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Assessment of Distribution and Associated Risk Factors of Lumpy Skin Disease in Selected Districts of West Wollega Zone, Western Ethiopia

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Abstract: Lumpy skin disease (LSD) is an economically devastating emerging viral disease of cattle caused by a virus associated with the Neethlig poxvirus in the genus Capripoxvirus of the family Poxviridae. A questionnaire survey was conducted from October, 2012 to May, 2013 in two (Gimbi and Lalo Assabi) districts of Western Wollega of Oromia Regional State. The objectives of the study were to determine animal and herd level seroprevalence of lumpy skin disease and to assess the risk factors that contribute to the occurrence of lumpy skin disease. A total of 252 households or farmers that is 127 from Gimbi and 125 Lalo Assabi districts were interviewed using designed questionnaire. A summer season showed statistically significant association ($p = 0.000$, OR = 4.224. CI = 1.13-7.57) with concomitant high levels of insect activity. Finally, the study revealed that, the risk factors of the disease observed warrants future detailed study on the transmission of the disease in the area.

Key words: LSD · Cattle · Risk factors · Seroprevalence · West Wollega · Ethiopia

INTRODUCTION

Agriculture is the most employment industry in the world and the sector is the world's largest user and steward of natural resources and, like any productive activity, livestock production exacts an environmental cost [1, 2]. Livestock production constitutes one of the principal means of achieving improved living standards in many regions of the developing world [3].

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 [4]. Beyond their direct role in generating food and income, livestock are a valuable asset, serving as a store of wealth, collateral for credit and an essential safety net during times of crisis [1, 2].

In Ethiopia Livestock, production is an integral 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 traction power, fertilizing and mean of transport [5,6]. The livestock sector now has significant contribution to the total foreigner currency of the country.

In the future, livestock production will increasingly be affected by competition for natural resources, particularly land and water [7]. Currently the overall livestock production constraints in Ethiopia are feed shortages, livestock diseases, low genetic potential of indigenous livestock and lack of marketing infrastructure and water shortages [8, 9]. Among the many other diseases, which are known in causing economic losses and of poor productivity in livestock specifically in cattle is the presence of lumpy skin disease in many parts of the country [10- 12].

Lumpy skin disease (LSD) is a generalized skin disease which is an infectious, eruptive, occasionally fatal disease of cattle caused by a virus associated with the neethlig poxvirus in the genus Capripoxvirus of the family Poxviridae [13- 16]. The economic losses due to this

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disease is associated with decreased milk production, traction power loss, weight loss, poor growth, abortion, infertility and skin damage. Pneumonia is a common sequel in animals with lesions in the mouth and respiratory tract [17- 22].

LSD was first observed in the western part of Ethiopia (southwest of Lake Tana) in 1983 [23]. It has now spread to almost all the regions and agro ecological zones [24, 10]. Some epidemiological studies have been carried out since the disease has become established in the country, with the diverse agro-ecological and production systems [10].

Study based on sero-prevalence in southern Ethiopia reported a prevalence of 6% [25]. Targeted sampling from outbreak areas around Southern Range land, Wolliso town and north Ethiopia reported prevalence's of 11.6%, 27.9% and 28%, respectively [25- 27]. A recent prevalence study [12] showed higher herd prevalence recorded in Afar (51%) and Tigray (37%) regions. Published information on the factors that influence the occurrence of LSD are not many as general, however some studies indicated that LSD is a disease which affects all age group; in Africa imported Bos taurus appear to be more susceptible than the indigenous breeds [17]. The LDSV was found to be associated with Capri poxvirus outbreaks in Kenya [28].

A clinical case of LSD has been reported in other animals: Asian water buffalo from Egypt [29]. Antibodies have been demonstrated in black and blue wild beests, Elan, Giraffe, greater Kudu and others [30, 31]. Some researchers have made attempt the transmission of the disease with different flies [32, 13, 33 and 34]. Recently [35] reported the potential role of ixodic tick in the transmission of LSDV. Weather changes such as cold may adversely affect the insect vector and infected saliva may contribute to the spread of the disease [36].

