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REVIEW ARTICLE

Current Status of Lumpy Skin Disease and Its Economic Impacts in Ethiopia

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Abstract

One of the most agricultural practices in Ethiopia is raring animals which is known by providing unlimited uses for the country. Livestock production constitutes a vital part of the agricultural system and it accounts about 40% of the agricultural gross domestic product. This unlimited uses has limited by different factors, from this factors one of the major problem is Animal disease. LSD is economically very important disease due to its large scale financial impact by downgrading skins, decreasing milk production, adding treatment costs, reduction in traction powers of oxen and death of the animals. It is listed as notifiable disease by OIE and is endemic in many African and Middle East countries including Ethiopia. The morbidity, mortality and case fatality rates of Lumpy Skin Disease were 15.71%, 2.86% and 18.18% respectively, indicating an important impact posed by the disease. This may be due to the farming and management system practiced in the area which favors the vector transmission and poor nourishment of diseased animals which will die due to secondary disease.

Keywords: Current Status; Economic Impacts; LSD; Ethiopia

Introduction

In Ethiopia, as a different sources information the total cattle population is about 59.5 million, livestock production constitutes a vital part of the agricultural system and it accounts about 40% of the agricultural gross domestic product (GDP) [1]. Livestock diseases are the major production constraints in Ethiopia in addition to poor nutrition, low genetic potential of indigenous livestock, lack of marketing infrastructure and water shortages [2]. Lumpy skin disease (LSD) is one of economically important viral diseases of cattle in Ethiopia caused by Lumpy skin disease virus in the member of the genus Capripox viruses.

Lumpy skin disease (LSD) is one of the most economically important viral diseases listed as notifiable trans-boundary animaldiseases by the World Organization for Animal Health (OIE) and the second significantly important cattle disease in Ethiopia [3, 4. In Ethiopia, LSD was first documented in 1981 in the northwestern part of the country near lake Tana [5, 6].

Lumpy skin disease (LSD) is caused by LSD virus which is a member of Capripox viruses (CaPVs) that are large double-stranded DNA viruses belonging to the family Poxviridae. The genus includes Sheeppox virus (SPPV), Goatpox virus (GTPV) and Lumpy skin disease virus (LSDV) (Facquet et al., 2005; Murphy, 2012).These viruses have genome of approximately 15kb and share a high degree of sequence homology,with 97% identity between LSDV and both GTPV and SPPV genomes [7].

Capripox viruses (CaPV) infections are generally host specific and not reported on CaPV infecting all threespecies: sheep, goats and cattle [8, 9]. This disease also has specific geographic distributions in which diseases of GTP and SPP areprevalent in Africa above the equator, Asia, the Middle East, and occasional outbreaks occur in regions of Europe surrounding the Middle East. In contrast, LSD is endemic in Africa and outbreaks have been occurred in the Middle East countries surrounding Egypt and in some parts of Europe like Greece [8, 9, 10]. The way of transmission in Lumpy Skin Disease was not well documented but the biting flies and some tick species are probably the most important method of transmission of disease. Therefore, quarantine and movement control is usually not very effective [11]. Epidemiologically the disease is usually more prevalent during wet summer and autumn months, particularly in low-land and mid land areas and around water courses, but outbreaks may also occur during the dry season and winter months [12, 13].

The disease is now the problem of all country that widely found in all the regions and agro ecological zones of Ethiopia. A major outbreaks of Lumpy Skin Disease have been recorded in different regions of Ethiopia like Amhara and Oromia regions in 2000/2001, Oromia and Southern nations nationalities and people regions in 2003/2004 and Tigray, Amhara and Benishangul regions in 2006/2007 [14]. When it was compared with in regions most of these outbreaks were from Oromia, Amhara, SNNP, Tigray and Benishangul regions.

This disease is an OIE listed disease because of recognized financial losses in Ethiopia due to the endemic nature of Lumpy Skin Disease; the country is facing serious difficulties in exporting live cattle and their products. In addition, to above situation contributes a negative impact on the national economic growth through the loss of meat production, milk production and poor quality of skin and hides [3]. Consequently, continuous surveillance on the status of the disease and genetic information oncirculating field viruses is mandatory in order to take effective measures for the control and there by eradication of the disease in the country [15]. Based on the above information given as background the present review has aimed to review the current status of lumpy skin disease including its Economic impacts in Ethiopia.

