investigation and control planning. Through methods like focus group discussions, matrix scoring, and proportional piling, communities can effectively prioritize diseases and describe their seasonal patterns, clinical signs, and impacts [4,5]. These methods help capture the lived experiences of livestock owners and herders, ensuring that interventions are culturally appropriate and context-sensitive.

Statement of Problems

Livestock play a crucial role in the livelihoods of communities in the Somali Region, providing food, income, and transport.

However, disease outbreaks significantly reduce productivity and lead to economic losses, especially in areas with limited veterinary support. The lack of effective surveillance and control measures exacerbates the impact of these diseases, particularly in this region where traditional disease monitoring is not sufficient. Participatory epidemiology offers a way to improve the relevance and responsiveness of animal health services in such settings. By involving local stakeholders in the identification and prioritization of livestock diseases, this approach ensures that disease control strategies are better aligned with the realities of pastoral communities. It also supports early warning systems and more targeted interventions, which are essential for maintaining livestock health and securing the livelihoods of pastoral families.

The study focuses on selected districts in the Korahay and Dollo zones of the Somali Region. As result, these areas were chosen for their relevance to the region's pastoral systems and the need for improved disease management strategies.

General Objective

The study has a general objective of assessing and documenting major livestock diseases using participatory epidemiological methods in selected districts of Korahay and Dollo zones in the Somali Region of Ethiopia, while, the goal is to enhance the effectiveness of disease surveillance, control strategies, and livestock health management systems in the region.

Specific Objectives

- Identifying and prioritizing major livestock diseases affecting various livestock species through participatory methods.
- Assessing the seasonal patterns of these diseases across the study areas.
- Evaluating the local community's knowledge of disease signs, symptoms, and their impact on livestock productivity.
- Recommending tailored animal health strategies that align with local disease dynamics and pastoral production systems.

Significance of Study

The significance of this study lies in its innovative approach to integrating local knowledge into livestock disease research. It addresses critical gaps in a region where traditional methods are insufficient. By involving livestock owners, herders, and community leaders, the study ensures that local expertise is recognized and utilized. The findings contribute to the development of more effective control measures, such as vaccinations, which are essential for managing livestock diseases in pastoral settings where mobility and environmental factors complicate disease management. This study is particularly relevant for improving livestock health and supporting pastoral livelihoods in the Somali Region. It provides a framework for enhancing disease surveillance and control strategies in the region, with the ultimate goal of protecting livestock and securing the well-being of pastoral communities.

Scope of the Study

The scope of this study focused on specific selected districts of Korahay and Dollo zones in the Somali Regional State of Ethiopia, prioritized the most impacting livestock diseases. Similarly, this study assessed the perception and knowledge of livestock owners how livestock diseases vary across study areas' seasons Spring (*Gu'ga*), Summer (*Xagaa*), Autumn (*Dayr*), and Winter (*Jilaal*) and evaluates community knowledge of disease signs, symptoms, and impacts. Beyond diseases, the study examines additional challenges hindering pastoralists offering a holistic perspective on livestock management issues in the Somali region. It provides a

practical framework for improving livestock health and supporting pastoral livelihoods in the Somali Region, Ethiopia.

Materials And Methods

Study Area Description

The Somali Regional State of Ethiopia, also known as the Somali Region, is Ethiopia's second- largest regional state, characterized by arid and semi-arid conditions. The region is divided into 11 regional zones, which are a predominantly pastoral area with a population mainly ethnic Somali the region faces recurring droughts, resource-based conflicts, and underdevelopment, but holds strategic geopolitical importance due to its location and cultural ties to neighboring countries. A participatory epidemiological study was conducted in selected districts of Korahay and Dollo zones, which are predominantly pastoral and heavily reliant on livestock for livelihoods. The Korahay Zone has 10 administrative districts and is prone to recurrent droughts and limited water sources. The Dollo Zone, located in the southeastern tip of the Somali Region, has 7 administrative districts and is arid and drought-prone. The population is predominantly nomadic pastoralists, relying on livestock for food, income, and trade.

Study Population comprised for livestock owners, herders, para veterinarians and community leaders from three selected districts in Korahay zone namely *Bodeley*, *Kabridahar* and *Kundunbur* and other two selected districts in Dollo zones namely *Danod* and *Galhamur* districts, each containing single kebele were targeted to participate this study effectively.

