

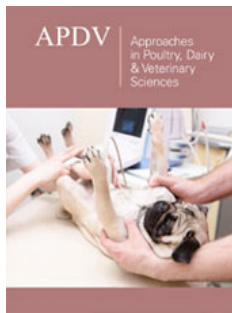
Sero-Epidemiological Survey on Major Cattle Diseases in Awsiresu Zone of Afar Region

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Abstract

Ethiopia's Afar region, crucial for its livestock-based economy, faces significant challenges due to cattle diseases impacting productivity and contributing to economic losses. This study evaluated local perceptions of cattle diseases, identified major health issues, and assessed their sero-prevalence in the Awsiresu zone. Using participatory epidemiological methods and serological testing, the research highlighted Contagious Bovine Pleuropneumonia (CBPP), ectoparasites, and Lumpy Skin Disease (LSD) as critical concerns. CBPP was prevalent in Asayita, Mille, and Dubti, while ectoparasites were most troublesome in Chifra. LSD affected cattle primarily between one and three years old. Serological results indicated an overall CBPP prevalence of 11.9%, with highest rates in Mille and lowest in Chifra, and a high Foot-and-Mouth Disease (FMD) prevalence of 77.6%. Gender and age did not significantly influence disease prevalence. The study underscores the need for targeted interventions such as vaccination and improved management practices, emphasizing community-based approaches for effective disease control and improved livestock productivity in the region

Keywords: Afar region; Cattle diseases; Ethiopia; Participatory epidemiology; Sero-prevalence

Introduction

Ethiopia's agricultural sector, critical for both highlanders and lowlanders, is heavily reliant on livestock, but economic returns are undermined by diseases, poor management, and low genetic potential of indigenous breeds. These diseases negatively impact herd productivity through animal deaths, weight loss, slow growth, and poor fertility, leading to suboptimal outcomes [1-3]. In sub-Saharan Africa, livestock disease-related losses are estimated at about \$2 billion annually, equally divided between direct mortality and indirect reductions in productivity [4]. In the Afar region, livestock production struggles due to declining pasture productivity caused by recurrent drought, land degradation, and other environmental stressors, which exacerbate disease prevalence and heighten poverty among pastoralists [5-8].

The limited and unreliable information on cattle diseases in Afar, due to accessibility and resource constraints, underscores the need for comprehensive data collection. A survey identified 19 major diseases, with ectoparasites, lumpy skin disease, CBPP, and anthrax being the most prevalent. Effective disease management requires both active and passive surveillance methods, including participatory appraisal (PA), which facilitates the collection of qualitative data and the development of targeted interventions [1,9,10]. Accurate and detailed data on disease types, prevalence, risk factors, and transmission are essential for designing effective preventive and control strategies, ultimately enhancing livestock health and productivity and contributing to poverty alleviation in the region [2,8-10].

Materials and Methods

Study area

The study was conducted in Awsirasu (Administrative Zone 1) in the Afar Region, Ethiopia. The area has a population of 410,790 and a density of 13.58 people/km². The population is primarily Afar (88.52%) and Amhara (9.97%), with Afar and Amharic as the main languages. The majorities (96.55%) are Muslim, and 43.47% are pastoralists. Key features include the Awash River, its tributaries, and a chain of six lakes [6].

Study population

The study targeted pastoralists and cattle in the Awsirasu zone.

Study Design, Sampling Strategies, and Sample Size Determination

- A. Study Design: A cross-sectional survey using participatory epidemiological techniques and a serological study was conducted from June 2020 to February 2021.
- B. Sampling Technique: Four districts (Chifra, Mile, Asayta, and Dubti) were purposively selected for high cattle populations. Two pastoral associations per district were chosen by lottery, and two focus group discussions (FGDs) were conducted in each, totaling 80 participants. For serological studies, 210 cattle were sampled.
- C. Sample Size Determination: For diseases CBPP, LSD, and FMD, sample size was calculated using Thrusfield’s formula with a 50% expected prevalence. The formula required 384 samples, but 210 were collected.

