



MEKELLE UNIVERSITY

COLLEGE OF VETERINARY SCIENCES

**KNOWLEDGE, ATTITUDE AND PRACTICE ASSESSMENT OF CATTLE
OWNERS ON LUMPY SKIN DISEASE IN SELECTED DISTRICTS OF
EASTERN AND SOUTHEASTERN ZONES, TIGRAY, ETHIOPIA**

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in Partial Fulfillment of the Requirements for the Degree of Master of Science in
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DECLARATION

I declare that this thesis presents the work carried out by myself and does not incorporate without the acknowledgement of any material previously submitted for a degree or diploma in any university; and to the best of my understanding, it does not contain any materials previously published or written by another person except where due reference is made in the text; all substantive contributions by others to the work presented including jointly authored publications, is clearly acknowledged.

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LIST OF ABBREVIATIONS

CSA	Central statistics Agency
DOVAR	Disease Occurrences and Vaccination Report
FGD	Focuses Group Discussion
KAP	Knowledge, Attitude and Practice
KII	Key Informant Interview
LSDV	Lumpy Skin Disease Virus
OIE	Office of International des Epizooties for animal health
PA	Peasant Association
PCR	Polymerase Chain Reaction
SEBoARD	South East bureau of Agriculture and rural development

ABSTRACT

A cross-sectional study design was conducted from April, 2021 to August, 2021, to assess knowledge, attitudes, and practices of cattle owners about LSD and review its occurrence selected districts of Eastern and Southeastern zones, Tigray. Primary and secondary data were collected. For the primary data a questionnaire surveys and FGD and KII were undertaken. A total of 438 questionnaires, 9 FGD and 12 KII were undertaken. The collected data were analyzed using STATA, descriptive statistics (expressed in terms of frequency and percentage) and univariate logistic regression were employed (expressed in terms of OR and 95% CI). In the current study majority of the respondents were in the age group of 31-40year (49.3%), male (92.5%), illiterate (52.1%) and farmer (75.3%). Majority of them had unfavorable attitude (69.8%) and poor practice (66.7%) toward LSD. Majority of the respondents (68.5%) identify LSD from other illnesses by nodular lesions and 53.0% believe that treating external parasites will reduce LSD infection. Eighty four percent of the respondents did not handle good management, 60.3% didn't clean pen of cattle regularly and 85.6% did not receive any training about sick animal handling. Knowledge of cattle owners on LSD from Enderta, Adigudem and Wukro districts were 2.16 (OR= 2.16, 95% CI: 1.008, 4.563), 2.15 (OR = 2.15; 95% CI: 0.977, 4.757) and 2.07 (OR=2.07; 95% CI: 0.881, 4.889) times higher as compare to cattle owners of Tsrae-wenberta, respectively. Respondents in the age group of ≥ 50 years old were 1.84 times higher likely to have positive attitude towards the disease compared to owners in the age group of 31-40 years old and the difference was statistically significant (OR=1.84,95% CI :1.091,3.108). Respondents who uses individual grazing land and individual ground water had 1.91 (OR= 1.91; 95% CI: 1.262, 2.893) and 2.80 (OR=2.80,95%CI: 1.476, 5.327) times better LSD prevention and control practice compared to cattle owners uses communal grazing land and dump, respectively. In conclusion, poor sick animal handling practice, poor animal pen hygienic, and inadequate information and training was encountered among respondents of the present study. Therefore, proper handling of sick animals, cleaning and disinfecting of pens and awareness creation need to be implemented.

Key word: *Cattle, East, FGD, KAP, KII, LSD, Questionnaire, Southeast*

CHAPTRR ONE

1. INTRODUCTION

The agricultural sector in Ethiopia contributes 90% of the export revenues, which also employs 80% of the country's workforce and accounts for around 50% of the country's overall GDP (Davis *et al.*, 2009). Livestock production was thought to be expanding the fastest of all agricultural industries in the worldwide (Hoag, 2022). Livestock rearing serves as a multipurpose activity and is essential to both the national economics of many developing nations and the subsistence of rural populations in Sub-Saharan Africa (Upton, 2004). In addition to their direct role in producing food and income, livestock are a valuable asset that can be used as a store of wealth, a source of manure for energy and soil productivity, clothing, transport, a guarantee for credit, and a life-saving guard in times of emergency (Alabi *et al.*, 2019).

Cattle are a major source of income for farmers among livestock species (Andualem, 2016). Ethiopia has 59.5 million cattle, of which 55.2% are female and 44.8% are male estimates (Leta and Mesele, 2014). These cattle are distributed throughout several agro ecological zones (Bogale, 2022). They support the rural farming population's ability to make a living, provide farm families with milk, meat, and manure, as well as cash income, and contribute significantly to the social and cultural aspects of the community. However, the nation's abundant cattle resources are not being fully utilized. The biggest barrier for the sector is cattle diseases, which is one of many Lumpy Skin illness (LSD) is the second major cattle illness in Ethiopia and one of the most economically significant viral infections identified as notable trans-boundary animal diseases (Mitiku, 2022; Regmi, 2020).

Lumpy Skin Disease, affects cattle of all ages and breeds. The virus that causes this illness is a member of the Poxviridae family, the Capri poxvirus genus, and the LSDV species, which are closely linked to the sheep and goat pox viruses in terms of antigens (El-Kenawy and El-Tholoth, 2010). The transmission of LSDV is thought to occur mainly by blood-feeding arthropods vectors including hard ticks, biting flies and mosquitoes (Sanz-Bernardo *et al.*, 2022). The illness, which affects cattle of all ages and

breeds and results in financial losses due to decreased milk production, beef loss and draft power loss, abortion, infertility, loss of body condition, and damage to the hide (Ranjan *et al.*, 2022; Farah, 2018).

The diagnosis of lumpy skin disease is often made using the characteristic clinical symptoms, epidemiology, histology, virus isolation, and PCR. It is an acute to chronic infectious viral disease that causes emaciation, swollen lymph nodes, edema of the leg and brisket, mastitis, and occasionally death. It is also characterized by fever, nodules on the skin, mucous membranes, and internal organs, high morbidity, low mortality, and emaciation (Khan. *et al.*, 2021; Selim *et al.*, 2021).

Lumpy Skin Disease was endemic throughout Ethiopia including Tigray region, reported in different agro-ecological zones (Hailu *et al.*, 2014; Feleke *et al.*, 2016). However, irregular cases have been observed in different districts of Tigray, only a small number of researchers have examined the disease prevalence and risk factors in Tigray. The cattle owners regularly complain about its frequent occurrence of the disease and lack of medicine. No research had been published on the risk factors associated with the spread of LSD in the mid-land study area of the East and South East zones of Tigray. One of the obstacles to the disease's prevention and control in general lack of knowledge about animal disease, especially LSD. Additionally, lack of inadequate animal health services, uncoordinated development programs between various levels of government institutions and /or non-government organizations. Farmers had not adequate information about economic lost and public health effect. There was also not enough veterinary facility available in the study area.

1.1. Objectives

1.2.1. General Objective

- To assess the knowledge, attitudes and practices of cattle owner respondent's regarding LSD differentiation by clinical sign and management practice for its prevention and control mechanisms.

1.2.2. Specific Objectives

The specific objectives of the present study were:-

- To assess the knowledge of cattle owners of the study area about LSD
- To assess the attitude of cattle owners of the study area about LSD
- To assess the practice of cattle owners of the study area about LSD
- To review the occurrence of LSD in the selected districts of the study area

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Definition

In many developing countries (In Sub-Saharan African countries), livestock keeping is a multifunctional activity and plays a crucial role both in national economies and the livelihood of rural communities (Hrabák and Konečný, 2018). The livestock sector globally is highly dynamic, contributes 40% of the global value of agricultural output and support the livelihoods and food security of almost a billion people (Herrero *et al.*, 2013). Ethiopia has the largest livestock population in Africa, through 65 million cattle, 40 million sheep, 51 million goats, 8 million camels and 49 million chickens in 2020 (CSA, 2020a).

Ethiopia basically comprises a rural society; the socio-economic activities of about 85% of the population are based on farming and animal husbandry. Therefore, Ethiopia livestock production is an essential part of the agricultural system. The livestock sub sector accounts for 40% of the agricultural gross domestic product (GDP) and 20% of the total GDP without considering other contribution like manure power, fertilizing and mean of transport (Metaferia *et al.*, 2011). But the huge number of cattle and their dairy industry the productivity still know low due to the constraints of disease, scarcity of feed, inefficient and insufficient AI services, poor management, lack of marketing facilities and opportunity, inadequate animal health services, uncoordinated development programs between various levels of government institutions and /or non-government organizations and poor performance of indigenous breeds (Baksi *et al.*, 2017).

Disease is a significant contributor to decreased production of meat and milk, as well as draft power, and dung fuel. Because of the significant economic impact of an outbreak, the World Organization for Animal Health (OIE) classifies LSD as a disease that notifiable trans boundary animal disease to reported under list (Kumar *et al.*, 2021).

Lumpy skin disease is caused by the lumpy skin disease virus (LSDV), a member of the genus Capri poxvirus (CaPV) under the family Poxviridae subfamily Chordopoxvirinae.

The LSD virus genus shares with sheep pox virus (SPPV) and goat pox virus (GTPV), which are closely related, but can be distinguished by routine virus neutralization or other serological tests. There is only one serological type of LSDV which is prototype strain of LSDV is the Neethling virus (Bhoye, 2022). The LSDV primarily affects cattle but can affect sheep and goats, experimentally (Haque *et al.*, 2021). Lumpy skin disease virus Where grow in tissue culture of bovine, ovine or caprine origin, although maximum yield is obtained using lamb testis cells (Giasuddi *et al.*, 2020). Large double-stranded DNA virus is very stable, and very little genetic variability occurs. Also the disease is an OIE notifiable trans boundary vector-borne that affected cattle and Asian water buffalo and causes substantial economic losses (Hailu, 2015).

Significant financial losses on a national level are brought on by restrictions on the international trade in live animals and animal products, expensive control and eradication efforts like vaccination campaigns, as well as indirect costs brought on by the mandatory restrictions on animal movement (CM *et al.*, 2003). High fever, swollen lymph nodes, firm skin nodules, and a high body temperature are the disease's trademarks (Khan *et al.*, 2021). Secondary bacterial complications may aggravate the illness cause the nation as a whole to suffer significant financial losses. It was mostly transmitted by arthropod vectors that bit animal (Bianchini *et al.*, 2023) and the disease is seriously harming farmers' livelihoods, particularly in rural areas where a heavy reliance on cattle exists. The repercussions are similarly disastrous on a national level because the disease's prevalence has resulted in strict trade restrictions (Fèvre *et al.*, 2006).

2.2. Historical Perceptions

Lumpy skin disease was first seen in Northern Zambia in 1929, and at that time it was considered as caused by either plant poisoning or an allergic response of insect bite. All of Africa was affected, with the exception of Libya, Algeria, Morocco, and Tunisia, which are still regarded as LSD-free (Tuppurainen *et al.*, 2012). The spread of the disease was accelerated to other African nations in the 1940s. Between 1981 and 1986, it reached Tanzania, Kenya, Zimbabwe, Somalia, and Cameroon (Wessie, 2018), and it later moved to the Middle East region (Beard, 2016). It began spreading from the north into the Sudan in 1970 (Elhaig *et al.*, 2017). LSD has been also reported in most of the Middle East

countries following the 1989 outbreak in Israel, which was the first confirmed report outside the African landmass (Tuppurainen and Oura, 2012). In recent years, LSD has been reported in central Asian countries (Azerbaijan, Iran and Kazakhstan) and in European countries (Turkey, Cyprus, Greece, Russian Federation, Armenia, Bulgaria, Macedonia, Serbia, Montenegro, and Albania) (Khany *et al.*, 2021).