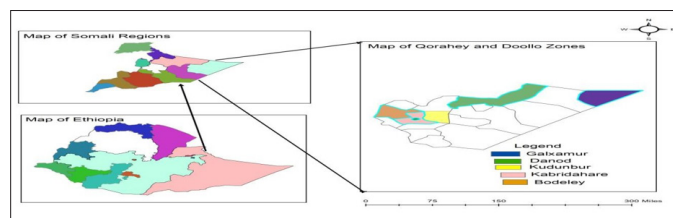


Figure 1: Map of study districts of Korahay & Dollo zones

Research Approach

A descriptive cross-sectional study was conducted from June 25 to July 30, 2025, in five districts within the Korahay and Dollo zones of the Somali Region in Ethiopia. This study employed a participatory epidemiological method to gather information on livestock diseases from local communities. The study aimed to include local knowledge and opinions about animal health to strengthen disease monitoring and management systems, particularly in pastoral areas where traditional surveillance methods are limited. The research team from the Kabridahar Regional Veterinary Laboratory focused on major livestock diseases affecting the targeted zones. Livestock owners, herders, para-veterinarians, and community leaders participated in focus group discussions held in each kebele of the five selected districts accordingly.

Sampling Technique

To carry out this study, a purposive sampling method was used to select the targeted districts and communities based on livestock population density, history of disease outbreaks from monthly reports of the Diseases Outbreak Vaccination Reporting II (DOVARII) system, and accessibility. The selection of kebeles within each district was done in consultation with district pastoral development office officials and their animal health experts. Within the selected study areas, the research team organized focus group discussions (FGDs) and key informant interviews to implement an accurate participatory disease surveillance (PDS) system.

Participatory Tools

The main participatory methods used in this study included semi-structured interviews, focus group discussions (FGDs), simple ranking, proportional piling to assess disease burden and affected livestock species, pairwise ranking and matrix scoring to evaluate disease symptoms and impacts, and seasonal calendars to identify peak seasons for livestock disease occurrences using participatory epidemiology methods [5].

These tools were used to identify priority livestock species, diseases, and their epidemiological patterns. Beads or stones were used in proportional piling to calculate priorities for livestock species and diseases. Participants were asked to distribute 100 beads or stones based on their preferences for different outcomes like livestock species and diseases. First, FGDs were asked to identify the five most important livestock species by allocating 100 beans or stones to the five species: Camel (*Geel*), Goat (*Ri'yo*), Sheep (*Lax*), and Cattle (*Lo'o*) and Donkeys (*Dameero*). Then, the most important livestock diseases were identified similarly, with FGDs describing the local/traditional names of each disease or syndrome and its clinical signs. These were used by local veterinarians facilitating the FGDs to translate the diseases or disease syndromes into their equivalent scientific names. Pairwise ranking and matrix scoring methods were used to prioritize and rank the five main livestock diseases and assess their impact on livestock species (see grouped images below in Figure 2).

The seasonal distribution of each of the five diseases affecting livestock species was discussed by dividing the scores for each disease into four seasons: Spring (*Gu'ga*), Summer (*Xagaa*), Autumn/Fall (*Dayr*), and Winter (*Jilaal*), based on the importance of the disease in each season within the study districts. Participants in FGDs defined that Spring (*Gu'ga*) is the main rainy season (March to May). Summer (*Xagaa*) is the dry season (July to September), Autumn/Fall (*Dayr*) is the short rainy season (October to November), and Winter (*Jilaal*) is the harsh dry season (December to March) every year (see grouped images in Figure 3).

Data Collection Methods and Analysis

A team of trained veterinarians, research experts, and local facilitators conducted the study, with support from local animal health workers to build community trust. A mixed-methods approach was used for data analysis. Qualitative data from focus group discussions was categorized to describe diseases and prioritize them by livestock species. Quantitative data was analyzed using descriptive statistics in STATA version 14, focusing on scores from FGDs by groups, districts, and seasons. Preferences of pastoralists were measured by allocating beads or stones to different categories. The analyzed data was accurately interpreted and presented in charts and tables accordingly.

Result Interpretations

Priority of Livestock Species Populations Kept

This study ranks five livestock species, including Camels, Goats, Sheep, Cattle, and Donkeys, based on pastoral perceptions across five selected districts namely Bodelley, Kabridahar, Kudunbur, Danod, and Galhamur. Thus, in terms of livestock population for priority of livestock species numbers, Goats were ranked first, followed by Sheep, Camels, Cattle, and Donkeys, with overall ranking derived from district data displayed in (see below table 1).