However, there is a gap in epidemiological disease information (Taransboundry diseases) particularly lumpy skin disease in West Wollega zone except few outbreak reports from the area. The study area interfaces with the pastoralists often crossing the border to other African countries (Sudan and South Sudan) and Benishangul Gumuz Regional State of Ethiopia. Thus, the objective of this research is to assess the risk factors those contribute to the occurrence of lumpy skin disease in the study areas.

MATERIALS AND METHODS

Description of Study Areas: The study was conducted in Gimbi and Lalo Asabi districts of West Wollega Zone of Oromiya Regional State; Western Ethiopia. West Wollega is one of the 18 Administrative Zones of Oromiya National Regional State. Administratively, the Zone has 21 districts, of which 19 are rural districts and 2 are urban administrations which are again subdivided into 533 kebele administrative units (487 rural and 46 urban Kebeles). Gimbi Town, which is located at a distance of 441 km from Addis Ababa, is the capital of the Zone, it is located between 8°12'- 10°03' N (latitudes) and 34°08'- 36°10'E (longitudes).

The Zone shares borders with Benishangul-Gumuz Regional State, Qellem Wollega Zone, East Wollega Zone, Illubabor Zone and Gambella Regional State in the Northwest, Northeast and east; West, East and in the South directions, respectively. The land area of the Zone is estimated to be 14,160.29 km^2. It experiences tropical climate with relatively high mean annual temperature. Generally, mean annual temperature of the Zone varies from 15°C to over 25°C [37].

The annual rainfall pattern in the Zone decreases from East to West following the physiographic nature of the Zone. The mean annual rainfall of the Eastern high lands ranges from 1800-2000 mm, while in the central plateaus. It ranges between 1600-1800 mm and in the remaining parts of the Zone, it becomes between 1200-1600 mm. In the South-western parts of the Zone, it is even less than 1200 mm [37].

Livestock population of West Wollega Zone is 1,775,404 Bovines, 385,098 Ovine, 353,385 caprine, 137,926 Equines, 2,066,678 poultry and 620,397 Bee colonies [38]. The farming system in the zone is mixed (Livestock production integrated with crop production). Livestock production system is usually extensive and the most common breeds are the local zebu breeds. Common grasslands provide extensive pasture for all parts of the areas of both study districts.

From the total (21) districts of the Zone, two of the rural districts (9.5%) were selected considered as representative of the rest districts of the Zone.

Gimbi District: Is located between 90°10°- 9°17° North latitude and 35°44°- 36°09° East longitudes. The mean minimum and maximum annual temperature ranges between 10°C and 30°C. The mean annual rainfall is 1400-1800ml. It lies at altitudinal range of 1200m-2222m above sea level (a.s.l.). As reported by Ghimbi District Finance and Economic Development office (2001), the district has high livestock potential with 107,334 cattle, 13,476 Ovine, 5124 Caprine, 5211 Equine and Poultry 44144 and 25600 Bee Colonies [39].