The spread of the disease in Africa took half a century and thus has been slow (Calistri *et al.*, 2019). However, the spread in most of the Middle East countries, Asia and Europe is rapid. The current fast spread of the disease is attributed to uncontrolled animal movement across borders and collapse of veterinary services in the politically unstable Middle East region (Klement *et al.*, 2020).

Lumpy Skin Disease was initially introduced to Ethiopia in the north-west (Gojjam and Gondar) in 1981. From Sudan, it was introduced in the west (Wollega) in 1982 and the center (Shewa) in 1983 (Mebratu *et al.*, 1984). Following its introduction, the illness expanded at first in all directions, then initially in the east (Gari *et al.*, 2010)

2.3. Epidemiology

Good types of the epidemiological facts of the disease, such as the cause factors related to agents, hosts, and the environment, with special emphasis on the importance of the experience assessments of the host to the environment and the association with the occurrence of the disease capacity support in the inhibition of the disease (Hewson, 2004). Big herds of cattle suffer considerable economic losses due to the disease's frequency of sickness and mortality, geographic dispersion, and route of transmission are significant role epidemiology of LSD (Sudhaka *et al.*, 2020).

Less seasonality in vector transmission exists in nations with warm winters. Different vectors of transmission may become more prevalent when LSD spreads to new geographic and climatic locations; changes in seasonality should be anticipated. While these flying vectors carry the disease at just 7.3 km/week on average animals in transit or on foot are crucial in long-distance transmission. LSDV may be maintained by ticks during dry or cold seasons. LSDV can be transmitted over great distances by tick-infested

live animals on moving vehicles, despite the fact that ticks do not move very much. There's a chance that some birds in Africa could spread LSD (Sudhaka *et al.*, 2020).

2.4. Risk Factors

2.4.1. Pathogen Risk Factors

A study looking into the risk factors for the development of LSD in Ethiopia revealed that a warmer, more humid agro-climate, which supports a large vector population, was linked to a higher prevalence of LSD (Molla *et al.*, 2018). Additionally, it was demonstrated that husbandry techniques like sharing grazing and drinking areas and adding new animals to a herd are connected to the occurrence of LSD. Since the virus may survive in lesions or scabs for extended periods of time and has a strong affinity for dermal tissues, it is thought that skin lesions or nodules are the most significant source of infection for healthy animals (Babiuk *et al.*, 2008).

The virus is also excreted in the blood, saliva, semen, nasal, and lachrymal secretions, as well as the milk of infected animals that can infect suckling calves and other susceptible cattle. In addition to ulcerating and shedding enough viruses, nodules that develop on the mucous membranes of the eyes, nose, mouth, rectum, udder, and genitalia can also act as sources of infections. Infections caused by viremic animals can be particularly harmful because they can linger for up to two weeks (Elhaig *et al.*, 2017). According to Irons *et al.* (2005) LSDV is also found in saliva, semen, and skin nodules for at least 11, 42, and 39 days following the onset of a fever, respectively. The virus may survive for a very long time on or off the animal host and is very resistant to the environment. In a favorable setting, such as shaded animal cages, they may last for up to six months (Molla *et al.*, 2018).

2.4.2. Host Susceptibility Risk Factor

Cattle are susceptible to lumpy skin disease, which can lead to a number of illnesses. All breeds and age groups are susceptible, however *Bos taurus* breeds are more likely than zebu cattle to develop clinical illness. The fine-skinned Channel Island breeds of the *Bos taurus* acquire more severe illness (Wu *et al.*, 2010). Due to a high fever brought on by

the viral infection itself as well as subsequent bacterial mastitis, lactating cows seem to be significantly impacted and their milk output drops abruptly (Tuppurainen *et al.*, 2012). Young animals are particularly harmed, and clinical symptoms show up quickly. Other than these animals, there haven't been many cases reported in Asian water buffalo (*Bubalus bubalis*. other species, such as oryx, have reported clinical instances or antibodies; however, these cases or antibodies may have been brought on by closely related poxviruses (Molini *et al.*, 2021).

2.4.3. Environmental Risk Factors

Environmental determinants play a great role in the epidemiology of the lumpy skin disease. It had major impact on the agent, host and the vectors as well as the interaction between them. These predisposing factors have a great role in the maintenance of the arthropod vector and the transmission of the virus to susceptible animals. These are herd risk factors that have an influence on the outbreak of the disease. Animals share the same grazing and watering points and unrestricted movement of animals across different borders following rainfall were some of the factors (Hailu *et al.*, 2014). Distribution of the disease in various agro climatic conditions, introduction of new animals to the herd and the presence water bodies are among the other risk factors that would facilitate the spread of outbreaks in various localities (Molla *et al.*, 2018). The vectors which play a great role in the transmission of the virus are maintained in such environment associated with the coming of the wet season followed by autumn (Conway *et al.*, 2014).

2.5. Transmission

The lumpy skin disease, transmission method was no clearly defined but Epidemiological evidence suggests, outbreaks of the diseases were highly associated with the prevalence of high insect vectors population and with upcoming of the rainy season. Ranjan *et al.* (2022) reported that the biting insects play the major role in the transmission of LSDV. The epidemics of LSD are associated with rainy seasons, river basins and ponds during which cattle grazed in and humid areas conducive to insect multiplication. These biting insects transmit the virus mechanically during their blood meals (CM *et al.*, 2003). Currently it is widely accepted LSDV is transmitted mainly by arthropod vectors

mechanically blood-feeding insects and play a major role in within-herd as well as between-herd transmission. Other routes of spread are iatrogenic, through direct or indirect contact and artificial insemination. Potential arthropod vectors vary by region (Elhaig *et al.*, 2017).

The outbreaks of the lumpy skin disease are highly associated with the seasonal peak of mechanical vectors in wet and warm weather conditions in Ethiopia (Kahana-Sutin *et al.*, 2017). Recently showed the molecular evidence of the potential viral transmission by hard ticks. E.g, *Rhipicephalus appendiculatus*, *Rhipicephalus decoloratus*, *Amblyomma hebraeum*. LSDV can be transmitted by various blood-feeding arthropods but is not known to replicate in vectors. Therefore, transmission is mechanical but not biological in nature. E.g, Mosquitos: *Aedes aegypti*, *Anopheles stephensi*, *Culex quinquefasciatus* Flies: *Stomoxys calcitrans*, *Haematobia irritans*, *Prostomoxys sp.*, *Haematopota spp.*, *Biomyia fasciata* ,Midges: *Culicoides nubeculosus* Ticks: *Rhipicephalus appendiculatus*, *Rhipicephalus decoloratus*, *Amblyomma hebraeum*

A study in Ethiopia also showed that communal grazing and watering points were found to be associated with the occurrence of LSD (Molla *et al.*, 2018), introduction of new animals to a herd had a strong association with an increased risk of disease in the herd. Excretion of the LSDV in semen was detecting using PCR from the experimentally challenged bulls (Bagla *et al.*, 2006). Great risks are imposed that semen or the movement of semen from countries where the disease is endemic can transmit the disease (Irons *et al.*, 2005).

The movement of infected stock, road and rail transport could play an important role in rapidly spreading the disease over larger areas. As indicated in the Australian veterinary emergency plan for lumpy skin disease (2009), the risk of introduction of the disease virus to one country or to the new areas may be by the movement of these infected animals or infected premises.

2.6. Diagnosis

LSD can be accurately diagnosed by vets with experience in animal health. In cattle from an endemic region, generalized skin nodules are strongly suggestive of LSD (Abebe,

2018). LSD is frequently diagnosed using recognizable clinical indicators. As only a few skin lesions or a transient fever may be present, LSD can occasionally be challenging to diagnose because it can be mistaken for skin lesions caused by other illnesses like pseudo-lumpy skin disease, bovine dermatophilosis, onchocerciasis, besnoitiosis, demodex infection, insect bites, and urticaria. Thus, laboratory diagnosis is needed for the confirmation that clinical signs are truly due to LSDV infections, which is most rapidly done by a polymerase chain reaction (PCR) method (Awad *et al.*, 2010) and (Gel aye *et al.*, 2017). A polymerase chain reaction (PCR) approach is the fastest way to determine if clinical indications are actually caused by LSDV infections, according to Body *et al.* (2012 and Balysheva *et al.* (2017).

LSD can also be diagnosed by serological assay techniques such as viral neutralization, indirect enzyme linked immune sorbent assay (iELISA), western blotting, agar gel immune diffusion test, and indirect fluorescent antibody test (Awad *et al.*, 2010). The most accurate serological test is the virus neutralization test, although it lacks the sensitivity to identify infected animals with low levels of neutralizing antibody. The Western blot test is expensive and challenging to perform, yet it is sensitive and specific for detecting antibodies to the Capri poxvirus (calistri *et al.*, 2019). As the most effective ways to identify Capri poxvirus infection, serum virus neutralization tests and electron microscopy analysis are frequently utilized (GSG *et al.*, 2019).

2.7. Prevention and Control

2.7.1. Vaccination In Endemic Areas

Vaccinating cattle older than six months once a year is the main method of controlling and preventing LSD in endemic nations like Ethiopia (Ben-Gera *et al.*, 2015). Due to the fact that calves born to immunized cows have passive immunity that lasts for up to age of six months (Andualem, 2016) .The experience in the country's key regions demonstrated that the vaccination strategy is frequently chosen and is frequently that of ring vaccination around a local concentrated outbreak when it arises. The Kenyan sheep- and goat-pox strain (KS-1), the Yugoslavian RM 65 sheep-pox strain, the Romanian sheep-pox strain, and the South African Neethling LSDV strain are the four live

attenuated Capri poxvirus strains being used as vaccinations to suppress LSD. For the prevention of LSD in cattle populations in Africa, two distinct vaccinations were utilized widely and successfully. The Neethling strain of LSD was passaged 50 times in tissue cultures of lamb kidney cells and 20 times in fertilized eggs in southern Africa. It is created in tissue culture and sold as a freeze-dried good. Prepubertal lamb testes or fetal muscle cell cultures in Kenya were used to passage a strain of the sheep and goat pox virus 16 times. Africa generally immunizes cattle using the Neethling strain vaccine (Klement *et al.*, 2020).

LSD could be controlled by vaccinating cattle annually induced lifelong immunity (Ayelet *et al.*, 2013). Commercially available live, attenuated LSD vaccinations are available. The local strain of Kenyan sheep and goat pox virus has been demonstrated to successfully immunize sheep, goats, and cattle against infection with capri pox virus with a remarkable success rate due to their antigenic similarity and cross protection among them (Tuppurainen *et al.*, 2014). The second is a vaccination against the attenuated South African LSD virus Neethling strain made from cattle; a freeze-dried version is also offered (Hunter, 2001). The vaccination against this infection was successfully employed by immunizing the animals annually in nations where LSD is endemic (Ben-Gera *et al.*, 2015).