Table 1: Priority of Livestock Species Population Numbers at Study Districts of Korahay and Dollo Zones

Districts	Camels	Goats	Sheep	Cattle	Donkeys	Overall Ranking
Bodelley	3	1	2	4	5	3
Kabridahar	3	1	2	4	5	1
Kudunbur	3	1	2	4	5	2
Danod	3	1	2	4	5	4
Galhamur	3	1	2	4	5	5
Overall ranking	3	1	2	4	5	-

Priority of Diseases Affecting Livestock Species

Simple Ranking Method

Through simple ranking method, a Fifteen (15) animal diseases or disease syndromes were identified by the FGD groups, reflecting the importance of these diseases impacting their livestock species including Camels, goats, sheep and cattle. Major livestock disease listed by pastoralist were as follows; Contagious Caprine Pluerepnumonia (*Sanbab riyaha*), Peste des Petits Ruminants (*Duufle*), Hemorrhagic septicemia (*Qanje*), Sheep & Goat Pox (*Furaqa ariga*), Trypanosomiasis (*Dhukan*), Lumpy Skin Disease (*Furaqa lo'da*). Camel Pox (*Furaqa geela*), Anthrax (*Kudka*), Foot and Mouth Disease (*Cabeeb*), Contagious Bovine Plueropnumonia (*Sanbakka lo'da*), Ectoparasites (*Dulinka maqaaarka*), Endoparasites (*Gooryaano*), Orf virus (*Af-garafow*), Black leg (*Garbogooye*) and Babesiosis (*Kaadidhiig*).

Proportional Piling Method

From 15 major livestock diseases listed by participants through simple ranking method, Similarly, proportional piling method were employed using focus groups across the selected five study districts. Participants were asked to allocate a total of 100 stones or beads based on the perceived relative frequency and impact of major livestock diseases affecting their livestock populations. Thus, the results of the proportional piling of 15 livestock diseases listed were summarized in below (table 2), revealing that Contagious Caprine Pleuropneumonia (CCPP) was the most frequently reported disease, accounting for 14.2% , followed by Peste des Petits Ruminants (PPR) (13.0%) , Hemorrhagic



Figure 2: Grouped Images of Proportional Piling, Pairwise Ranking and Matrix Score in FGDs in Study Areas (Bodeley, Kabridahar, kudunbur, Danod and Galhamur)



Figure 3: Grouped Images of Livestock Diseases Seasonal Ranking in FGDs (Bodeley, Kabridahar, kudunbur, Galhamur)

Septicemia (HS) (12.0%), Sheep and Goat Pox (SGP) (11.0%) and Trypanosomiasis (9.8%), were top five livestock diseases frequently affecting the livestock species at study districts. Other notable diseases included Camel Pox (9.2%), Anthrax (8.0%), Ectoparasites (5.6%), Contagious Bovine Pleuropneumonia (CBPP) (4.8%), Lumpy Skin Disease (LSD) (4.0%), Foot and Mouth Disease (FMD) (2.6%), Endoparasite (2.0%), Orf virus (1.6%), Blackleg (1.2%), and Babesiosis (1%) respectively. Similarly, the result of proportional pilling frequency major prioritized livestock diseases showed statistically significant as the the Kendall's coefficient of concordance ($W = 0.886, p < 0.001^*$) revealed high inter-districts agreements across the five study districts accordingly.

Table 2: Overall Proportional Pilling Frequencies and Percentages (%) of Major Livestock Diseases Across Five Study Districts (Bodeley, Kudunbur, Kabridahar, Danod and Galhamur)

Major Livestock Diseases	Local names	Frequency	Percentage (%)
Contagious Caprine Pleuropneumonia (CCPP)	<i>Sanbab riyaha</i>	71	14.2
Peste des Petits Ruminants (PPR)	<i>Duufle</i>	65	13.0
Hemorrhagic Septicemia	<i>Qanje</i>	60	12.0
Sheep and Goat Pox (SGP)	<i>Furaqa adhiga</i>	55	11.0
Trypanosomiasis	<i>Dhukaan</i>	49	9.8
Camel Pox	<i>Furaqa geela</i>	46	9.2
Anthrax	<i>Kudka</i>	40	8.0
Ectoparasites	<i>Dulinka maqaarka</i>	28	5.6
Contagious Bovine Pleuropneumonia (CBPP)	<i>Sanbaska lo'da</i>	24	4.8
Lumpy Skin Disease (LSD)	<i>Furaqa lo'da</i>	20	4.0
Foot and Mouth Disease (FMD)	<i>Cabeeb</i>	13	2.6
Endoparasites	<i>Gooryaanka</i>	10	2.0
Orf Virus	<i>Af-garafow</i>	8	1.6
Black Leg	<i>Garbogooye</i>	6	1.2
Babesiosis	<i>Kaadidhiiga</i>	5	1.0
Total Score		500	100.0
Overall: Kendall's coefficient of concordance ($W = 0.886, p < 0.001^*$), Strong agreement			