Literature Review

Lumpy Skin Disease Virus

Lumpy skin disease is caused by Lumpy skin disease virus, one of the members of Capripox viruses which are enveloped, brick shaped with complex symmetry, measuring 300x270x200 nm in size (Shakya, 2001). Mature *Capripoxvirions* have a more oval profile and larg-

er lateral bodies than *Orthopoxvirions* [11]. These viruses are generally resistant to drying, survive freezing and thawing, and remain viable for months in the lyophilized state. Sensitivity to heat differs among strains [16].

Epidemiology of LSD

Lumpy skin disease is a disease caused by a virus which is believed to be mainly transmitted by flying insects [17, 18]. Recently, [6] 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 [19].

The occurrence of LSD is an endemic disease of most African countries particularly in those of the sub Saharan region. After 2012 it has spread rapidly through the Middle East, south-east Europe, the Balkans, Caucasus, Russia and Kazakhstan [4, 12]. Mostly, field outbreaks can be severe and generalized infection with high morbidity and mortality rates, while in others there may be few affected animals and few or no deaths recorded but in general outbreaks are more severe with the initial Mostly, field outbreaks can be severe and generalized infection with high morbidity and mortality rates, while in others there may be few affected animals and few or no deaths recorded but in general outbreaks are more severe with the initial introduction of the infection to a regions then will decrease probably associated with the development of wide spread of immunity. Morbidity rates reach 80% during epizootics, but nearer 20% in endemic areas [20].

Furthermost, four (2012-2015) retrospective data shown in figured out the occurrence of 1015 outbreaks of LSD in 10 national regional states of the country (Tigray, Amhara, Oromia South Nation and Nationalities(SNN), Benishangulgumz, Gambella, Somali, Afar and Addis Ababa) (Figure 1). Those reports were based on clinical signs that shown and reports were also from every corner of Ethiopia. Of these outbreaks 58.22 % of the out breaks were reported from the Oromia national regional state. Moreover, more than 46 % of the out breaks occurred during the 3 months of the years; September – December but the remaining outbreaks appeared randomly in the rest of the months of the years [21].