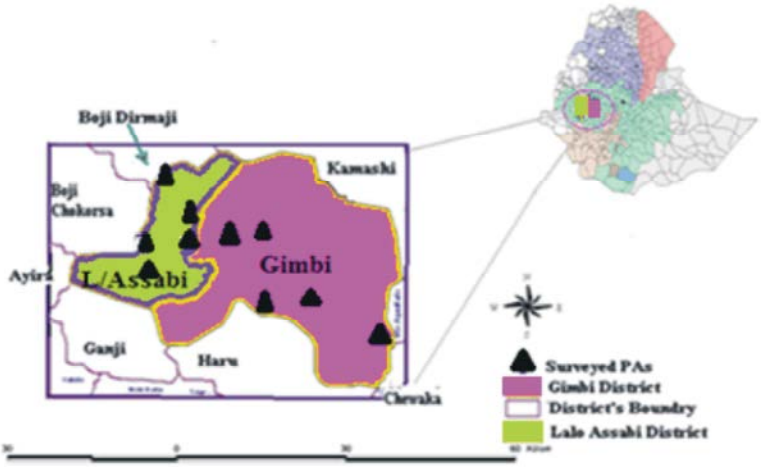

Fig. 1: Map of the study Area

Lalo Asabi District: Has an area of 418Km^2 and located in the Eastern part of West Wellega Zone. It shares common boundaries with Gimbi, Guliso, Bodji and Yubdo districts and Benishangul-Gumuz Regional State. Enango town is its capital town that is about 23km far away from the Capital of the Zone (Gimbi). Altitudine ranges between 1500 and 1900 m.a.s.l. The district has an estimated 37, 279 cattle, 13870 Ovine, 565 Caprine, 4383 Equine, 50,109 Poultry. The district is classified into kola (2.2%) and Woinadega (97.8%) agro climatic zones [40].

The differences between both districts were altitudinal ranges, livestock size which is very low in Lalo Assabi District and agro climatic zones in which all types were found in Gimbi District.

Study Population: The households in both districts were selected based on the accessibility, presence of livestock markets activity, production and management system, history of contact with wild life and transboundary animal's movement from other pastoralist area of neighbouring Regional States of Ethiopia. These districts share similar farming system but different in agrological locations.

Study Design: A cross-sectional study was carried out from October, 2012- May, 2013 to determine the risk factors for Lumpy Skin Disease occurrence in the study area. Multi-stage sampling method was followed to select the sampling units, districts and PAs were selected to be included in the study.

The households included in the study were distributed over the purposively selected districts. Five PAs were randomly selected from each district in consultation with the respective district Agricultural Office; especially Livestock Resource, Development and Health Agency expert's based on location and accessibility.

Sampling Technique and Sample Size Determination

Questionnaire Survey: By assuming an average number of 10 animals per herd which represent households (herd owners), there were a total of 5,028 in both districts. A questionnaire which equivalent to the herd size was designed and administered to the herd owners (household) and interview face to face by using local language, which was Afan Oromo that taken 10-15 minutes was carried out.

In each PA, the number of selected herd owners range from 22 (Were Seyo of Gimbi District) to 28 (Bikiltu Tokuma of Gimbi and Dongoro Dissi of Lalo Assabi Districts) in both Districts. Accordingly, 127 and 125 households were included in the study from Gimbi and Lalo Assabi districts respectively. So, a total of 252 households or farmers were interviewed using prepared semi-structured questionnaire.

About sixteen (16) questions were designed to capture information of the disease and associated risk factors that may be associated with the occurrence of the disease in the study area. The contents of the questionnaire survey include general information of the respondents (age, sex, religion, educational status, bases of their livelihood). It also includes history of disease occurrence (common constraints of livestock, major livestock diseases, season of occurrence and duration of outbreak).

Additionally, herd management (Herd size, herd structure, farming system, introduction of new animal, vaccination status, watering or grazing points, contact of

animals with different areas and wild life, presence of disease transmission, Biting flies & existence of livestock markets), breed and sex were collected.

The risk factors for the outbreak of the disease would be observed in the study area (Annex 1). The survey was carried out in two purposively selected districts after serum collection had been finalized. Ten (10) PAs that were selected for serological survey were included in the questionnaire survey to assess factors for LSD occurrence in the study area. Household having cattle were the sampling units for questionnaire survey.

The selected farmers then were asked questions related to the composition of the herd, the management system used and if vaccination or any other treatment had been applied during or after the course of the disease. Additionally, they were asked to explain the symptoms of the disease and clinical observation of sick animals related to LSD would be observed during sample collection in order to crosscheck whether the disease is surely lumpy skin disease or not. Finally, valuable information was collected through questionnaire from randomly selected herd owners found in each PAs of the districts.