Pairwise Agreement Matrix

This study assesses the pairwise agreement matrix in the frequency of five prevalent livestock disease Contagious Caprine Pleuropneumonia (CCPP, *Sanbaska ri'yaha*), Peste des Petits Ruminants (PPR, *Duufle*), Haemorrhagic Septicemia (*Qanje*), Sheep and Goat Pox (SGP, *Furaqa ariga*), and Trypanosomiasis (*Dhukan*) across five districts (Bodelley, Kabridahar, Kudunbur, Danod, and Galhamur) in Korahay and Dollo Zones of Somali region, Ethiopia. This study applied pairwise ranking to identify and rank the top five livestock diseases across five districts (Bodeley, Kabridahar, Kundur, Danod, and Galhamur) in the Somali Region of Ethiopia. Contagious caprine pleuropneumonia (CCPP) and peste des petits ruminants (PPR) emerged as the highest priorities with total scores of 24 and 21 respectively, with standard deviation of 0.45 for both diseases. While, Hemorrhagic septicemia (HS), Sheep and Goat Pox (SGP), and Trypanosomiasis ranked lower scores of 15, 10, and 5 respectively, with standard deviation of 0.00 for Hemorrhagic septicemia (HS), Sheep and Goat Pox (SGP), and Trypanosomiasis, reflecting consistent perceptions. Low variability indicates robust pastoralists community agreement. Moreover, the Kendall's coefficient of concordance ($W = 0.95, p < 0.001$) confirmed high inter-district alignment, underscoring the reliability of participatory approaches in pastoral systems. (see below table 3).

Table 3: Pairwise Ranking Scores of Top Livestock Diseases at Study Districts of (Bodeley, Kabridahar, Kudunbur, Danod and Galhamur) in Korahay and Dollo zones

Top 5 livestock Diseases	Local names	Total Score	Overall Rank	Standard Deviation
Contagious Caprine Pleuropneumonia	<i>Sanbab riyaha</i>	24	1	0.45
Peste des Petits Ruminants	<i>Duufle</i>	21	2	0.45
Hemorrhagic Septicemia	<i>Qanje</i>	15	3	0.00
Sheep and Goat Pox	<i>Furaqa adhiga</i>	10	4	0.00
Trypanosomiasis	<i>Dhukaan</i>	5	5	0.00
Overall: Kendall's coefficient of concordance ($W = 0.95, p < 0.001^*$), Strong agreement				

Matrix Scoring Method

Similarly, a well-structured assessment of pastoralists' perceptions using matrix score was conducted to evaluate the impact of five major livestock diseases Contagious Caprine Pleuropneumonia (CCPP), Peste des Petits Ruminants (PPR), Haemorrhagic Septicemia, Sheep and Goat Pox (SGP), and Trypanosomiasis across five selected districts of Korahay and Dollo zones in the Somali Region, Ethiopia.

Therefore, Scores out of 100 counters of type of disease impact per each livestock disease highlighted that CCPP and PPR's dominated the morbidity and mortality rates in which 27% and 22% for CCPP morbidity/mortality rate), 18% and 21% for PPR morbidity/mortality rate, HS in species-wide effects (27%), and Trypanosomiasis in zoonotic risks (implied low but cross-species). Also, this study revealed high percentages for severity and transmission rate in CCPP (14.2% and 11.4%) and PPR (12.4% and 11.2%) as shown in below table 4.