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

D. Study Procedure and Methodology

- E. Proportional Piling: Informants ranked ten cattle diseases using 100 stones based on their impact, discussing clinical signs and transmission.
- F. Seasonal Calendar: Seasons were represented symbolically, and informants used 100 stones to indicate disease occurrences.
- G. Blood Sample Collection: 10ml of blood was collected from the jugular vein, stored overnight for serum separation, and analyzed at the National Veterinary Institute, Ethiopia. Data on age, sex, and geo-reference were recorded.
- H. Serological Identification: Standard tests used were c-ELISA for CBPP, 3ABC ELISA for FMD, and Serum Neutralization Test for LSD

Data Analysis

Participatory epidemiology data was entered to EPI INFO software and was exported to SPSS (version 23) computer program. Both analytical and descriptive statistics were used to analyze the data. Serological results were analyzed by using SPSS (version 20) computer program. The statistical tests like descriptive statistics and chi-square test of independence were used.

Result

District level prioritization of common cattle diseases

The survey revealed that CBPP was the priority disease in Asayita, Mille and Dubti districts while ectoparasites take the priority in Chifra district. furthermore, skin diseases (ectoparasites and LSD) were major concerns for cattle herders across the community. The table and key findings provide a clear overview of the primary and secondary diseases affecting cattle in these districts, highlighting the regional variations in disease prevalence and priority (Table 1).

Table 1: District level prioritization of common cattle diseases.

Disease Rank	Asayita	Chifra	Mille	Dubti
1	CBPP	Ectoparasite	CBPP	CBPP
2	Ectoparasite	Endoparasite	LSD	Ectoparasite
3	LSD	LSD	Endoparasite	LSD
4	Endoparasite	CBPP	Ectoparasite	Pasteurellosis
5	TB	Typanosomiasis	FMD	TB
6	Pasteurellosis	FMD	Pasteurellosis	Endoparasite
7	FMD	Pasteurellosis	TB	FMD
8	Trypanosomiasis	TB	Trypanosomiasis	Mastitis
9	Mastitis	Mastitis	Mastitis	Trypanosomiasis
10	BRD	Anthrax	Anthrax	BRD

Zonal level prioritization of cattle diseases, seasonal occurrence and affected age groups

The prioritization of cattle diseases at the zonal level revealed that CBPP (Contagious Bovine Pleuropneumonia), ectoparasites,

and LSD (Lumpy Skin Disease) were the top three concerns among cattle herders. Ectoparasite infestation and mastitis were identified as year-round issues. Age-specific disease prevalence showed that ectoparasites primarily affected calves under 6 months, while

tuberculosis and mastitis were more common in cattle over 3 years. CBPP predominantly impacted animals below 1 year of age, peaking in March and April. These findings emphasize the need for tailored interventions, such as regular vaccination and veterinary care for

CBPP, year-round ectoparasite control measures, and improved husbandry practices to manage mastitis. The results also highlight the importance of community-based approaches to enhance disease management and control in these regions (Table 2).

Table 2: Prioritization of cattle diseases, seasonal occurrence and affected age groups.

Disease (Local name)	Score	Seasonal Occurrence				Affected Age Group			
		July- Sept	Oct- Feb	Mar- Apr	May- June	0-6 months (Score)	6-12 months (Score)	1-3 years (Score)	More than 3 years (Score)
CBPP (Gubullo)	109	X	x	✓	✓	25	50	15	10
Ectoparasite (Agara)	100	✓	✓	✓	✓	40	10	30	20
LSD (kizi)	91	✓	x	✓	x	-	10	60	30
Endoparasite (Andero)	82	✓	x	x	x	-	20	30	50
TB (mesengle)	60	X	x	✓	✓	-	-	30	70
Pasteurellosis (lahi caughtu)	59	✓	x	✓	✓	20	20	30	30
FMD (abebi, eba ke aff biaka)	55	x	x	✓	✓	10	10	40	40
Trypanosomiasis (degar biak)	39	✓	✓	x	x	-	20	40	40
Mastitis (koda, angu biaka)	29	✓	✓	✓	✓	-	-	30	70
BRD(afihina)	9	✓	✓	✓	✓	10	30	30	30

Clinical signs and transmission methods of prioritized diseases

The prioritized cattle diseases, as identified by FGD participants, exhibit distinct clinical signs and transmission methods (Table 3).