2.7.2. Vaccination in New Areas

By bringing contaminated items and affected animals into new locations, there is a risk of spreading the disease (Hahladakis *et al.*, 2018). Before the spread of the disease to other areas extensively, quarantining the area, slaughtering the diseased and infected animals, and cleaning and disinfecting the contacted equipment are required (Grompone *et al.*, 2010). If the existence of LSD is reported or confirmed in new areas (Hailu, 2015) quarantine and limiting animal movement should be implemented within foci of infection with a radius of 25 to 50 km, mass vaccination of cattle is the most practical method for controlling the disease in areas where it has spread widely (Farah, 2018). Effective control measure of the disease is achieved through mass vaccination though separation and culling of infected animals are optional methods (Molla *et al.*, 2017).

CHAPTER THREE

3. MATERIALS AND METHODS

3.1. Description of the Study Area

The study was conducted in selected districts of Eastern and Southeastern zones, Tigray region, Ethiopia. Tigray is located in the most northern part of Ethiopia and bordering with Eritrea in the north, Sudan in the west, Afar in the east and Amhara in the southwest. Extends from 120° 13' to 140° 54' N and from 36° 27' to 40° 18' E., The total livestock population in Ethiopia, Tigray respectively are 170,820,789 / 8,767,661 out of those 53,382,194/3,630,957 head of cattle according to (CSA 2020a). Tigray region has seven Administrative Zones: Western, North western, Central, Eastern, Mekelle, south eastern, and Southern zones. The Eastern Zone is located at longitude and latitude of 14°16'N 39°27'E coordinates: with an elevation of 2457 m.a.s.l. The mean annual rainfall is 552 mm. The annual minimum and maximum temperatures are 7.77 °C and 24.21 °C respectively. The zone has 11 districts, 2 towns and 135 tabias (PA). In this study 3 tabias (PA) included, such as 2 from wukro and one from Tsraewenberta. From this zone two districts, wukro and Tsrae –wenberta have been selected.

Southeast zone is located in latitude of 13° 14' 60.00" N and longitude 39° 09' 60.00" E. The altitude of the area ranges from 1470-2370 meter above sea level (m.a.s.l.). The average annual temperature and rain fall ranges from 13 to 25 degree Celsius and 350mm to 700mm, respectively (SEBoARD, 2017). This zone has 6 districts, 2 towns and 81 tabias (PA). From this zone two districts, Enderta and Adigudom have been selected.

From the two zones 4 districts were selected by purposively based on accessibility transport, animal population and peace to comber with other districts at that time bloody war in Tigray. Also from each district to selected study area from Wurkro two tabias and from Tsrae wenberta one tabia, from Enderta 4 tabias, from in and around in Adigudem 2 tabias, a total were 9 tabias the sampling study area. From the study area total 438 respondents asked by questioner form, such as from eastern zone 125 respondents which are 85 in wkro and 40 from Tsrae wenberta districts, also from south east zone are 313

respondents which are 175 from enderta district and 138 from in and around Adigudem due to proportion by number of animal population owner's concerned in this study.

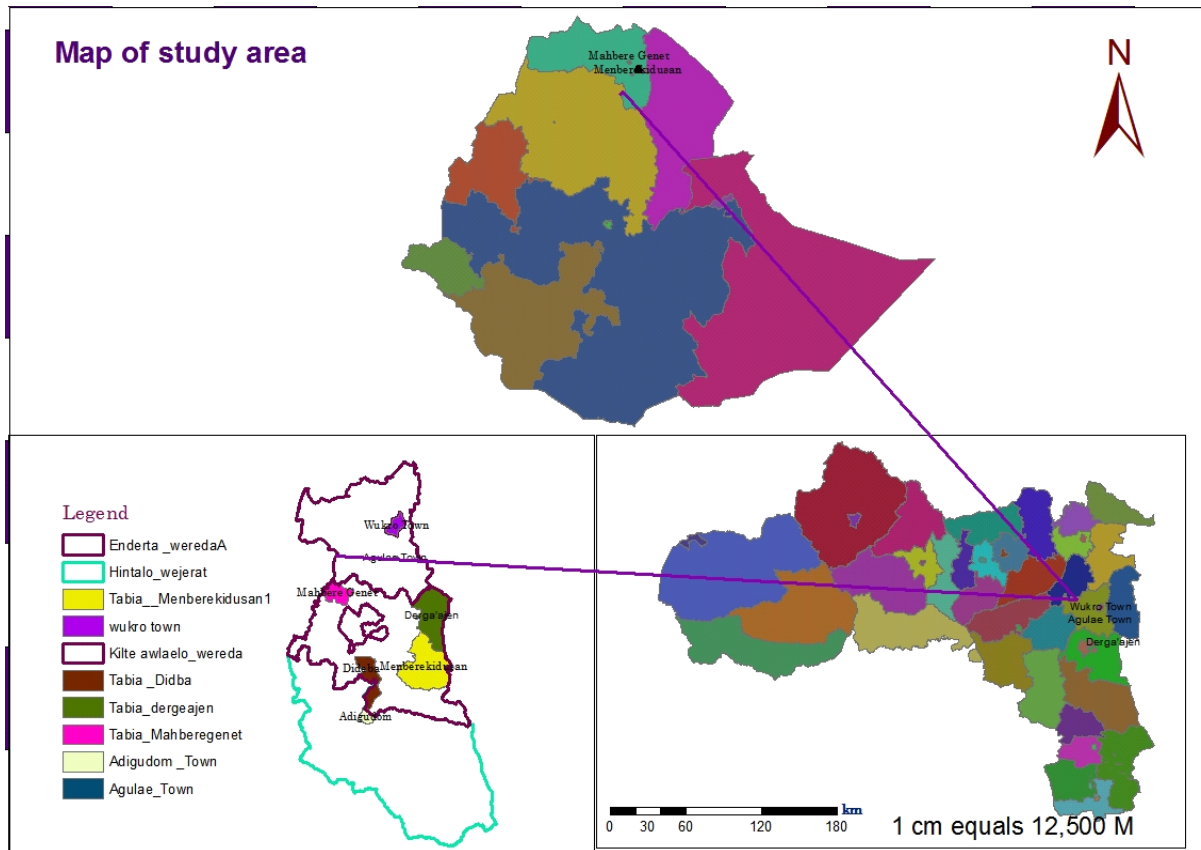


Figure 1: Map of the study area

3.2. Study Population

The study population for the present research work includes household cattle owners and animal health workers who reside in the selected districts of East and Southeast zones of Tigray region. Households of different sexes, age groups, occupational status, and educational level were included in this study.

3.3. Study Design

A cross-sectional study design was conducted from April, 2021 to August, 2021, to assess knowledge, attitudes, and practices of cattle owners and animal health experts who reside in the selected districts of the study area in relation to lumpy skin disease. A,

questionnaire surveys and Focus Groups Discussion (FGD) and Key Informants' Interview (KII) were undertaken to assess management of animal handling and feeding system. All data were gathered in accordance with the animal population at the beginning of the study, and a brief overview and discussion of the study was conducted for the district's animal health experts. Using data from the Agriculture Bureau of districts, and Director of Director Animal Health Tigray regional bureau, a retrospective data was carried out using ten years of LSD outbreak reports from (2014–2023 GC).

3.4. Sampling Technique

For this study zones, districts, and kebelles were purposively chosen based on accessibility to transportation, the presence of a high concentration of dairy farms, the activity of livestock markets, comparison to other districts during the Tigray war, and the absence of funding for transportation in other districts. Random sampling was used to select study participants in each district. Accordingly, a total of four districts were chosen from each administrative zone: two districts from the eastern zone and two from the south-eastern zone were chosen, then three kebelles from the east district and six kebelles from the south-eastern district. With the help of kebele administrators or agricultural specialists from district agricultural offices, the sampling frame for kebelles and home cattle owners was created.

In order to identify houses with cattle owners for the study, a recruitment operation was initially carried out. The district animal health experts conducted a brief research description and discussion at the beginning, and all data were gathered in accordance with population sizes.

A comprehensive list of cattle owners who were registered with the administration of the chosen districts was created as a sampling frame. In order to acquire the most thorough lists and reduce selection bias, records from the Agricultural Bureau (the government office district for animal health) were reviewed during the development of the sampling frame. Using a numbered list and a random number generator, participants from each category set were then arbitrarily chosen in proportion based on their desire. Participants

for FGD were selected based on farmers' and animal health professional's willingness and all animal health experts of the selected districts were included for KII.

3.5. Sample Size Determination

Based on source of selective zone data base, there are about 97076 cattle owner farmers were recorded. To determine a sample size, the study adopted a simplified proportions suggested by Yamane's formula (2022). By considering 95% confidence level and 5% precision level.

$$n = \frac{N}{1+N(e)^2}$$

$$n=(97076\sqrt{1 + 97076 * 0.05 * 0.05})= 398$$

where ; n = Required sample size,

N= Total population on the study = 97076

e² = the margin error in the calculation (level of precision) = 0.05

The calculated sample size for this study was 398, the necessary sample size. In order to reduce the possibility of random errors and increase accuracy, the sample size was improved by 10% (non-response rate) or 40 respondents were added. Accordingly, a total of 438 cattle owners were selected and interviewed in the present study. Due to the difference in population size in the selected district, sample size was allocated proportionally based on the existing population per districts. Moreover, a total of 9 Focus Group Discussion (FGD) consisting of 6-8 individuals/ group and 12 Key Informant Interviews (KII) from the selected district (animal health experts) were interviewed.

3.6. Data Collection

In the KAP assessment, data was collected from three sources:

(a) Quantitative data was collected from cattle owners and collected using a semi-structured close end questionnaire. It had translated into the local language, Tigrigna, and then translated back into English to maintain consistency. The questions were divided into the following four sections: (1), questions about the participant's socioeconomic and demographic makeup (such as age, sex, level of education, size of the herd, occupation,

and place of residence). (2) Questions that test participants' understanding of LSD causes, symptoms, transmission techniques, and effects are included. (3) Questions were used to assess respondents' beliefs regarding the incubation time of LSD, how frequently it occurs, animals that are most sensitive to it, and ways for prevention. and (4), issues addressing animal management practices relating to seasonal animal movement, grazing or watering point, integrating new animal into herd, and intake of vaccine for prevention/control measures in animals. Herd size, herd structure, animal contact with other wild species, and the presence of cattle markets were important factors.

(b) Data going to be collected through focus group discussions (FGDs) which include (PAs cattle owners or workers) and animal health workers. There had been 9 groups formed, ranging in size from 6 to 10. Each group was made up of different genders, cattle owners, and animal health professionals. The researchers facilitated the focus group discussions, which continued until they reached a saturation point.

(c) Data from key informant interviews (KIIs) predominantly from livestock and health sectors, such as Veterinarians and livestock experts. Twelve KIIs had been held with officers from the veterinarian and livestock experts.

Discussions in Focus Groups and Key Information had been conducted in Tigrigna. For both the FGDs and the KIIs, interview guides with open-ended questions or themes were used to let the participants express themselves freely.

On the other hand secondary data of 10 years (from 2014 to 2023), such as (LSD) outbreak occurring periods/years, in east and south east zone of selective districts, cattle affected by the disease of ten years were collected. The DOVAR report data from Tigray regional bureau directorial of director animal health and east and south east zone of selective district animal health office were the sources in this study.

3.7. Operational Definition

I. Knowledge assessment:

The level of knowledge of LSD awareness of transmission was measured using a set of structured questions. (For example do you know the methods LSD transmission through

contact?). Each correct response was given a Likert scale score of 1 for yes and 0 for no. The assessment method was modified Bloom's cutoff points from the 2007 KAP (knowledge, attitude, and practice) Study by Ms. Nahida. Out of ten available points, a score of five or above (50–100% of correct answers) indicated good knowledge, while a score of four or lower (40%) showed weak knowledge.