RESULTS

Study Population: There were a total of 63 (58 rural and 5 urban) kebeles (PAs) in both districts. The total cattle population from 10 PAs was 17,917 (out of which 11,603 heads of cattle from five PAs of Gimbi and 6,314 heads of cattle from five PAs of Lalo Assabi district).

The number of cattle in each selected kebeles of Gimbi district was ranging between 1,725 (Lowest) in Were Seyo and 2,734 (Largest) heads in Bikiltu Tokuma kebele.

Similarly, cattle population in kebeles of Lalo Assabi district was ranging between 994 in Horda Daleti and 1,724 heads in Dongoro Dissi kebele and the average number of cattle per kebeles of Gimbi and Lalo Assabi districts was 2,230 and 1,359 heads respectively (Table 1).

Description of the Interview Respondents: During the study period, 252 (n=252) respondents (individuals of herd owners) in selected 10 PAs of two (2) districts of the Zone were interviewed.

Based on their religion and educational status, the respondents were classified as Muslim; 4.0%, Christian; 93.3% and others (Wakefeta); 2.8% and as literate; 80.2% while illiterate; 19.8%. According to their sex and age; 81.3% of them were males while 18.7% of them were females and 83.3% of them were adult while 16.7% of them were young. Additionally, based on their livelihood; 73.8% practiced mixed agriculture; 12.3% practiced mixed agriculture and trading; 7.9% practiced mixed agriculture, trading and employed and 6.0% of them were practicing others. Agro climate of the surveyed PAs of the two districts were mostly high lands and midlands. Generally, most Christian, literate and male respondents those running their livelihood with mixed agriculture were included in this study (Table 2).

Associated Risk Factors of Lumpy Skin Disease Occurrence in the Study Area: Questionnaire survey was carried out and it has been tried to identify risk factors for LSD occurrence. The seasons were compared and about 74.2% of respondents informed that, summer was the season at which the disease occurred in the area. The disease occurrence in a spring season was the lowest (3.85%) in the area.

Also about 95.6% of respondents informed that they introduced new cattle to their herds. As 50.8% of respondents replied that their cattle had not been vaccinated and according to a proportion of 68.3% herd owners, there was no seasonal movement of animals from place to place for search of feed and water; that means most of the farming system in the area was sedentary.

In both districts, cattle grazed communally and higher frequency of communal grazing type 73.0% and 100.0% communal watering point was reported by herd owners during this study. As the result indicated that, 98.8%, 65.5%, 91.7% and 61.5% of herd owners was reported as the presence of animals contact with different PAs, district, Zone or regions and countries, respectively. A 91.7% of them reported that, dry season (Bona) was a season at which contact of animals is high in the area. However, dry season has no statistically significance ($p>0.05$) association with the occurrence of lumpy skin disease. As 67.1% of herd owners informed, a summer season (Ganna) was the leading season of the year. A summer season showed statistically significant association ($p<0.05$) with concomitant high levels of insect activity.

In addition, factors with p-values less than or equal to 0.20 (vaccination history, seasonal movement and contact with other districts livestock's) were fitted into the multivariate logistic regression model. Nevertheless, except summer season with a high of activity of flies, none of the farm-level risk factors were found statistically significant ($p>0.05$).