Table 4: Percentage of Pastoralist Determining Reasons for Ranking Top Diseases Affecting Their Livestock Species Using

Impacts of Disease	CCPP (%)	PPR (%)	HS (%)	SGP (%)	Trypanosomiasis (%)	Total
Affects all species	0.0	13	27	10	25	75.0
Affects all ages	20	14	22	20	20	96.0
Severity	14.2	12.8	12	23.4	19	81.4
Mortality rate	22	18	14	12.4	10	76.4
Morbidity rate	27	21	9.8	10.6	11	79.4
Transmission rate	11.4	11.4	8.2	9.2	5.0	45.2
Reduced productivity	5.4	9.8	4.0	8.0	7.0	34.2
Zoonotic risks	0.0	0.0	3.0	5.2	3.0	11.2
Overall Score per Disease	100	100	100	100	100	500

Matrix scoring method study districts of Korahay and Dollo zones

Seasonal Calendaring Method

In addition, the seasonal distribution of the top five livestock diseases was assessed across five study districts namely; Bodeley, Kabri-dahar, Kudunbur, Danod, and Galhamur based on participatory ranking data using 10 stones or beads per each disease for countering the frequencies occurrence of each disease in different seasonal calendars through Focus group Discussion. Then-after, the mean scores and standard deviations (SD) for each disease were calculated for the four seasons: Spring (*Gu'ga*), Summer (*Xagaa*), Autumn (*Dayr*), and Winter (*Jilaal*). The results revealed clear seasonal patterns in disease occurrence.

Consequently, Contagious Caprine Pleuropneumonia (CCPP) showed the highest mean scores during Summer (4.0 ± 0.0) and Autumn (3.4 ± 0.5), indicating a peak in these seasons, while lower scores were observed in Spring (1.2 ± 0.4) and Winter (1.4 ± 0.5). Peste des Petits Ruminants (PPR) followed a similar trend with elevated scores in Summer (4.6 ± 0.5) and Autumn (3.0 ± 0.0), and minimal presence during Spring and Winter. In addition, Hemorrhagic Septicemia (HS) presented a more balanced seasonal occurrence, with higher scores in Summer (2.6 ± 1.0) and Winter (4.2 ± 0.4). Sheep and Goat Pox (SGP) were consistently reported, peaking in Spring (4.4 ± 0.5), but showed a decline in Autumn (1.6 ± 0.5). Trypanosomiasis showed elevated scores in Spring (3.4 ± 0.5) and Autumn (3.6 ± 1.2), which may reflect the influence of ecological factors such as vector abundance during and after the rainy season.

Moreover, the statistical analysis using Kendall's coefficient of concordance yielded $W = 0.887$ ($P < 0.001$) was significant indicating a strong level of agreement among districts regarding seasonal disease ranking. These findings underline the importance of incorporating season-specific strategies in livestock health planning and resource allocation, particularly in preparation for disease peaks in different seasonal pattern.

Table 5: Overall Mean Scores and Standard Deviations of Seasonal Patterns of Top Five Livestock Diseases at Study Districts in Korahay and Dollo Zones using Matrix Scoring Methods

Top 5 Livestock Diseases	Local names	Spring (Gu'ga) (Mean ± SD)	Summer (Xagaa) (Mean ± SD)	Autumn (Dayr) (Mean ± SD)	Winter (Jilaal) (Mean ± SD)
Contagious Caprine Pleuropneumonia	<i>Sanbab riyaha</i>	1.2 ± 0.4	4.0 ± 0.0	3.4 ± 0.5	1.4 ± 0.5
Peste des Petits Ruminants	<i>Duufle</i>	1.0 ± 0.0	4.6 ± 0.5	3.0 ± 0.0	1.4 ± 0.5
Hemorrhagic Septicemia	<i>Qanje</i>	1.2 ± 0.4	2.6 ± 1.0	2.0 ± 0.9	4.2 ± 0.4
Sheep and Goat Pox	<i>Furaqa adhiga</i>	4.4 ± 0.5	1.2 ± 0.4	3.0 ± 0.0	1.6 ± 0.5
Trypanosomiasis	<i>Dhukaan</i>	3.4 ± 0.5	1.0 ± 0.0	3.6 ± 0.5	2.0 ± 0.0
Overall agreement		$W = 0.887, P < 0.001^*$, Strong agreement			

Furthermore, the according responses of pastoral study participants during FGDs on frequency of the five livestock diseases on seasonal patterns across the five study districts (Bodeley, Kabri-dahar, Kudunbur, Danod, and Galhamur) with their result analysis revealed distinct epidemiological associations between disease occurrence and climatic seasonal factors as shown below table 6.