II. Attitude assessment:

Nine questions were prepared to gauge how the community feels about the effects of LSD (For example, are cross breeds and calves more affected than local breeds and adults?). Five alternative responses exist for questions on a Likert scale: 1. Strongly agree, 2. agree, 3. Disagree, 4. Strongly disagree and 5. I don't know. After the replies are totaled, each respondent will earn a score. After calculating the average score from the nine questioners, it was decided that people with scores above the average (5 and above, or =55-100%) had a favorable attitude toward the LSD-affected group, while scores below the average (5, or =54%) showed a negative attitude.

III. Practice assessment:

Fifteen questions were prepared to assess participants to evaluate their activity of the LSD control mechanism practice, for instance: "Do you diagnose new animals for LSD before mixing in your farm? moreover, do you routinely keep the animal pen's hygiene? Using Yes/No format and the Likert scale across all 15 questionnaires, a good practice was defined as providing eight or more accurate responses (53.3%), whereas a poor practice was defined as providing fewer than eight correct answers (46.7%).

3.8. Data Analysis

The collected data was entered into a Microsoft Excel spreadsheet and analyzed by using STATA statistical software version 14. The data was cleaned, coded, recoded, and checked for statistical assumptions. Descriptive statistics was employed to summarize the data and reported as frequency and percent in table form. Additionally, logistic regression analysis was carried out to quantify the degree of association between knowledge, attitude, and practice levels of the participants with the socio-demographic factors and

expressed in terms of odds ratio (OR) and 95% Confidence level (CI). For all analysis a cutoff value ($P < 0.05$) was used for statistical significant difference.

CHAPTER FOUR

4. RESULTS

4.1. Socio Demographic of the Respondents

In the current study a total of 438 cattle owners were interviewed, of which majority of respondents (cattle owners) were in the age group of 31-40year old (49.3%) and male (92.5%). Higher proportion of the respondents were illiterate (52.1%), with an occupational status of farmers (75.3%). Moreover, majority of the cattle owners of this study used communal grazing pasture (66.76%) and communal watering point/dump (52.1%) (Table 1).

Table 1: Socio Demographic of the Respondents

Characteristics	Frequency	Percentage (%)
District		
Wukroklte-wlaelo (Wukro town)	85	19.4
Tsraewenberta (Agulae)	40	9.1
Enderta	176	40.2
Adi-gudem	137	31.3
Total	438	100.0
Age of respondents (Years)		
25-30	19	4.3
31-40	216	49.3
41-49	115	26.3
>=50	88	20.1
Total	438	100
Sex of respondents		
Male	405	92.5
Female	33	7.5
Total	438	100

Educational status		
Illiterate	228	52.1
Elementary from grad 1-8	166	37.9
High school from grad 9-10	41	9.4
College and above	3	7
Total	438	100
Current occupation		
Farmer	330	75.3
Business mane	101	23.1
Government	7	1.6
Total	438	100
How many cattle herd size?		
Small 2-11 heard size	380	86.8
Medium 12-21 head size	55	12.6
Large >22 or = head size	3	7
Total	438	100
Type of grazing pasture		
Communal	292	66.7
Individual	146	33.3
Total	438	100
Use of watering		
River	156	35.6
Common dump	228	52.1
Individual ground water	54	12.3
Total	438	100
Moving animal place to place?		
Yes	256	58.4
No	182	41.6
Total	438	100

4.2. Knowledge Assessment of Lumpy Skin Disease

Majority of the cattle owners of the current study have good knowledge about LSD (80.4%). In the study are, 57.8% of those surveyed were aware of LSD's presence in their herd. In 68.5% of the responders, the nodular clinical characteristic helped to identify LSD from other illnesses. The spread of LSD through contact with sick animals, according to 87.2% of those who responded, was the primary factor in the disease's raise. In this study, 60.0% of survey participants says that the disease aggravated by blood feeding insects. In addition, the present investigation revealed that the disease is known to cause higher morbidity (72.1%) than mortality (Table 2).

Table 2: Knowledge assessment of cattle owners about LSD

Characteristics	Frequency	Percentage (%)
Knowledge		
Good knowledge	352	80.4
Poor knowledge	86	19.6
Total	438	100
Is founded Skin disease in herd?		
Yes	253	57.8
No	185	42.2
Total	438	100
Have you seen clinical sign of LSD?		
Yes	300	68.5
No	138	31.5
Total	438	100
Is LSD transboundary?		
Yes	251	57.1
No	188	42.9
Total	438	100
Is LSD transmission through contact?		
Yes	382	87.2

No	56	12.8
Total	438	100
Is LSD is morbidity higher than mortality?		
Yes	316	72.1
No	122	27.9
Total	438	100
Is LSD aggravated by blood feeding vectors?		
Yes	263	60.0
No	175	40.0
Total	438	100
Is LSD not good respondent with drug treatment?		
Yes	280	63.9
No	158	36.1
Total	438	100
Can you decrease or control the risk factor of LSD?		
Yes	394	90.0
No	44	10.0
Total	438	100
Use of quarantine for control LSD?		
Yes	301	68.7
No	137	31.3
Total	438	100
Use of trapping for LSD control?		
1= Yes	337	76.9
0= No	101	23.1
Total	438	100
Do you know the impact of LSD?		
Yes	390	89.0
No	48	11.0
Total	438	100
Have you important to keep or clean pen for reducing LSD spread?		

Yes	383	87.4
No	55	12.6
Total	438	100

4.3. Attitude of cattle owners on Lumpy Skin Disease

Higher proportion of cattle owners of this study have negative/unfavorable attitude (69.8%) toward the lumpy skin disease. In the present study 26.3% of respondents indicated they had no idea how LSD was spread, and 12.8% disagreed that a vector was not responsible for it. The majority of respondents agreed (67.1%) that immunization could prevent LSD use, although 2.5% of them disagreed and 3.9% said they were still unsure. Moreover, 41.6% agree that the disease occurs seasonally, but 18.7% still don't know or express an opinion (unfavorable attitudes) in the study locations. Fifty three percent believe that treating external parasites will reduce LSD infection, whereas 8.9% didn't know (Table 3).

Table 3: Attitude assessment of cattle owners about LSD

Characteristics	Frequency	Percentage (%)
Attitude		
Favorable attitude	136	31.1
Un favorable attitude	302	69.8
Total	438	100
Is calf more affected than adult by LSD ?		
Strongly agree	237	54.1
Agree	131	29.9
Dis-agree	31	7.1
Strongly dis-agree	3	.7
I don't Know	36	8.1
Total	438	100
Is cross breed more affected than local breed by LSD?		

Strongly agree	359	82.0
Agree	33	7.5
Dis-agree	24	5.5
I don't Know	22	5.0
Total	438	100
Is LSD occurred seasonally?		
Strongly agree	152	34.7
Agree	182	41.6
Dis-agree	17	3.9
Strongly dis-agree	5	1.1
I don't Know	82	18.7
Total	438	100
Do you agree to go to animal health clinic when the sick animal by LSD?		
Strongly agree	99	22.6
Agree	298	68.0
Dis-agree	22	5.0
Strongly dis-agree	5	1.1
I don't Know	14	3.2
Total	438	100
Have you perceived LSD spread by blood feeding insect?		
Strongly agree	67	15.3
Agree	168	38.4
Dis-agree	56	12.8
Strongly dis-agree	32	7.3
I don't Know	115	26.3
Total	438	100
Have your confidence prevention of LSD by vaccination?		
Strongly agree	294	67.1
Agree	108	24.7
Dis-agree	11	2.5
Strongly dis-agree	8	1.8

I don't Know	17	3.9
Total	438	100
Do you agree reducing LSD infection by external parasite treating		
Strongly agree	140	32.0
Agree	232	53.0
Dis-agree	21	4.8
Strongly dis-agree	6	1.4
I don't Know	39	8.9
Total	438	100
Do you belief that regular follow-up after treat LSD elaborate progress of disease?		
Strongly agree	110	25.1
Agree	258	58.9
Dis-agree	29	6.6
Strongly dis-agree	15	3.4
I don't Know	26	5.9
Total	438	100
Should allow to administered injectable drug for LSD Prevention?		
Strongly agree	107	24.4
Agree	82	18.7
Dis-agree	184	42.0
Strongly dis-agree	48	11.0
I don't Know	17	3.9
Total	438	100

4.4. Practice of cattle owners on Lumpy Skin Disease

The total average result of practice study was 66.7% had been poor practice on the livestock activity which was not diagnosing new animal before mixed in herd 69.9%. More than half (51.6%) of the cattle owners uses common shared bull for breeding system, 53.7% of the respondents used communal grazing and watering area with Niebuhr, 60.3% interviewers were not done regularly clean the pen of cattle, 84.0%

respondents did not handle good management practice for LSD sick animal and almost all of the respondents (85.6%) did not received training about sick animal handling management (Table 4).

Table 4: Practice assessment of cattle owners about LSD

Characteristics	Frequency	Percentage (%)
Practice		
Good practice	146	33.3
Poor practice	292	66.7
Total	438	100
Introducing new animal to your herd?		
Yes	249	56.8
No	189	42.3
Total	438	100
Is diagnosis new animal before mixing your farming?		
Yes	333	30.4
No	305	69.9
Total	438	100
Is together with Niebuhr animals grazing /watering?		
Yes	235	53.7
No	203	46.3
Total	438	46.3
Is vaccinated regularly Above 6 months of all ages LSD vaccine?		
Yes	259	59.1
No	179	40.0
Total	438	100
Is treat animals after onset LSD?		
Yes	282	64.4
No	156	35.6
Total	438	100

Do you regularly follow up progress of the LSD after treated?		
Yes	305	69.6
No	133	30.4
Total	438	100
Type of breeding system		
AI (artificial insemination)	143	32.6
Your own bull	69	15.8
Shared bull	226	51.6
Total	438	100
Action take of died animal by LSD?		
Burring	145	33.1
Consuming for food	130	29.7
Throw away	163	37.2
Total	438	100
What Action takes of infected animals by LSD?		
Inform for veterinarian	287	65.5
Segregation	104	23.7
Follow up in home	44	10.0
I don't know	3	.7
Total	438	100
If LSD occurred in your herd, do you report for veterinarians?		
Yes	388	88.6
No	50	11.4
Total	438	100
Is LSD patient animals to treat itself by antibiotic drug?		
Yes	134	30.6
No	304	69.4
Total	438	100
Do you clean the equipment?		
Yes	148	33.8
No	290	66.2

Total	438	100
Is regularly clean the pen?		
Yes	174	39.7
No	264	60.3
Total	438	100
Do you handle a good management of LSD sick animals?		
Yes	70	16.0
No	368	84.0
Total	438	100
Do you receive training LSD?		
Yes	63	14.4
No	375	85.6
Total	438	100

4.5. Univariate Logistic Regression Results

The crude odds ratio from the current study displayed that the knowledge of cattle owners on LSD from Enderta district were 2.16 times higher as compare to cattle owners of Tsrae-wenberta and the difference was found to be statistics significant (OR= 2.16, 95% CI: 1.008, 4.563). Likewise, the knowledge of cattle owners on LSD from Adigudem and Wukro districts were 2.15 (OR = 2.15; 95% CI: 0.977, 4.757) and 2.07 (OR=2.07; 95% CI: 0.881, 4.889) times higher than cattle owners of Tsrae-wenberta, respectively (Table 5).