Table 3: Clinical signs and Transmission methods of prioritized diseases.

Disease (Local name)	Clinical signs, description of disease	Transmission methods
CBPP (Gubullo)	Cough, nasal discharge, depression, high temperature, death within few days	Contact
Ectoparasite (Agara)	Loss of hair, the presence of small organisms, loss of body weight, rubbing their skin, skin wound	Air, contact, insect
LSD (kizi)	Multiple swelling in the skin of the animal, high temperature, depression	Air, contact, insect
Endoparasite (Andero)	Loss of body condition, watery feces for long time, coughing, swelling around the neck	Contact, air
TB (mesengle)	Great Loss of body weight, coughing for long time, diarrhea, decrease productivity	Contact, air
Pasteurellosis (lahi caughtu)	Depression, nasal discharge, high temperature, decrease desire to eat	Contact, air
FMD (abebi, eba ke aff biaka)	Loss of feed intake, wound in the mouth and leg, high temperature	Air
Trypanosomiasis (degar biak)	Marked loss of body weight, watery feces, loss of hair, weakness, decrease productivity	Fly
Mastitis (koda, angu biaka)	Swelling of the udder, milk with blood or pus, closed teat, drying of the udder, production loss	Contact
BRD (afihina)	Difficulty in breathing, death in short period (BRD)	-

Description of explanatory variables

From a total of 210 animals 28.6% animals was from chifra district while assayita, mille and dubti contributing 23.8% of

animals independently. Regarding with sex of animals, 84.3% of animals was females and 15.7% of animals were males. Moreover, 76.7% and 23.3% of animals was from adult and young age categories (Table 4).

Table 4: Description of explanatory variables.

Variables		Frequency (%)
District	Dubti	50(23.8)
	Asayita	50(23.8)
	Mille	50(23.8)
	Chifera	60(28.6)
Sex	Female	177(84.3)
	Male	33(15.7)
Age	Young	49(23.3)
	Adult	161(76.7)
	Total	210(100)

Prevalence of CBPP with respect to associated risk factors

The overall prevalence of CBPP antibody was 11.9% in zone one of afar region in the study period. The highest prevalence rate was recorded from mille (28%) and the lowest was from Chifra (3.3) with a significant association between districts. Age and sex was insignificantly associated with prevalence of CBBP antibody (Table 5).

Table 5: Prevalence of CBPP with respect to associated risk factors.

Variables		Test result		X ²	p-value
		Negative	Positive		
District	Dubti	45(90%)	5(10%)	17,454	0.001
	Asayita	46(92)	4(8%)		
	Mille	36(72)	14(28%)		
	Chifera	58(96.7)	2(3.3)		
Sex	Female	156(88.1)	21(11.9)	0.002	0.967
	Male	29(87.9)	4(12.1)		
Age	Adult	143(88.3)	18(11.2)	0.345	0.557
	Young	42(85.7)	7(14.3)		
Total		185(88.1)	25(11.9)		

Prevalence of FMDV with respect to associated risk factors

The overall prevalence of bovine FMD virus antibody was 77.6% in zone one of afar region in the study period. The highest prevalence rate was recorded from Dubti, Assayita, Mille and Chifra were 68%, 86.4%, 86.4% and 68.3% respectively and the association between woredas was significant (p<0.05%). The highest prevalence regarding sex and age were recorded in female (79.1%) and adult (78.9%) animals. Age and sex was insignificantly associated with prevalence of FMDV virus (Table 6).

Table 6: Prevalence of CBPP with respect to associated risk factors.