Therefore, CCPP and PPR consistently demonstrated peak mean scores during the Summer (Xagaa) season. This periodicity is

primarily attributed to environmental stress like dust and nutritional deficiency leading to immunosuppression and management practices including herding congregation around scarce resources, which significantly increase animal density and facilitate direct contact transmission of these highly contagious pathogens. Similarly, Sheep and Goat Pox (SGP) and Trypanosomiasis demonstrated highest peak mean scores during spring (Gu'ga) and Autumn (Dayr) respectively, particularly, the occurrence optimal ecological conditions including; high humidity and dense vegetation required for the proliferation and survival biting flies like (Tabanus and Tsetse fly vectors). Moreover, the peak in Hemorrhagic Septicemia (HS) was observed in winter (Jilaal) season was associated with the environmental stress such as sudden changes in temperature/humidity and possible enhanced pathogen survival linked to heavy rainfall period.

Table 6: Mean Scores in Peak Seasonal Patterns of Top Five Livestock Diseases Across Study Districts in Korahay and Dollo Zones

Livestock Diseases	Local names	Peak Season	Mean Scores	Bubble chart Size
Contagious Caprine Pleuropneumonia (CCPP)	<i>Sanbab riyaha</i>	Summer (Xagaa)	4.0	
Peste des Petits Ruminants (PPR)	<i>Duufle</i>	Summer (Xagaa)	4.6	
Hemorrhagic Septicemia (HS)	<i>Qanje</i>	Winter (Jilaal)	4.2	
Sheep and Goat Pox (SGP)	<i>Furaqa adhiga</i>	Spring (Gu'ga)	4.4	
Trypanosomiasis	<i>Dhukaan</i>	Autumn (Dayr)	3.6	

Assessing Livestock Constraints at Study Areas

Similarly, this study displayed the matrix scoring analysis of major livestock constraints across five districts namely; Bodeley, Kabridahar, Kudunbur, Danod, and Galhamur. This study analyzes the ranking of major livestock constraints such as: Shortage of feed, Water scarcity, Poor veterinary service, Animal diseases, and Droughts across five districts. Constraints were ranked from 1 (most severe) to 5 (least severe) based on stakeholder assessments, with total scores and overall ranks calculated. The analysis conducted identified that animal diseases (1st rank) and concurrent droughts (2nd rank) as the most severe constraints followed by poor veterinary services (3rd rank), shortage of feed (4th rank) and water scarcity (5th rank) respectively shown as below table 7.

Table 7: Describes the Ranking Scores of Livestock Constraints from Study Districts of Korahay and Dollo Zones

Livestock constraints	Targeted study districts					Total	Overall rank
	<i>Bodeley</i>	<i>Kabridahar</i>	<i>Kudunbur</i>	<i>Danod</i>	<i>Galhamur</i>		
Short of feed	3	2	3	3	3	14	4
Water scarcity	5	5	4	2	5	21	5
Poor Veterinary services	4	3	2	5	4	18	3
Animal Diseases	1	2	1	2	2	8	1
Droughts	2	4	3	1	1	11	2

Discussions

This participatory epidemiological study offers valuable insights into the major livestock diseases, their seasonal patterns, and the primary constraints affecting pastoral communities in the Korahay and Dollo zones of the Somali Region, Ethiopia. Utilizing focus group discussions, proportional piling, and matrix scoring, the study effectively harnessed local knowledge to identify priority diseases and challenges. This approach aligns with research emphasizing the importance of participatory epidemiology (PE) in capturing community perspectives for disease surveillance and control in East Africa [5].

The study identified Contagious Caprine Pleuropneumonia (CCPP), Peste des Petits Ruminants (PPR), Haemorrhagic Septicemia, Sheep and Goat Pox (SGP), and Trypanosomiasis as the top five livestock diseases at selected districts of Korahay and Dollo zones in the Somali regional state of Ethiopia. These findings are consistent with study conducted by other researchers who also prioritized CCPP and PPR in Ethiopian pastoral systems using similar participatory methods [6]. The prominence of these diseases highlights their economic and health significance in small

ruminant populations, a critical livelihood asset in the region [2,6-9].

Seasonal analysis revealed that CCPP and PPR peak during the summer (Xagaa) season, likely due to increased livestock movement and congregation around scarce water points, a pattern supported by [5]. This seasonal dynamic underscore the role of environmental stressors, such as drought, in amplifying disease transmission, necessitating timely interventions like vaccination campaigns [7,8].