The respondents in the age group of > or =50 years and 41-49 years old had 2.24 (OR=2.24, 95% CI: 0.736,6.853) and 2.06 (OR=2.06; 95% CI: 0.703,6.064) times higher knowledge about LSD as compared to respondents in the age group of 25-30 years old. However, the difference this difference was found to be statistically not significant (Table 5).

Male respondents had better knowledge which is 2.20 times higher than female respondents, and this difference was found to be statistically significant (OR=2.20; 95% CI: 1.022, 4.732). Moreover, cattle owners who uses communal grazing land and communal dump had 1.16 (OR= 1.16; 95% CI: 0.709, 1.902) and 1.06 (OR=1.06,95%CI:0.510,2.240) times higher knowledge about LSD compared to cattle owners who uses individual grazing land and watering point, respectively. However, the difference was not statistically significant (Table 5).

Table 5: Logistic regression analysis of the knowledge difference among factors

Characteristics	Total	Knowledge N (%)	Odds Ratio (95% CI)	P-value
District				
Wukro	85	69(81.18)	2.07(0.881,4.889)	0.095
Tsrae wenberta	40	27(67.50)	1	-
Enderta	176	144(81.75)	2.16(1.008,4.653)	0.047
Adigudem	137	112(81.75)	2.15(0.977,4.757)	0.057
Age of respondents (years)				
25-30	19	13(68.42)	1	-
31-40	216	172(79.63)	1.80(0.649,5.015)	0.258
41-49	115	94(81.74)	2.06(0.703,6.064)	0.187
>50	88	73(82.95)	2.24(0.736,6.853)	0.155
Sex				
Male	405	330(81.48)	2.20(1.022,4.732)	0.044
Female	33	22(66.67)	1	-
Educational Status				
Illiterate	228	179(78.51)	1.82(0.162,20.564)	0.626
Elementary 1-8 grad	166	137(82.53)	2.36(0.207,26.928)	0.489
High school 19-10	41	34(82.93)	2.42(0.192,30.056)	0.493
college and above	3	2(66.67)	1	-
Occupational Status				
Farmer	330	264(80.00)	1	-

Business Man	101	82(81.19)	1.07(0.611,1.902)	0.793
Government Employed	7	6(85.710)	1.50(0.1777,12.674)	0.710
Heard size				
small size (2-11)	380	305(80.26)	1	-
medium size (12-21)	55	44(80.00)	0.98(0.484,1.995)	0.963
large head size (>22)	3	3(100.00)	Omitted	-
Grazing Land				
Communal	292	237(81.16)	1.16(0.709,1.902)	0.552
Individual	146	115(78.77)	1	-
Watering Animal				
River	156	125(80.13)	1,03(0.477,2.228)	0.937
common dump	228	184(80.70)	1.06(0.510,2.240)	0.858
Individual ground water	54	43(79.63)	1	-
Movement of Animal				
No	182	139(76.37)	1	-
Yes	256	213(83.20)	1.53(0.954,2.460)	0.077

In the present study attitude of cattle owners about LSD were assessed in relation with different factors. Cattle owners from Tsrae wenberta, Enderta and Adigudem were having 2.60 (OR=2.60,95% CI:1.048,6.483), 2.39 (OR=2.39, 95%CI :1.711, 6.720) and 3.38 (OR=3.38, 95% CI:1.676,6.844) time higher positive attitude towards LSD compared to cattle owners resides in Wukro. The difference was also found to be statistically significant (Table 6).

Those respondents who were at the age group of >or =50 years were 1.84 times higher likely to have positive attitude towards the disease compared to owners in the age group of 31-40 years old and the difference was statistically significant (OR=1.84,95% CI :1.091,3.108). Even though the number of male and female participated in the present study was not comparable, however, male owners were found to be 3.50 (OR=3.50; 95%

CI: 1.207, 10.177) times higher likely to have positive attitude as compared to female owner and this difference was statically significant (Table 6).

Table 6: Logistic regression analysis of the Attitude difference among the factors

Characteristics	Total	Attitude N (%)	Odds Ratio 95% CI	P-value
District				
Wukro	85	12(14.12)	1	-
Tsrae wenberta	40	12(30.00)	2.60(1.048,6.483)	0.039
Enderta	176	62(35.80)	2.39(1.711,6.720)	0.000
Adigudem	137	49(35.77)	3.38(1.676,6.844)	0.001
age of respondents (years)				
25-30	19	6(31.58)	1.28(0.467,3.547)	0.625
31-40	216	57(26.39)	1	-
41-49	115	38(33.04)	1.37(0.84,2.252)	0.203
>50	88	35(39.77)	1.84(1.091,3.108)	0.022
Sex				
Male	405	132(32.59)	3.50(1.207,10.177)	0.021
Female	33	4(12.12)	1	-
Educational Status				
Illiterate	228	71(31.14)	1.01(0.661,1.571)	0.929
Elementary 1-8 grad	166	51(30.72)	1	-
High schoo 19-10 grad	41	13(31.71)	1.04(0.501,2.185)	0.903
college and above	3	1(33.33)	1.12(0.099,12.717)	0.923
Occupational Status				
Farmer	330	115(34.85)	2.30(1.334,3.993)	0.003
Business Man	101	19(18.81)	1	-
Government Employed	7	2(28.57)	1.72(0.310,9.583)	0.532
Heard size				

small size (2-11)	380	116(30.53)	1	-
medium size (12-21)	55	20(36.36)	1.30(0.720,2.348)	0.384
large size (>22)	3	0(0.00)	Omitted	
Grazing Land				
Communal	292	101(34.59)	1.67(1.069,2.630)	0.024
Individual	146	35(23.97)	1	-
Watering Animal				
River	156	58(37.18)	1.77(1.141,2.762))	0.0011
common dump	228	57(25.00)	1	-
Individual ground water	54	21(38.89)	1.90(1.023,3.562)	0.042
Movement of Animal				
No	182	45(24.73)	1	-
Yes	256	91(35.55)	1.67(1.099,2,563)	0.016

Cattle owners of Wukro and Tsrae-wenberta had good practice in prevention and control of LSD, were 1.88 (OR=1.88; 95% CI: 1.102,3.236) and 1.65 (OR= 1.65; 95% CI: 0.992,4.050) times better than cattle owners of Enderta. The differences in practices among the districts were statistically significant (Table 7).

Regarding occupation of respondents, the business man had more times 2.12 times better practice than over the farmer cattle owner and the difference was found to be statistically significant (OR=2.12; 95% CI: 1.342,3.352). Likewise, cattle owners who uses individual grazing land and individual ground water had 1.91 (OR= 1.91; 95% CI: 1.262, 2.893) and 2.80 (OR=2.80,95%CI: 1.476, 5.327) times better practice about LSD compared to cattle owners who uses communal grazing land and communal dump, respectively. The difference was also statistically significant. On the other hand difference in practice about LSD prevention and control among age groups, sex, educational level, animal herd size and movement of animal were found to be statistically not significant ($P>0.05$) (Table 7).

Table 7: Logistic regression analysis of the Practice difference among the factors

Characteristics	Total	Practice N (%)	Odds Ratio 95% CI	P-value
District				
Wukro	85	37(43.53)	1.88(1.102,3.236)	0.021
Tsrae wenberta	40	18(54.00)	1.65(0.992,4.050)	0.052
Enderta	176	51(28.98)	1	-
In and around adigudem	137	40(29.20)	1.01(0.618,1.652)	0.966
Age of respondents (years)				
25-30	19	10(52.63)	2.31(0.901,5.959)	0.081
31-40	216	70(32.41)	1	-
41-49	115	42(36.52)	1.20(0.746,1.928)	0.452
>50	88	24(27.27)	0.78(0.451,1.354)	0.0.380
Sex				
Male	405	134(33.09)	1	-
Female	33	12(36.36)	1.15(0.552,2.419)	0.701
Educational Status				
Illiterate	228	65(28.51)	1	-
Elementary 1-8 grad	166	61(36.75)	1.45(0.950,2.232)	0.084
High schoo 19-10 grad	41	17(41.46)	1.77(0.895,3.522)	0.100
college and above	3	3(100.00)	Omitted	-
Occupational Status				
Farmer	330	96(29.09)	1	-
Business Man	101	47(46.53)	2.12(1.342,3.352)	0.001
Government Employed	7	3(42.86)	1.82(0.401,8.322)	0.435
Heard size				
small size (2-11)	380	125(32.89)	1	-

medium size (12-21)	55	21(38.18)	1.26(0.702,2.260)	0.438
large size (>22)	3	0(0.00)	Omitted	-
Grazing Land				
Communal	292	83(28.42)	1	-
Individual	146	63(43.15)	1.91(1.262,2.8930)	0.002
Watering Animal				
River	156	41(26.28)	1	-
common dump	228	78(34.21)	1.45(0.930,2.286)	0.100
Individual ground water	54	27(50.00)	2.80(1.476,5.327)	0.002
Movement of Animal				
No	182	69(37.91)	1.41(0.950,2.120)	0.087
Yes	256	77(30.08)	1	-

4.6. Focus Group Discussion and Key Informant Interview Results

In the present study a total of 9 FGDs were conducted from the selected districts. In the FGD majority (66.7%) of the participants agreed that the primary clinical sign of LSD was coin-shaped swelling throughout the body, particularly around the neck, lacrimation, lameness in the hind leg, and abnormal walking patterns. Meanwhile, 33.3% reported loss of feed and water intake, loss of body condition, and swelling on the shoulder in the hind leg. Moreover, it was found that the primary risk factor for LSD was tick infection, house flies, or, as it is known locally, "hamema," an insect, and contact with a healthy animal, even if the disease had spread widely.

Vaccination regimen with routine follow-up in the study FGD due to ignorance and a low opinion of the efficiency of LSD, 66.7% of people do not follow up; nevertheless, 33.3% have good, routine follow-up, and of those, 44.4% report nice vaccination effectiveness. since no animal disease occurred following vaccination. However, 22.2% of the vaccination was filed; this was because it was handled and administered correctly, as well as because it was studied in earlier studies. In the group discussion, 33.3% were unsure

about the LSD vaccine's efficacy because there was no suggestion. Which vaccine makes you forget about the animal? received a vaccination or not.

The Maine challenge in the regulation of LSD transmission; 55.5% of the group respondents attribute the lack of awareness in the community to the failure to separate infected animals, the lack of restrictions on animal movement, and the scarcity of veterinary facilities and medicine. In contrast, 22.2% cite the lack of veterinary professionals, the lack of vaccines or the ignorance of every unvaccinated animal, and the laxity of government regulations pertaining to the vaccination policy and certified animal movement.

In the Key Informant Interview, majority of the key informant interview were awareness creation on LSD impacted to apply short and long training for animal owners and students based on the impact of LSD. known by mass media, journal and government regulation animal movement restricted. In addition, well development of quarantine inspection, well development plane prepared for control of disease.

4.7. Retrospective Results

A secondary data were collected from selected districts of Eastern (W/kltewlaelo) and Southeastern (Enderta and in and around Adigudem) zones of Tigray region from 2014 to 2023 GC. There were a total of 27 LSD outbreaks in the two-zone with 239 cases and 65 documented fatalities. The most instances and deaths were documented in 2008; there were 67 (0.34%) cases, 22 (32.84%) deaths, and the least in 2007; there were 7 (0.41%) cases, 2 (28.57%) deaths (Table 8).