Table 1: Summary of kebeles, herd owners and livestock population in both districts

	N° of PAs in districts							
Name of districts	Rural	Urban	Total	Name of selected PAs	Total herd owners	N° of selected herd owners	Cattle Pop^n in PA	Altitude
Gimbi	31	1	32	Were Seyo	150	23	1,725	1903
				Bikiltu Tokuma	460	28	2,734	1821
				Jogir	579	25	2,422	1298
				Chutta Khaki	421	23	2,474	2016
				Lelisa Yesus	510	28	2,248	1851
Subtotal	31	1	32	5	2,120	127	11,603	-
Lalo Assabi	27	4	31	Horda Daleti	707	25	994	1766
				Nebo Daleti	513	26	1,040	1618
				Werebabo Siben	620	23	1,212	1933
				Haroji Serdo	652	28	1,344	1936
				Dongoro Dissi	416	23	1,724	1937
Subtotal	27	4	31	5	2,908	125	6,314	-
G. total	58	5	63	10	5,028	252	17,917	

Source: From the Livestock Resource, Development and Health Agency Office of Gimbi and Lalo Assabi districts

Table 2: Summary of related information from respondents in both districts

Parameters	Categories	Frequency	Percentage (%)
Sex of owners	Females	47	18.7
	Males	205	81.3
Age of owners	Adults	210	83.3
	Young	42	16.7
Religion	Christian	235	93.3
	Muslim	10	4.0
	Others	7	2.8
Education	Literate	202	80.2
	Illiterate	50	19.8
Livelihood (Occupation)	Mixed agriculture only	186	73.8
	Mixed agriculture & trading	31	12.3
	Mixed agriculture, trading		
& employed	20	7.9	
	Others*	15	6.0

*(Mixed agriculture & employees, mixed agriculture & trading)

Fig. 2: A lumpy skin diseased cows (Local and crossbreds) showing skin nodules covering the entire body at Dongoro Dissi village of Lalo Assabi district

Table 3: Summary of associated risk factors and its effect on herd-level sero-positivity to LSD in the study area

Major Risk Factors for LSD Occurrence	Categories	N° of herd examined	Percentage (%)	P-Value	OR (95%CI)	95%CI
Season of outbreak	Autumn (Birra#)	26	26 (10.3)	0.30	3.39	0.33-34.9
	Winter (Bona#)	12	12 (4.8)	-	-	-
	Spring (Arfasa#)*	27	10.7(27)	-	-	-
	Summer (Ganna#)	187	187 (74.2)	0.64	1.63	0.20-13.1
An introduction of new cattle	No	11	11 (4.4)	0.65	0.61	0.07-5.16
	Yes	241	241 (95.6)			
Vaccination history	No	128	128 (50.8)			
	Yes	124	124 (49.2)	0.17	2.15	0.71-6.5
Seasonal movement of animals	No		172	172 (68.3)		
	Yes	80	80 (31.7)	0.14	1.08	0.35-3.24
Grazing Type	Communal*	184	184 (73.0)			
	Separate	38	38 (15.1)	0.54	1.45	0.31-5.45
	Both	30	30 (11.9)	0.34	0.25	0.31-5.45
Watering point	Communal	30	30 (100.0)	-	-	-
Contact of animals with different PAs	No	3	3 (1.2)	-	-	-
	Yes	249	249 (98.8)			
Contact of animals with different district	No	87	87 (34.5)	0.23	2.2	0.60-8.00
	Yes	165	165 (65.5)			
Contact with different Zone or regions	No	21	21 (8.3)	0.81	1.3	0.16-10.32
	Yes	231	231 (91.7)			
Contact with other country	No	97	97 (38.5)	0.33	1.7	0.55-5.74
	Yes	155	155 (61.5)			
Season of contact	Dry season	231	231 (91.7)	-	-	-
	Wet season	21	21 (8.3)	-	-	-
Season at activity of biting flies high	Summer (Ganna#)	162	169 (67.1)	0.000**	4.224	1.13-1.57
	Autumn (Arfasa#)*	47	40 (15.9)	-	3.982	3.98-8.98
	Spring (Birra#)	43	43 (17.1)	-	-	-
Existence of livestock marketing	No	175	175 (69.4)	0.36	0.54	0.18-1.99
	Yes	77	77 (30.6)			

Note: Number of examined herds is equal to the number of respondents (Herd owners) included into the study and # Local language for seasons, *Reference variable for OR, **Statistical significance