Variables		Test result		X ²	p-value
		Negative	Positive		
District	Dubti	16(32)	34(68)	11.845	0.008
	Asayita	6(13.6)	44(86.4)		
	Mille	6(13.6)	44(86.4)		
	Chifera	19(31.7)	41(68.3)		
Sex	Female	37(20.9)	140(79.1)	1.414	0.234
	Male	10(30.3)	23(69.7)		
Age	Adult	34(21.1)	127(78.9)	0.634	0.426
	Young	13(26.5)	36(73.5)		
Total		47(22.4)	163(77.6)		

Discussions

District-level prioritization in the Afar region highlighted Contagious Bovine Pleuropneumonia (CBPP) as the top concern in Asayita, Mille, and Dubti. CBPP, caused by Mycoplasma mycoides subsp. mycoides, leads to severe respiratory disease and high cattle mortality, resulting in significant economic losses. This prioritization aligns with its documented impact in sub-Saharan Africa, where CBPP remains a major threat to cattle health and productivity [11,12]. Mariner et al. [11] reported high CBPP prevalence and significant economic losses in East Africa, emphasizing the need for effective vaccination and control measures. Schieck et al. [12] also highlighted the persistence of CBPP as a major issue in Kenya, reflecting similar challenges in the Afar region.

In Chifra, ectoparasitic diseases were prioritized due to their role as vectors for other diseases and their direct impact on cattle health. Ectoparasites like ticks, mites, and lice cause skin irritation and can transmit diseases such as anaplasmosis and babesiosis. Their prevalence is particularly high in warm climates, where they thrive and pose a significant challenge [13]. Gharbi & Darghouth [13] emphasized the importance of managing ectoparasites to prevent secondary infections and improve cattle health, while Walker et al (2003) detailed the effectiveness of various control strategies in reducing ectoparasite-related issues.

Lumpy Skin Disease (LSD), a viral disease characterized by skin nodules and associated with economic losses due to reduced milk production and weight gain, was a significant concern across all districts. LSD's increasing prevalence in East Africa underscores the urgency of control measures [14,15]. Tuppurainen & Oura [14] documented the rising incidence of LSD and its impact on livestock, highlighting the need for effective vaccination and management strategies. Coetzer & Tuppurainen [14] similarly discussed the economic impact of LSD and recommended comprehensive control measures to mitigate its spread.

These district level CBPP, ecto-parasite and LSD findings underscore the importance of targeted disease management strategies, including vaccination, improved husbandry practices, and community-based approaches like focus group discussions, to address the specific challenges posed by CBPP, ectoparasitic diseases, and LSD [9,16].

Contagious Bovine Pleuropneumonia (CBPP), ectoparasites, and Lumpy Skin Disease (LSD) emerged as the top three prioritized cattle diseases at the zonal level. CBPP, a severe respiratory disease caused by *Mycoplasma mycoides* subsp. *mycoides*, primarily affects young cattle below one year of age, particularly in March and April. This disease causes significant economic losses due to high morbidity and mortality rates, and its impact on young cattle underscores the need for effective vaccination and control measures [11,12,17,18]. Ectoparasites, including ticks, lice, and mites, pose a year-round threat, predominantly affecting calves under six months. These parasites not only cause direct harm, such as anemia and skin irritation, but also serve as vectors for other diseases, necessitating consistent control efforts like regular acaricide treatments and improved pasture management [13,19-21]. LSD, a viral disease spread by insect vectors, primarily affects cattle between one to three years old, leading to nodules on the skin and mucous membranes. Its seasonal peaks, aligning with increased vector activity, highlight the importance of vector control and vaccination to mitigate its impact [14-16,22,23]. Together, these diseases underscore the critical need for targeted interventions to improve cattle health and productivity in affected regions.

Regarding clinical signs and transmission methods explained by the respondents, Contagious Bovine Pleuropneumonia (CBPP), Ectoparasites, and Lumpy Skin Disease (LSD) are significant cattle diseases with distinct clinical signs and transmission methods. CBPP, caused by *Mycoplasma mycoides* subsp. *mycoides*, presents with cough, nasal discharge, fever, and rapid decline, often leading to death within days. It spreads primarily through direct contact with respiratory secretions from infected animals, making it highly contagious in crowded conditions. Effective control measures include vaccination, quarantine, and culling of infected animals [11,12,17,18]. Ectoparasites, such as ticks, lice, and mites, cause direct harm through blood-feeding, leading to anemia, hair loss, skin irritation, and secondary infections. They also act as vectors for diseases like anaplasmosis and babesiosis. Transmission occurs through direct contact and environmental vectors. Management strategies include regular acaricide use, pasture rotation, and maintaining overall herd health to reduce infestation [13,19,20,21]. LSD, caused by the Capripoxvirus, manifests as skin nodules, fever, and general malaise, and is primarily transmitted through insect vectors like mosquitoes and flies, as well as direct contact and contaminated equipment. Control involves vaccination, vector control, and quarantine measures during outbreaks to prevent spread [14-16,22,23].