On the other hand, the magnitudes of cases and deaths at the zone level in the east zone; with 37 cases and 7 deaths were reported, and the South-east, with 202 cases and 58 deaths (28.71%) were reported (Table 8).

Table 8: Occurrence of LSD in selected districts of East and Southeast zone, Tigray

Year	Zone	Wereda	No of outbreaks	No of cases	No of deaths	Population at risk
2006	East	W/kltewlaelo	No report	No report	No report	No report
	South east	Enderta	No report	No report	No report	No report
		Adigudem	No report	No report	No report	No report
2007	East	w/kltewlaelo	1	7 (0.41)	2(0.12)	1700
	South East	Enderta	5	65(0.093)	19(0.027)	69994
		Adigudem	3	24(0.26)	9(0.098)	9200
2008	East	W/kltewlaelo	1	7(0.41)	2(0.12)	1700
	South east	Enderta	8	67(0.34)	22(0.11)	19500
		Adigudem	1	12(0.8)	2(0.13)	1500
2009	East	W/kltewlaelo	3	23(0.17)	3(0.02)	13500
		Tsraewenberta				
	South East	Enderta	4	24(0.14)	4(0.024)	16600
		Adigudem	No report	No report	No report	No report
2014	East	W/kltewlaelo	No report	No report	No report	No report
		Tsraewenberta	No report	No report	No report	No report
	South East	Enderta	1	10	2	1500
		Adigudem	No report	No report	No report	No report
2015	East	W/kltewlaelo	No report	No report	No report	No report
		Tsrae wenberta	No report	No report	No report	No report
	South East	Enderta	No report	No report	No report	No report
		Adigudem	No report	No report	No report	No report
Total			27	239(0.18)	62(0.046)	135194

CHAPTER FIVE

5. DISCUSSION

This study was conducted to assess cattle owner farmers' understanding of lumpy skin disease (LSD), attitudes toward it, and practices in a region with a strong agricultural interest, more especially in the east and south east zone of the selected districts. Despite the fact that the specific lumpy skin disorders were taken into account in the creation of the knowledge score, the results indicate that there are some significant knowledge and awareness gaps. In terms of gender, 405 (92.5%) of cattle owners who are involved in livestock activities are men. Due to cultural custom men is the managers of the family and the external activities inclusive over the men, but female done in around home.

The current finding was in line with the study of Mollel and Mtenga (2000), reported that gender roles in livestock production in Tanzania, which found that men performed a higher percentage of squares such as feeding, providing for the needs of others, maintaining the shed, and selling.

According Oladele *et al.*, (2013) reported Approximately 82.9% of respondents had a high school education or more, which was in line with their understanding of diseases that are differentiated by clinical signs, transmission, and management techniques, particularly with regard to LSD. Because of the use of modern technologies (such as enhanced vaccines and medications), farmers claimed high literacy levels may result in increased output. The present study disagree with above report because 52.1% of the respondents Illiterate but they have knowledge on LSD through experience separated by clinical character sticks. Totally 80.4% of respondents had a good knowledge on LSD.

Vaccination is one of the disease controls mechanisms, in our study 67.5% of respondents had a favorable attitude toward the use of vaccination and treat animal diseases, including LSD. This result disagrees with that of (Belay *et al.*, 2022) reports. who discovered that 79% of patients preferred a specific medication for disease control. Additionally, it is

claimed that over 50% of farmers lacked supportive attitudes and insufficient knowledge of animal immunization.

Awareness creation community-based training especially on trans boundary animal disease to increase house hold income, according Belay *et al.*, (2022) reported 79% of the farmers in threat study area did not take part in any training on animal illnesses and vaccinations. This report similarity with our study 85.6% of survey respondents said they had no training about livestock disease impacts specially on LSD influencing in community.

On the other hand, 33.3% of respondents they don't care about animal immunization through vaccination. This due to lack of training About LSD important, poor governmental policy for LSD control on short and long community-based training frequently.

Therefore, one of the main obstacles to preventing and controlling livestock disease is a lack of or inadequate training for farmers. Because effective disease prevention, control, and eventual elimination depend on knowing what people know, think, and do about the threats these diseases pose.

The results of our current attitude survey revealed that 69.8% of respondents had a negative opinion toward the methods used to prevent and control cattle disease. This finding is in agreement with the study conducted by Girma *et al.* (2022) in Sidama Zone Southern Region, Ethiopia, 71.1% of farmers believed that animal diseases could develop after immunizations were observed. Lack of veterinary education due to community level factors, including the causes of disease transmission and control strategies, is the source of the study area's negative attitude. This may be due to a lack of ongoing education about animal diseases and vaccinations. Previous studies found that higher levels of education were positively related to better knowledge and practices, while close veterinary supervision of the farm was related to better practices regarding the control of diseases.

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particularly with regard to LSD. Because of the use of modern technologies (such as enhanced vaccines and medications), farmers claimed high literacy levels may result in increased output. Our study disagrees with above report because 52.1% of the respondents Illiterate but they have knowledge on LSD through experience separated by clinical character sticks. Totally 80.4% of respondents had a good knowledge on LSD. The findings point to the need for ongoing awareness-raising and educational initiatives. The existing LSD immunization program and the creation of rising awareness campaigns in partnership with other public health professionals can both benefit greatly from close interaction with a veterinarian.

A properly practice, typical procedures like bringing animals into farms from flocks with unknown health statuses without testing and quarantine may be able to account for the persistence of the LSD problem to this day. In this study 69.6% of interviewers did not disclose new animal diagnoses before to mixing in flocks of healthy animals.

Farmers with greater LSD knowledge and practices have been linked to higher levels of schooling. These results can be linked to the development of the educational system throughout time, the exposure of the younger generation to technological advancements, and the implementation of training programs for educating new farmers in this area. These training sessions, especially for the elderly farmers, might actively contribute to LSD awareness. For the control of LSD and to support increased livestock production, the role of the veterinarian in the dissemination of information and training of farmers appears to be of utmost importance.

Although many farmers acknowledged that they are aware of the right course of action, they do not carry it out due to cost, the amount of labor necessary, or carelessness; attitudes definitely do not match practices. This makes even more sense in light of the high-risk habits that the self-reported practices revealed.

The current study revealed that 66.2% of interviewers were not done regularly clean the pen of cattle, 84.0% respondents did not handle good management practice for LSD sick animal and majority of the respondents 85.6% did not receive training about sick animal

handling management. This might be due to lack continuous training community based and shortage of veterinarian skill development.

Majority of the FGD and KII respondents agreed on the disease transmission that unlimited animal movement, shortage of vaccine availability and veterinary service, lack of community-based training especially on LSD.

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

The current study showed that most of the respondents had poor practice; poor hygienic animal pen and no animal diagnosis before mixing with health animal in herds, there is movement of animal from border to border or contact with wild life animals. Moreover, majority of the cattle owners had unfavorable attitude toward the disease. Majority of the respondents had not adequate information and training concerning the livestock diseases and vaccination. There was also a poor sick and health animal handling practice the disease was endemic in the study area. Communication between farmers and veterinary could play an important role in achieving optimization of awareness creation and disease control strategies. There was also not enough veterinary facility available in the study area.

6.2. Recommendations

Based on the above conclusion the following recommendations are forwarded:-

- Implementation of better management practices like, proper disposal of dead animals, cleaning and disinfecting of pens, introducing LSD free animals to herd, animal movement control, and implementing vaccination programs
- Extensive extension service including health education/training must be launched to make the cattle owners, cattle attendants and animal health experts aware of the disease transmission, prevention and control.
- The governmental and non-governmental organization should provide enough veterinary facilities.

7. REFERENCES

- Abebe, W. M. (2018): Bovine lumpy skin disease epidemiology , economic impact and control opportunities in Ethiopia. *PhD Thesis, Wageningen University, The Netherlands.*, 1–12.
- Alabi, O. O., Shoyombo, A. J., Ajala, A. O., & Ogunjimi, S. I. (2019): Animal agriculture: A viable tool for rural women empowerment and redemption from poverty. *International Journal of Civil Engineering and Technology*, 10(2), 2365–2373.
- Andualem, T. (2016): A review on cattle husbandry practices in Ethiopia. *International Journal of Livestock Production*, 7(2) :5–11. <https://doi.org/10.5897/ijlp2015.0276>
- Awad, W. S., Ibrahim, A. K., Mahran, K., Fararh, K. M., & Moniem, M. I. A. (2010): Evaluation of different diagnostic methods for diagnosis of Lumpy skin disease in cows. *Tropical Animal Health and Production*, 42(4): 777–783. <https://doi.org/10.1007/s11250-009-9486-5>
- Ayelet, G., Abate, Y., Sisay, T., Nigussie, H., Gelaye, E., Jemberie, S., & Asmare, K. (2013): Lumpy skin disease: Preliminary vaccine efficacy assessment and overview on outbreak impact in dairy cattle at Debre Zeit, central Ethiopia. *Antiviral Research*, 98(2), 261–265. <https://doi.org/10.1016/j.antiviral.2013.02.008>
- Babiuk, S., Bowden, T. R., Boyle, D. B., Wallace, D. B., & Kitching, R. P. (2008). Capripoxviruses: An emerging worldwide threat to sheep, goats and cattle. *Transboundary and Emerging Diseases*, 55(7), 263–272. <https://doi.org/10.1111/j.1865-1682.2008.01043.x>
- Bagla, V. P., Osuagwuh, U. I., Annandale, C. H., Irons, P. C., & Venter, E. H. (2006): Elimination of toxicity and enhanced detection of lumpy skin disease virus on cell culture from experimentally infected bovine semen samples. *Onderstepoort Journal of Veterinary Research*, 73(4), 263–268.
- Baksi, S., Puwar, P., Rao, N., & Oza, R. (2017): Evaluation of antibody response to Goat Pox cell culture vaccine in goats in India. *Bangladesh Veterinarian*, 33(1): 23–27. <https://doi.org/10.3329/bvet.v33i1.33310>

- Balysheva, V. I., Zhivodeorov, S. P., Pivova, E. Y., Bobrovskaya, N. K., Zhivodeorova, A. V., Anisimova, L. I., Kushnir, S. D., Usadov, T. R., Yurkov, S. G., Salnikov, N. I., & Lunitsin, A. V. (2017): Permissivity of various cell cultures to lumpy skin disease virus. *Sel'skokhozyaistvennaya Biologiya*, 52(6): 1265–1272. <https://doi.org/10.15389/agrobiology.2017.6.1265eng>
- Beard, P. M. (2016): Lumpy skin disease: A direct threat to Europe. *Veterinary Record*, 178(22): 557–558. <https://doi.org/10.1136/vr.i2800>
- Belay, G.M., Alemu, T.G., Techane, M.A., Wubneh, C.A., Assimamaw, N.T., Tamir, T.T., Muhye, A.B., Kassie, D.G., Wondim, A., Terefe, B. and Tarekegn, B.T., 2022. COVID-19 vaccine acceptance rate and its predictors in Ethiopia: A systematic review and meta-analysis. *Human vaccines & immunotherapeutics*, 18(6), p.2114699.
- Ben-Gera, J., Klement, E., Khinich, E., Stram, Y., & Shpigel, N. Y. (2015): Comparison of the efficacy of Neethling lumpy skin disease virus and x10RM65 sheep-pox live attenuated vaccines for the prevention of lumpy skin disease - The results of a randomized controlled field study. *Vaccine*, 33(38): 4837–4842. <https://doi.org/10.1016/j.vaccine.2015.07.071>
- Bhoye, S. (2022): Lumpy skin disease (LSD) in cattle caused by the lumpy skin disease virus (Neethling virus): A member of the genus capripoxvirus within the family poxviridae. *International Journal of Veterinary Sciences and Animal Husbandry*, 7(6): 25–28. <https://doi.org/10.22271/veterinary.2022.v7.i6a.451>
- Bianchini, J., Simons, X., Humblet, M. F., & Saegerman, C. (2023): Lumpy Skin Disease: A Systematic Review of Mode of Transmission, Risk of Emergence and Risk Entry Pathway. *Viruses*, 15(8). <https://doi.org/10.3390/v15081622>
- Body, M., Singh, P. K., Hussain, H. M., Al-rawahi, A., Al-maawali, M., Al-lamki, K., & Al-habsy, S. (2012): Clinico-histopathological findings and PCR based diagnosis of lumpy skin disease in the Sultanate of Oman. *Pakistan Veterinary Journal*, 32(2), 206–210.
- Bogale, G. A., & Erena, Z. B. (2022): Drought vulnerability and impacts of climate change on livestock production and productivity in different agro-Ecological zones of Ethiopia. *Journal of Applied Animal Research*, 50(1), 471–489.