Table 4: Summary of the major constraints by their rank in the study area

Major constraints	Frequency	Percentage
Diseases	93	36.9
Diseases, water shortage & flies	33	13.1
Diseases, feed shortage & water shortage	30	11.9
Diseases, feed shortage, water shortage, predators & flies	18	7.1
Diseases & water shortage	16	6.3
Feed shortage & water shortage	13	5.2
Water shortage & flies	12	4.8
Diseases, water shortage & predators	12	4.8
Diseases, feed shortage, water shortage & predators	8	3.2
Flies*	6	2.4
Diseases & predators	4	1.6
Diseases, feed shortage & predators	3	1.2
Diseases, feed shortage, water shortage & flies	3	1.2
Diseases and feed shortage	1	0.4
Total	252	100.0

NB: * constraints those were play a major role for the disease transmission in the area

Table 5: Summary of the Local and scientific name of major diseases in the study sites

Diseases local name	Scientific name of the diseases	Frequency	Percentage
Gandi	Trypanosomosis	44	17.5
Abba Sanga or chita	Anthrax	12	4.8
Masa or Okolcha	Foot and mouth disease	7	2.8
Gororsa	Pasteurollosis	30	11.9
Somba (Kufa)	Bovine TB	12	4.8
Dibe guru	Mastitis	11	4.4
Dibe goga	Skin Diseases	16	6.3
Dulandula	Leach	8	3.2
Gandi and Bokoksa	Trypanosomosis and Bloat	17	6.7
Bokoksa & Gororsa	Bloat and Pasteurollosis	17	6.7
Gandi and Sinchi	Trypanosomosis & Black leg	2	0.8
Gandi and silmi	Trypanosomosis &Tick infest^{n}	50	19.8
Others*	-	26	10.3
Total		252	100.0

NB: *[Dhukuba sare (Rabies), Dhukuba tiruu (Fasciolosis), Hidda arrabaa (Toxocity), Cininnaa (Colic)

Major Livestock Constraints in the Area: There are different major constraints limiting livestock in the area. During the study period, it was attempted to identify the major constraints those commonly encountered in daily activity of livestock production system in the study area. Generally, the respondents were reported that diseases, shortage of feed, shortage of water, predators and flies are main problems/constraints. Although one or more than one constraints were reported by a single interviewer and as indicated below (Table 4), diseases were firstly reported by a proportion of 36.9% respondents which indicated as the first most important constraint or the eading problems for livestock.

Major Diseases in the Area: Most of the time, Trypanosomosis and external and internal parasites were repeatedly reported as the main diseases from the areas. However, including the above diseases of livestock, the respondents in the study areas commonly reported major diseases. As usually reported from the area, a proportion of 19.8% (50) respondents reported Trypanosomosis and ticks infestation as the leading diseases in their area. These diseases were listed below in (Table 5) according to their local and scientific names.

DISCUSSION

In the present study, Lumpy Skin Disease Virus (LSDv) exposure was investigated in the two administrative districts of West-Wollega Zone (Gimbi and Lalo-Assabi) by applying field study and questionnaire surveys.

This finding agrees well with the finding of [25], who stated a difference in the frequency of occurrence of LSD across 15 districts they selected for their study. In addition, many factors such as season, insect vector activity, the health status and breed of the animals can affect the magnitude and the occurrence of LSD [17, 24, 21, 31 and 41].

Associated Risk Factors: Herd those selected for serological survey were also included in the questionnaire survey to assess factors for LSD occurrence in the study area. Beside the blood collection, questionnaires were commonly applied in epidemiological investigation to collect information on disease occurrence and associated risk factors and they have been used successfully.

The study was under taken to identify risk factors that contribute to the occurrence of lumpy skin disease in the study area. This has been reported [29, 42] that the outbreak of the disease was mostly associated with the prevalence of insect vectors, host susceptibility, livestock density at the grazing and watering points, husbandry systems, wet seasons and agro ecologic conditions, presence of moist, humidity, market conditions and an introduction of new animals without any examination.