The study revealed an overall CBPP antibody prevalence of 11.9% in Zone One of the Afar region, with notable differences between districts: Mille had a high prevalence of 28%, while

Chifra had a much lower rate of 3.3%. This variation likely reflects differences in local cattle management, environmental conditions, and vaccination efforts. Mille's higher prevalence might be due to less effective control measures or higher livestock density, while Chifra's lower rate could be a result of better management or more effective vaccination programs. Interestingly, the study found that age and sex did not significantly affect CBPP prevalence, suggesting that these factors may be less important compared to other aspects like herd density and vaccination status. Similar trends have been observed in other studies, both in Ethiopia and internationally, where differences in CBPP prevalence are often linked to local practices and control measures [11,12,24,25]. While age has sometimes been associated with higher prevalence in other research, and sex rarely shows a significant impact, it's clear that management practices and environmental factors play a more critical role in determining disease rates [11,12,25].

The study found a high overall prevalence of Foot-and-Mouth Disease Virus (FMDV) antibodies at 77.6% in Zone One of the Afar region, with significant district-level variations: Dubti, Asayita, Mille, and Chifra had prevalence rates ranging from 68% to 86.4%. This variability likely reflects differences in cattle management, vaccination coverage, and exposure levels. Although higher prevalence was observed in females (79.1%) and adults (78.9%), these differences were not statistically significant, suggesting that other factors, such as district-specific control measures and environmental conditions, play a more critical role. Similar regional variations in FMDV prevalence have been documented in Ethiopia and other countries, underscoring the importance of local management practices and vaccination strategies [1,10,25].

Conclusion and Recommendations

The study underscores the critical importance of addressing Contagious Bovine Pleuropneumonia (CBPP), ectoparasitic diseases, and Lumpy Skin Disease (LSD) in the Afar region, where these diseases significantly impact cattle health and productivity. CBPP emerged as the top concern in Asayita, Mille, and Dubti due to its severe respiratory effects and high mortality rates. Ectoparasitic diseases were identified as a major issue in Chifra, impacting cattle year-round and acting as vectors for other diseases. LSD was a widespread concern across all districts, causing notable economic losses through reduced milk production and weight gain. The study revealed a 77.6% prevalence of Foot-and-Mouth Disease Virus (FMDV) antibodies and significant variations in CBPP and FMDV prevalence between districts, reflecting differences in local management and vaccination efforts. Effective control and management strategies are essential to mitigate the impact of these diseases [26-33].

Recommendations

1. Enhanced Vaccination Programs: Implement comprehensive and targeted vaccination campaigns for CBPP, LSD, and FMDV. Focus on areas with high prevalence rates and ensure vaccines are administered according to recommended schedules.

2. Improved Disease Surveillance: Strengthen surveillance systems to monitor and control the spread of CBPP, ectoparasites, and LSD. Regular health checks and timely reporting of disease outbreaks are crucial.
3. Ectoparasite Control: Develop and implement effective ectoparasite management strategies, including regular use of acaricides, improved pasture management, and vector control measures. Educate farmers on the importance of parasite control and integrated pest management.
4. Community Engagement: Use community-based approaches, such as focus group discussions, to identify local disease priorities and tailor interventions accordingly. Involve local farmers in disease management and prevention efforts to enhance the effectiveness of control measures.
5. Training and Capacity Building: Provide training for veterinarians and livestock keepers on disease identification, prevention, and management. Increase capacity for handling and controlling outbreaks through workshops and educational programs.
6. Research and Development: Support ongoing research to develop more effective vaccines and treatments for CBPP, LSD, and ectoparasitic diseases. Invest in studies to better understand disease dynamics and improve control strategies.
7. Policy and Infrastructure Support: Advocate for policy changes and infrastructure improvements to support livestock health management. Ensure adequate funding and resources are allocated for disease control programs and veterinary services.

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