The study pinpointed that the occurrences of animal diseases and droughts as the most severe constraints, followed by poor veterinary services, feed shortages, and water scarcity. These findings is agreement with study reported by who identified similar challenges in Kenya's pastoral areas, indicating shared vulnerabilities across East African pastoral systems [10]. The limited access to veterinary services, a recurring issue in remote regions, exacerbates disease impacts and highlights the need for improved animal health infrastructure.

The high perceived impact of CCPP and PPR, in terms of severity and mortality/morbidity rates aligns with their status as transboundary diseases with significant economic consequences [6-9]. Targeted vaccination programs, as recommended for PPR control, could mitigate these impacts.

Additionally, the participatory approach employed in this study enhances community engagement, a strategy endorsed for tailoring interventions to local contexts [5].

While participatory methods offer rich qualitative insights for its innovative approach to integrate local knowledge into livestock disease research, addressing critical gaps in remote pastoral areas where conventional methods are insufficient. However, there might be several important limitations in the study that should be considered when interpreting its findings. Firstly, the research relied predominantly on qualitative participatory methods such as focus group discussions, proportional piling, and scoring tools. While these approaches are effective for capturing local perceptions and indigenous knowledge, they are inherently subjective and prone to personal bias and recall errors, especially in the absence of objective verification. Secondly, the geographic coverage of the study was limited to five districts across two zones, which restricts the generalizability of the results to the wider Somali Region or to other pastoral areas in Ethiopia.

Another significant limitation is the absence of laboratory diagnostic confirmation for the diseases reported by participants. This lack of scientific verification may affect the accuracy of the identified disease prevalence and severity. Additionally, the study was conducted during a narrow time frame (June–July), which may not reflect seasonal variations in disease patterns throughout the year. Lastly, there is the possibility of inaccurate classification of diseases, given the overlapping clinical signs and the absence of veterinary diagnostic support in the field.

Therefore, addressing these limitations in future research such as incorporating laboratory diagnostics, expanding geographic coverage, and conducting multi-seasonal assessments will be crucial to enhancing the reliability of data and informing more effective disease control strategies in pastoral regions.

Conclusion and Recommendations

This participatory epidemiological study highlights key livestock diseases affecting pastoral communities from five selected districts of Korahay and Dollo zones in the Somali Region of Ethiopia, with Contagious Caprine Pleuropneumonia (CCPP) and Peste des Petits Ruminants (PPR) respectively being the most frequently prioritized livestock diseases followed by Haemorrhagic Septicemia, Sheep and Goat Pox, and Trypanosomiasis respectively. The findings provide important insights into disease prioritization, seasonal patterns, and local knowledge that can support improved disease control strategies.

Therefore, based on the above-mentioned conclusion, the following recommendations were designed to improve livestock health, productivity, and resilience in the study areas accordingly.

- Standard mobile veterinary clinics should be established to enhance access to veterinary care in remote pastoral areas.
- Regular vaccination campaigns for high-impact diseases like Contagious Caprine Pleuropneumonia (CCPP) and Peste des Petits Ruminants (PPR) and timed to seasonal disease peaks should be implemented.
- Routine Participatory Disease Surveillance and conventional diagnostic methods should be combined to improve animal

disease detection and early reporting systems.

- Multiple water harvesting facilities should be constructed to promote fodder production and address water scarcity and feed shortages.
- Pastoral education programs on livestock disease recognition, bio security, and reporting, leveraging pastoralists' local knowledge should be conducted.
- Foster collaboration should be created with neighboring regions and countries to control trans-boundary animal diseases.
- Livestock health interventions in broader poverty reduction and rural development initiatives should be embedded.

Conflict of Interest

The authors declared that there is no conflict of interest.

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Authors' Contributions

A.A.M. (Ahmed Abdi Mohomed) and A.A.Mu. (Ahmed Ali Muhumed) conceptualized and designed the study. N.M.B. (Najib Ma'alin Badal), A.I.B. (Ade Ibrahim Barkadle), Y.Y. (Yahye Yasin), H.A.A. (Hassan Abdi Arog), and M.H.A. (Mohamednur Husen Ahmed) were responsible for field data collection, community engagement, and preliminary data processing. A.A.M. and A.A.Mu. drafted the main manuscript. All authors contributed to the analysis, revised the manuscript critically for intellectual content, and approved the final version.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are not publicly available due to privacy agreements with participants but are available from the corresponding author upon reasonable request.

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