As the questionnaire survey result indicated Lumpy Skin Disease (LSD) was dominates the area due to one or more factors those attributes the occurrence of the disease. From the result, 65.1% of respondents informed presence of the disease in their area and it agrees well with the finding of Gari *et al*. [10], in which about 42.8% of the interviewees reported occurrence of LSD in their herd.

This finding revealed that, 95.6% of herd owners informed that they introduced new cattle to their safe herds without identifying whether the animal was vaccinated or not and the result of analysis confirmed that, 5.8% herds were sero positives. This indicated that, most herd owners from both districts acquired cattle through purchasing from auction markets and very few of

them claimed that they acquired cattle from inheritance or dowry. It also showed, cattle keepers were tilted towards commercial farming than traditional cattle keeping in which there is a chance to introduce a LSD positive animal into the LSD free herds. However, it was not statistically significant ($p>0.05$) for the occurrence of the disease in the area.

Similar finding was reported by Gari *et al*. [10], as the frequency of introduction of new animals was higher in the midland agro-climate zone (40.6%) than in the highland and the lowland zones (25.2% and 21%, respectively). The same authors also reported that the introduction of new animals to a herd had a strong association with an increased risk of disease in the herd and a noticeable proportion of farmers (32.1%) reported introducing new animals to their herd following purchase (for replacement, herd expansion, fattening), receiving cultural gifts or cattle exchange without any screening for the health status of the new animal.

Another attempt has been made in the present study to compare the season at which an outbreak of the disease can be occurred and about 74.2% of respondents reported; it was high in summer season and the lowest Spring seasons was (3.85%) in the area. This could be due to rainy nature of the season and livestock production system in which the extensive system was dominant in the area, that exposes animals to the biting flies those are active for interrupting feeding.

Similar to this finding [42] and Gari *et al*. [10] mentioned, LSD outbreaks were associated with wet and warm weather conditions due to an abundance of blood-feeding arthropod populations in the summer season.

According to a proportion of 68.3% (172) herd owners, there was no seasonal movement of animal from place to place for search of feed and water; that means most of the farming system in the area was sedentary. As a result of analysis revealed, there is a slight difference of 6.3% sero-positivity for LSD in herds those move as compared to the herds not move from place to place with no statistically significant variation among ($p=0.14$, OR=1.08, CI=0.35-3.24).

Higher frequency of communal grazing type 63.5% and 100.0% communal watering point was reported by herd owners during this study. In both districts, cattle grazed communally (Table 8) although those with a few cattle had them tethered. Even though there was, an increment report found with communal grazing and watering points, multivariate logistic regression analysis revealed statistically insignificant effect among these risk factors and occurrence of the disease in the area.

However Gari *et al*. [10] mentioned that communal grazing and watering points were found to be associated with the occurrence of LSD. Additionally, different authors [21, 43, 44] were reported as sharing watering points, grazing plots and post-harvest fields would allow contact and intermingling of different herds that would probably increase the risk of exposure.

A questionnaire result of the present study showed that, 67.1% of respondents reported that, a summer (wet season) was a season at which the activity of biting flies is high and showed statistically significant association ($p = 0.000$, OR = 4.224. CI = 1.13-1.57). Flies activity was four times (4x) more likely to be high in the summer (wet) as compared to other seasons for the occurrence of the disease in the area (Table 9).

Similar to this finding, Davies [45] and Mac Owen [46] and Zelalem *et al*.[47] reported that biting insects play the major role in the transmission of LSDV. Zelalem *et al*. [47] also mentioned that, epidemics of LSD are associated with rainy seasons. Currently, it is widely agreed that LSDV is transmitted mechanically via arthropod vectors.