<https://doi.org/10.1080/09712119.2022.2103563>

- Botlhoko, G. J., & Oladele, O. I. (2013): Factors Affecting Farmers Participation in Agricultural Projects in Ngaka Modiri Molema District North West Province, South Africa. *Journal of Human Ecology*, 41(3): 201–206. <https://doi.org/10.1080/09709274.2013.11906568>
- Calistri, P., DeClercq, K., Gubbins, S., Klement, E., Stegeman, A., Cortiñas Abrahantes, J., Antoniou, S., Broglia, A., & Gogin, A. (2019): Lumpy skin disease. *EFSA Journal*, 17(3): <https://doi.org/10.2903/j.efsa.2019.5638>
- CM, C., LF, R., RP, K., & PS, M. (2003): Attempted mechanical transmission of lumpy skin disease virus by biting insects. *Medical and Veterinary Entomology*, 17(3): 294–300. <https://pubmed.ncbi.nlm.nih.gov/12941014/>
- Conway, M. J., Colpitts, T. M., & Fikrig, E. (2014): Role of the vector in arbovirus transmission. *Annual Review of Virology*, 1(1): 71–88. <https://doi.org/10.1146/annurev-virology-031413-085513>
- CSA. 2020a. Agricultural Sample Survey 2019/20 [2012 E.C.]. Volume II report on livestock and livestock characteristics (private peasant holdings). Central Statistical Agency (CSA): Addis Ababa, Ethiopia.
- Davis, K., Swanson, B., Res, D. A.-G. O., & 2019, undefined. (2009): Review and recommendations for strengthening the agricultural extension system in Ethiopia. *Gatesopenresearch.OrgPaperpile*. <https://gatesopenresearch.org/documents/3-1164>
- El-Kenawy, A. A., & El-Tholoth, M. S. (2010): Sequence analysis of attachment gene of lumpy skin disease and sheep poxviruses. *Virologica Sinica*, 25(6): 409–416. <https://doi.org/10.1007/s12250-010-3150-0>
- Elhaig, M. M., Selim, A., & Mahmoud, M. (2017): Lumpy skin disease in cattle: Frequency of occurrence in a dairy farm and a preliminary assessment of its possible impact on Egyptian buffaloes. *Onderstepoort Journal of Veterinary Research*, 84(1): <https://doi.org/10.4102/ojvr.v84i1.1393>
- Farah Gumbe, A. A. (2018). Review on lumpy skin disease and its economic impacts in Ethiopia. *Journal of Dairy, Veterinary & Animal Research*, 7(2). <https://doi.org/10.15406/jdvar.2018.07.00187>

- Feleke, F. B., Berhe, M., Gebru, G., & Hoag, D. (2016): Determinants of adaptation choices to climate change by sheep and goat farmers in Northern Ethiopia. the case of Southern and Central Tigray, Ethiopia. *SpringerPlus*, 5(1):<https://doi.org/10.1186/s40064-016-3042-3>
- Fèvre, E. M., Bronsvoort, B. M. D. C., Hamilton, K. A., & Cleaveland, S. (2006): Animal movements and the spread of infectious diseases. *Trends in Microbiology*, 14(3): 125–131. <https://doi.org/10.1016/j.tim.2006.01.004>
- Gari, G., Biteau-Coroller, F., LeGoff, C., Caufour, P., & Roger, F. (2008): Evaluation of indirect fluorescent antibody test (IFAT) for the diagnosis and screening of lumpy skin disease using Bayesian method. *Veterinary Microbiology*, 129(3–4): 269–280. <https://doi.org/10.1016/j.vetmic.2007.12.005>
- Gari, G., Waret-Szkuta, A., Grosbois, V., Jacquiet, P., & Roger, F. (2010): Risk factors associated with observed clinical lumpy skin disease in Ethiopia. *Epidemiology and Infection*, 138(11): 1657–1666. <https://doi.org/10.1017/S0950268810000506>
- Gelaye, E., Mach, L., Kolodziejek, J., Grabherr, R., Loitsch, A., Achenbach, J. E., Nowotny, N., Diallo, A., & Lamien, C. E. (2017): A novel HRM assay for the simultaneous detection and differentiation of eight poxviruses of medical and veterinary importance. *Scientific Reports*, 7. <https://doi.org/10.1038/srep42892>
- Giasuddin, M., Yousuf, M., Hasan, M., Rahman, M., Hassan, M., & Ali, M. (2020): Isolation and molecular identification of Lumpy Skin Disease (LSD) virus from infected cattle in Bangladesh. *Bangladesh Journal of Livestock Research*, 26(1–2): 15–20. <https://doi.org/10.3329/bjlr.v26i1-2.49933>
- Girma, A., Workineh, C., Bekele, A., Tefera, D., Gelana, H., Gebisa, D., Chalchisa, T., & Pal, M. (2022): Assessment of Farmers Knowledge and Attitude on Vaccination of Livestock and its Implications in Ejere District of West Shewa Zone, Oromia, Ethiopia. *Acta Scientific Microbiology*, 03–11. <https://doi.org/10.31080/asmi.2022.05.1170>
- Grompone Von Gioi, R., Jakubowicz, J., Morel, J. M., & Randall, G. (2010): LSD: A fast line segment detector with a false detection control. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 32(4): 722–732. <https://doi.org/10.1109/TPAMI.2008.300>

- GSG, Z., AH, M., AM, A., KAEA, E.-R., MH, K., & HAAA, Z. (2019): Detection of lumpy skin disease virus in cattle using real-time polymerase chain reaction and serological diagnostic assays in different governorates in Egypt in 2017. *Veterinary World*, 12(7) :1093–1100. <https://pubmed.ncbi.nlm.nih.gov/31528038/>
- Hahladakis, J. N., Velis, C. A., Weber, R., Iacovidou, E., & Purnell, P. (2018): An overview of chemical additives present in plastics. Migration, release, fate and environmental impact during their use, disposal and recycling. *Journal of Hazardous Materials*, 344: 179–199. <https://doi.org/10.1016/j.jhazmat.2017.10.014>
- Hailu, B. (2015): Economic Importance and Control Techniques of Lumpy Skin Diseases. *Animal and Veterinary Sciences*, 3(2), 58. <https://doi.org/10.11648/j.avs.20150302.15>
- Hailu, B., Tolosa, T., Gari, G., Teklue, T., & Beyene, B. (2014): Estimated prevalence and risk factors associated with clinical Lumpy skin disease in north-eastern Ethiopia. *Preventive Veterinary Medicine*, 115(1–2): 64–68. <https://doi.org/10.1016/j.prevetmed.2014.03.013>
- Haque, M. H., Roy, R. K., Yeasmin, F., Fakhruzzaman, M., Yeasmin, T., Sazib, M. R. I., Uddin, M. N., & Sarker, S. (2021): Prevalence and Management Practices of Lumpy Skin Disease (LSD) in Cattle at Natore District of Bangladesh. *European Journal of Agriculture and Food Sciences*, 3(6), 76–81. <https://doi.org/10.24018/ejfood.2021.3.6.420>
- Herrero, M., Grace, D., Njuki, J., Johnson, N., Enahoro, D., Silvestri, S., & Rufino, M. C. (2013). The roles of livestock in developing countries. *Animal*, 7(SUPPL.1), 3–18. <https://doi.org/10.1017/S1751731112001954>
- Hewson, C. J. (2004). Veterinary Epidemiologic Research. *Applied Animal Behaviour Science*, 88(1–2), 183–184. <https://doi.org/10.1016/j.applanim.2004.03.001>
- Hoag, C. (2022): Livestock Production. *The Fluvial Imagination: On Lesotho's Water-Export Economy*, 100–119. <https://doi.org/10.1525/luminos.134.f>
- Hrabák, J., & Konečný, O. (2018): Multifunctional agriculture as an integral part of rural development: Spatial concentration and distribution in Czechia. *Norsk*

<https://doi.org/10.1080/00291951.2018.1532967>

- Hunter, P., & Wallace, D. (2001): Lumpy skin disease in Southern Africa. A review of the disease and aspects of control. *Journal of the South African Veterinary Association*, 72(2):68–71. <https://doi.org/10.4102/jsava.v72i2.619>
- Irons, P. C., Tuppurainen, E. S. M., & Venter, E. H. (2005): Excretion of lumpy skin disease virus in bull semen. *Theriogenology*, 63(5): 1290–1297. <https://doi.org/10.1016/j.theriogenology.2004.06.013>
- Kahana-Sutin, E., Klement, E., Lensky, I., & Gottlieb, Y. (2017): High relative abundance of the stable fly *Stomoxys calcitrans* is associated with lumpy skin disease outbreaks in Israeli dairy farms. *Medical and Veterinary Entomology*, 31(2): 150–160. <https://doi.org/10.1111/mve.12217>
- Khan, Y. R., Ali, A., Hussain, K., Ijaz, M., Rabbani, A. H., Khan, R. L., Abbas, S. N., Aziz, M. U., Ghaffar, A., & Sajid, H. A. (2021): A review: Surveillance of lumpy skin disease (LSD) a growing problem in Asia. *Microbial Pathogenesis*, 158. <https://doi.org/10.1016/j.micpath.2021.105050>
- Klement, E., Broglia, A., Antoniou, S. E., Tsiamadis, V., Plevraki, E., Petrović, T., Polaček, V., Debeljak, Z., Miteva, A., Alexandrov, T., Marojevic, D., Pite, L., Kondratenko, V., Atanasov, Z., Gubbins, S., Stegeman, A., & Abrahantes, J. C. (2020): Neethling vaccine proved highly effective in controlling lumpy skin disease epidemics in the Balkans. *Preventive Veterinary Medicine*, 181. <https://doi.org/10.1016/j.prevetmed.2018.12.001>
- Muhammad Ashfaq* , Amar Razzaq, Sarfraz Hassan and Shamsheer ul Haq(2015): Institute of Agricultural & Resource Economics, University of Agriculture, Faisalabad, Pakistan
- Kumar, P., Kumari, R. R., Devi, S., Tripathi, M. K., Singh, J., Kumar, R., & Kumar, M. (2021): Emergence and transboundary spread of lumpy skin disease in South Asia. *Indian Journal of Animal Sciences*, 91(7): 507–517. <https://doi.org/10.56093/ijans.v91i7.115893>
- Leta, S., & Mesele, F. (2014): Spatial analysis of cattle and shoat population in Ethiopia: Growth trend, distribution and market access. *SpringerPlus*, 3(1): 1–10.