This result also agrees well with the finding of Troyo *et al*.[48], who described the warm and humid climate in midland and lowland agro-climates has been considered a more favourable environment for the occurrence of large populations of biting flies than the cool temperature in the highlands. The same authors also stated that both biting-fly activity and disease outbreak frequencies begin to increase from April reaching a maximum in September. In conclusion, the result of this work strongly supported that LSDV is transmitted mechanically via arthropod vectors.

Out of 252 interviewees; 98.8 %, 65.5%, 91.7% and 61.5% of them reported that their cattle could travel and be in contact with different animals of different PAs, district, Zone or regions and countries, respectively. This could be due to animal's movement from place to place for the purpose of vaccination, trade activity, searching for feed and water during dry season and other activities, which is a risk factor in contracting cattle diseases such LSD. A 69.4% of respondents were declared, as there was no existence of livestock marketing in the area.

During this study period, it has been tried to identify the major constraints commonly encountered in daily activity of livestock production system in the study area. As herd owners informed diseases, shortage of feed and water, predators and flies were the main problems or constraints of livestock in the area. Although a single interviewer and diseases reported, one or more than one

constraints were firstly reported by a proportion of 36.9% respondents, which indicated as the first most important constraint or the leading problems for livestock production and followed by water shortage and flies by 13.1% in the area.

Similarly, Nibret and Basaznew [49] and Belay Duguma *et al*. [50] stated that diseases were the main constraints of livestock. Some other constraints observed in both districts were lack of veterinary extension services and poor breeds. So, the findings of the major constraints limiting livestock production during the present study in the area was tended to agree with findings found [48].

The same authors also mentioned that, fasciolosis (32.45%), gastrointestinal parasitism (14.66%), anthrax (10.54%) and blackleg (9.56%), pasteurellosis (7.91%), lumpy skin disease (5.60%) and trypanosomosis (2.31%) were the most frequently observed diseases in cattle.

A 19.8% of respondents reported that Trypanosomosis and ticks infestation as the leading diseases and about 6.3% of skin diseases (Dibe goga in local language) including lumpy skin disease were reported by herd owners in the area in their area in which the result of the finding agrees well with the previous study.

CONCLUSION AND RECOMMENDATIONS

The study indicated that LSD is an important disease in the western Wollega zone of Oromia regional state of Ethiopia. It has been associated with periods (Seasons) of high rainfall and concomitant high levels of insect activity.

The result also revealed that some of the current cattle management practices executed by livestock owners of the study area, namely: Introduction of new animal to the herd, mixing of cattle in watering and grazing areas, free movement of animals to different areas and direct contact of animals with wild animals are very common, can be a risk factors. These risk factors could aggravates the spread of lumpy skin disease and found to be spreading in to new areas that have been considered previously as free areas (kebeles or districts) of the zone and will be a major livestock health problem.

This study provides the first evidence (preliminary information) of the presence of LSDV infection in the West Wollega. This finding also gives attention on the distribution of LSDV in the study area and can assist planners, decision-makers, practitioners and researchers in their efforts. In addition, it could help them in disease surveillance and control activities for risk mitigation and to improve the health of animals.

Therefore, based on these findings the following recommendations are forwarded that might help in preventing losses associated with the occurrence of LSD improving the productivity of cattle: Mass vaccination should be applied for all breeds of cattle in both districts using an effective specific vaccine against LSD, such as the attenuated Neethling strain vaccine. The use of insecticides to control biting flies before raining season should be practiced in the area. Livestock owner need to be introduced with the basic knowledge of risk factors those contribute to disease in the study area. Due to the biggest challenge, that was poor infrastructure that facing during this study, further research is needed to assess the status of the disease and to suggest implementation of appropriate control and prevention methods in the areas.

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Authors' Contributions:

ZA: Conception of the research idea, designing and data collection, interpretation of the results and drafting of the manuscript.
HD and GG: Interpretation of the results and manuscript reviewing.
All authors read and approved the final manuscript.

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