<https://doi.org/10.1186/2193-1801-3-310>

- Metaferia, F., Cherenet, T., Gelan, A., Abnet, F., Tesfay, A., & Ali, J. A. (2011): A Review to Improve Estimation of Livestock Contribution to the National GDP. *IGAD Livestock Policy Initiative, December*, 0–42.
- Mitiku Tamire. (2022). Current Status of Lumpy Skin Disease and Its Economic Impacts in Ethiopia. *Journal of Vaccine Research REVIEW*, 1(1): 1–9.
- Molini, U., Boshoff, E., Niel, A. P., Phillips, J., Khaiseb, S., Settypalli, T. B. K., Dundon, W. G., Cattoli, G., & Lamien, C. E. (2021): Detection of lumpy skin disease virus in an asymptomatic eland (*Taurotragus oryx*) in Namibia. *Journal of Wildlife Diseases*, 57(3), 708–711. <https://doi.org/10.7589/JWD-D-20-00181>
- Molla, W., de Jong, M. C. M., Gari, G., & Frankena, K. (2017): Economic impact of lumpy skin disease and cost effectiveness of vaccination for the control of outbreaks in Ethiopia. *Preventive Veterinary Medicine*, 147: 100–107. <https://doi.org/10.1016/j.prevetmed.2017.09.003>
- Molla, W., Frankena, K., Gari, G., Kidane, M., Shegu, D., & de Jong, M. C. M. (2018): Seroprevalence and risk factors of lumpy skin disease in Ethiopia. *Preventive Veterinary Medicine*, 160: 99–104. <https://doi.org/10.1016/j.prevetmed.2018.09.029>
- Mollet, N. M., & Mtenga, N. (2000): Gender Roles in Livestock Production. the Case of Tchenzema Ward in the Western Uluguru Highlands-Morogoro-Tanzania. *South African Journal of Agricultural Extension*, 29: 47–57.
- Oladele, D.A., Balogun, M.R., Odeyemi, K. and Salako, B.L., 2020. A comparative study of knowledge, attitude, and determinants of tuberculosis-associated stigma in rural and urban communities of Lagos State, Nigeria. *Tuberculosis research and treatment*, 2020, pp.1-14.
- Ranjan Jena, B., Kantale, R. A., Dash, A., Singh, P., Basak, G., Singh, S., & Jadhao, A. (2022): *Emergence of lumpy skin disease virus (LSDV) infection in cattle and buffaloes in India*. www.thepharmajournal.com
- Regmi, S. (2020): Lumpy skin disease (LSD) outbreak in Nepal. *Authorea Preprints*, 1–4. <https://www.authorea.com/doi/full/10.22541/au.159986266.62442803?commit=2cc0d5e0720d5fd3da779f217117ad6f6fa66f36>

- Sanz-Bernardo, B., Suckoo, R., Haga, I. R., Wijesiriwardana, N., Harvey, A., Basu, S., Lerner, W., Rooney, S., Sy, V., Langlands, Z., Denison, E., Sanders, C., Atkinson, J., Batten, C., Alphey, L., Darpel, K. E., Gubbins, S., & Beard, P. M. (2022): The Acquisition and Retention of Lumpy Skin Disease Virus by Blood-Feeding Insects Is Influenced by the Source of Virus, the Insect Body Part, and the Time since Feeding. *Journal of Virology*, 96(15). <https://doi.org/10.1128/jvi.00751-22>
- Selim, A., Manaa, E., & Khater, H. (2021): Molecular characterization and phylogenetic analysis of lumpy skin disease in Egypt. *Comparative Immunology, Microbiology and Infectious Diseases*, 79. <https://doi.org/10.1016/j.cimid.2021.101699>
- Sudhakar, S. B., Mishra, N., Kalaiyarasu, S., Jhade, S. K., Hemadri, D., Sood, R., Bal, G. C., Nayak, M. K., Pradhan, S. K., & Singh, V. P. (2020): Lumpy skin disease (LSD) outbreaks in cattle in Odisha state, India in August 2019: Epidemiological features and molecular studies. *Transboundary and Emerging Diseases*, 67(6): 2408–2422. <https://doi.org/10.1111/tbed.13579>
- Tuppurainen, E. S. M., & Oura, C. A. L. (2012): Review: Lumpy Skin Disease: An Emerging Threat to Europe, the Middle East and Asia. *Transboundary and Emerging Diseases*, 59(1), 40–48. <https://doi.org/10.1111/j.1865-1682.2011.01242.x>
- Tuppurainen, E. S. M., Pearson, C. R., Bachanek-Bankowska, K., Knowles, N. J., Amareen, S., Frost, L., Henstock, M. R., Lamien, C. E., Diallo, A., & Mertens, P. P. C. (2014): Characterization of sheep pox virus vaccine for cattle against lumpy skin disease virus. *Antiviral Research*, 109(1): 1–6. <https://doi.org/10.1016/j.antiviral.2014.06.009>
- Upton, M. (2004): The role of livestock in economic development and poverty reduction. *PPLPI Working Paper N^o 10*.
- Wu, D., Courtney, C. G., Lance, B. J., Narayanan, S. S., Dawson, M. E., Oie, K. S., & Parsons, T. D. (2010): Optimal arousal identification and classification for affective computing using physiological signals. Virtual reality stroop task. *IEEE Transactions on Affective Computing*, 1(2): 109–118. [10.1109/T-AFFC.2010.12](https://doi.org/10.1109/T-AFFC.2010.12)

8. ANNEXES

1: Questioner format

Date of collection _____

MEKELLE UNIVERSITY COLLEGE OF VETERINARY SCIENCE

Introduction: Dear respondents you are kindly to respond you know to the following forwarded questions. Consent agreement: All data information collected in this questionnaire will not be disclosed and stored coded all data that cannot identify each respondent apart from the investigator

Section I; social demographic character of the participants put tike (√) in selective item.

1. Name of respondent (cod) -----Zone -----District-----PA-----Age ----
2. Agro climatic of the area: highland low land midland
3. Sex of respondents: male female
4. Educational status: illiterate Elementary (grade 1-8) High school (grade 9-10),
 College and above
5. Current occupation: Farmer Business man Governmental

Section II; The potentials of risk factors to LSD occurrence

1. How many cattle herds size? -----
2. Which type of grazing in the pasture point use? Commune Individual
3. What type of watering point use? River common dump individual Ground water
4. Do you moving the animals from place to place for searching feed/water seasonally?
Yes No
- 4.1. If yes, When? Summer autumn winter spring

3. Section III; Knowledge assessment regarded of LSD.

1. Have you ever heard of skin disease of cattle in herd? Yes No
2. Have you seen clinical sign of LSD which is firm coin shape swelling on skin, rough hair coat and lesion in mucus membrane in your cattle? Yes No
3. Do you know LSD is tans boundary disease? Yes No
4. Do you know the methods of transmission LSD by through Contact, introduce new animal before diagnosis to mix with herd and use of common grazing/watering point?
Yes No
5. Do you know LSD it is morbidity higher than mortality? Yes No

6. Do you know the possible causes for LSD aggravated by arthropod blood feeding vectors? Yes No

7. Do you know the LSD virus is not good response for drug treatment? Yes No

8. What do you think about the different methods for LSD control or decrease of risk factors?

8.1. Is Use of quarantine for LSD to reduced spread of the disease? Yes No

8.2. Use of trapping reduces the risk of transmit LSD to other community. Yes No

8.3. Is use of treatment external parasite reducing the risk factor of LSD? Yes No

9. Do you know the impacts of LSD (loss of animal production, draft power and increase the health care cost)? Yes No

10. It is important to keep the environment around pen clean to avoid contamination of LSD. Yes No

4. Section IV; community attitude regarding LSD

1. Is their calf was more affected than adult regarded LSD? Strongly-agree Agree
Dis-agree Strongly-disagree, I don't know

2. Is cross breed of cattle is more affected than local breed by LSD? Strongly-agree
Agree, dis-agree strongly-disagree I don't know

3. Is LSD occurred seasonally? Strongly-agree Agree dis-agree strongly
disagree I don't know

4. Do you agree to go to the animal health clinic when your animals sick by LSD? Strongly agree
Agree disagree strongly-disagree I don't know

5. Have you perceived LSD spread by blood feeding insects during outbreak? Strongly-agree
Agree disagree strongly- disagree I don't know

6. Do you have confidence in prevention the LSD by vaccination? Strongly -agree
Agree strongly disagree I don't know

7. Do you agree by twelve-day interval spray of chemical for external parasite is reducing of LSD infestation? Strongly-agree Agree disagree strongly- dis
agree I don't know

8. Do your belief that regularly follows up LSD after treated of sick animal to elaborate progress of the disease? Strongly-agree Agree disagree strongly- disagree I
don't know

9. Do you believe that animal owners should allow to administer injectable drugs to their animals for LSD Infection prevention. Strongly-agree agree disagree strongly-disagree I don't know

Section v; related practice regarding LSD

1. Had you introduced new cattle to your herd? Yes No
2. Do you diagnose new animal before mixing your farming? Yes No
3. you allow your cattle to graze/watery together with other Niebuhr animals? yes No
4. Have you vaccinated regularly LSD vaccine your animals above 6 months of all age? Yes No
- 4.1. If yes, when? Before LSD onset After LSD onset
5. Do you treat your animal after onset of the LSD? Yes No
- 5.1. If yes, what type's treatment you use? Traditional medicine go to veterinary clinic
- 5.2. If use the traditional medicine (List the type and source)-----
- 6. Do you regularly follow up progress of the LSD after treated? Yes No
7. What types of breeding system did you use? AI your own bull shared bull
8. If the cattle died by LSD what is the action to be take? Burying Consuming for food throw-away
9. What action do you take for LSD infected cattle? Inform to veterinary service/clinic segregation Follow up in home I don't know
10. If the LSD occurred in your herd, do you report for veterinarians? Yes No
11. Do you buy medical antibiotic drugs for your self-treating of LSD your patient animals? Yes No
12. If yes, do you do cleaning equipment after working of LSD treatment? Yes No
13. Do you maintain the hygiene of the pen regularly? Yes No
14. Do you handle a good management of LSD sick animals means to give soft and palatable feed, clean water and shelter? Yes No
15. Did you receive training on LSD? Yes No

Section I, group focus discussion (GFD) questions regarding of LSD.

Address: Zone-----City: _____ Keeble: _____ Mobile _____

1. What are the most important clinical sign of LSD? -----

2. What did you think about the pre disposing factors for LSD outbreak in your community? -----

3. What did you think about the vaccination status of LSD related regularly all above six month age vaccinated and related Effectiveness of the vaccine? -----

4. What are the possible reasons or challenges for LSD transmission control?-----

Section II, key informative interview (KII) questions regarding of LSD.

Address: Zone-----City: _____ Kebelle: _____ Moble ____

1. What is the importance of LSD in the community? -----

2. In which season LSD are mostly occurred (summer, autumn, winter and spring)? Why? Write the reason.-----

3.How do awareness raising on LSD outbreak?-----

4. What are your suggestion for controlling of LSD and minimize their impacts on the community? -----



Figure 2: Focus Group Discussion in Enderta district



Figure 3 : Focus Group Discussion in Wukro



Figure 4: Clinical sign of LSD active case



Figure 5: Clinical sign of LSD chronic case