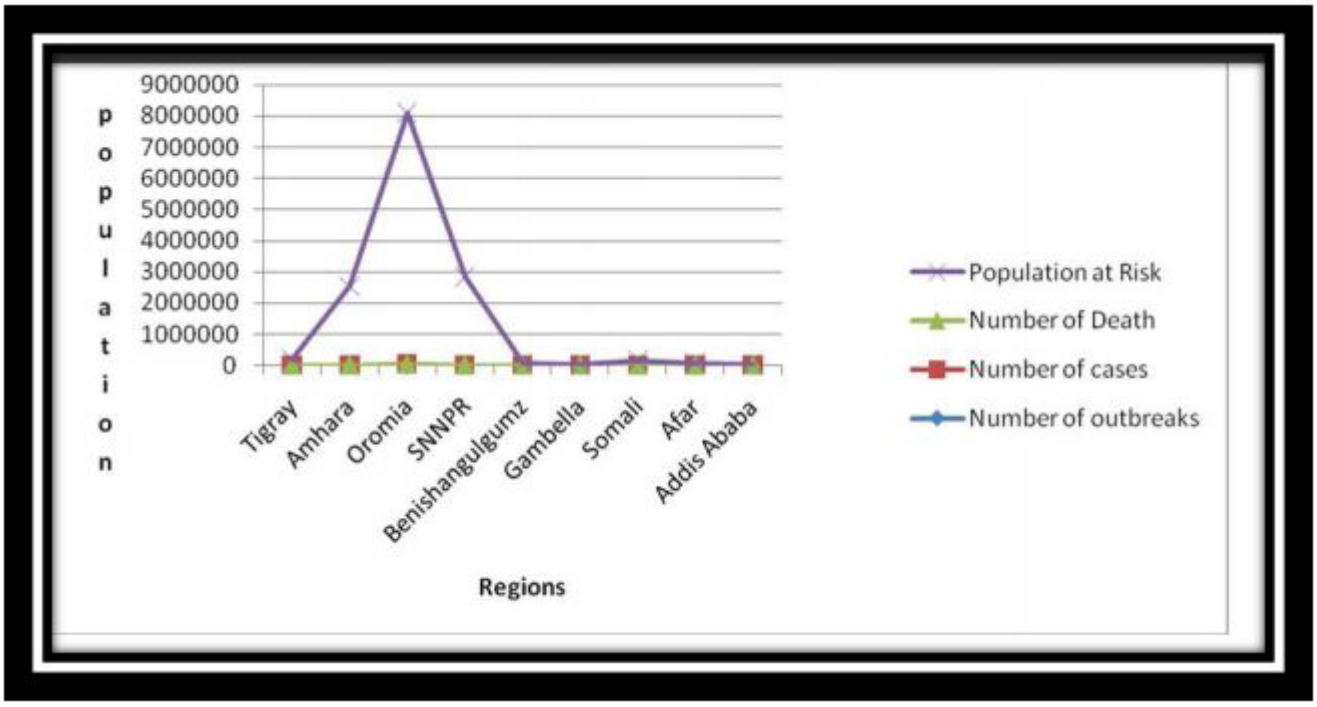

Figure 1: Four years 2012 to 2015 LSD outbreak reports from nine national regional states of Ethiopia (MoA, 2016)

No	Regions	Number of Outbreaks	Number of Cases	Number of Death	Population at Risk
1	Tigray	20	318	44	164278
2	Amhara	246	8274	540	2509568
3	Oromia	591	31558	1292	8049485
4	SNNPR	116	8762	450	2809373
5	Benishangulgumz	6	395	18	54068
6	Gambella	2	35	15	2640
7	Somali	4	382	122	142000
8	Afar	2	90	2	46080
9	Addis Ababa	28	226	68	19217

Table 1: Occurrence and outbreaks of LSD in Ethiopian Region

Hosts and Susceptibility

Domestic cattle and Asian water buffalo are the animals affected by LSDV naturally during field outbreaks [22, 23]. Some strains may replicate in sheep and goats but still now no epidemiological studies have evidenced small ruminants as reservoirs for the virus (Tuppurainen, 2017). Very little is reported about the susceptibility of wild ruminants to LSDV. The susceptibility of host animals mostly depends on immune status, age and breed rather than the virulence of the virus.

Sources of the virus

They can survive in scab or tissue fragments for very long periods of time [24]. It can be recovered from skin nodules kept at –80°C for ten years and from infected tissue culture fluid stored at 4°C for about six months [12]. As [4] reported the viral shedding in semen can be prolonged as it was isolated from the semen of infected bull after 42 days. Also LSDV can be isolated for up to 35 days or longer from skin nodules, scabs and crusts which are known to contain relatively high amounts of virus. It can also be isolated from blood, saliva, ocular and nasal discharges [25], and semen [26] of infected animals.

Reports have shown that the main route of transmission for LSD is through vectors whereas transmission ways like direct contact are not effective (Magori-Cohen et al., 2012). Stomoxys, Musca confiscate and Aedes egypti mosquitos and the three common. African hard tick species, namely, Rhipicephalus appendiculatus, Amblyomma hebraeum and the African blue tick Rhipicephalus (Boophilus) decoloratus, were reported to have a great role in the transmission of Lumpy Skin Disease (Chihota et al., 2001; Chihota et al., 2003).Studies also showed that the disease can also transmit when common drinking troughs are used, thus confirming the suspicion that infected saliva might contribute towards the spread of the disease. The disease is transmissible to young calves through infected milk [12].

Pathogenesis and Clinical Signs

LSDV replicates inside the host cells such as macrophages, fibroblasts, pericytes and endothelial cells in the lymphatics and blood vessels walls leads to vasculitis and lymphangitis,in severe cases thrombosis and infarction may also develop [23]. In the acutely infected animal, there is initial pyrexia, which may exceed 41°C and can persist for 1 week. The superficial lymph nodes become enlarged and lesions may develop over the body, particularly on the head, neck, udder, scrotum, vulva and perineum between 7 and 19 days and the first ones usually appearing in the perineum. In lactating cattle there is a marked reduction in milk yield [4, 20].

Diagnosis of LSD

There are no available commercial diagnostic test kits for LSD virus detection. Thus, the tentative diagnosis of LSD is usually based on the characteristic clinical signs, differential diagnosis, and confirmation is done by laboratory tests using molecular techniques

of conventional or real time polymerase chain reaction (PCR) and cell culturing. LSD should be suspected clinically when there are characteristic skin nodules, fever and enlargement of superficial lymph nodes [4, 11]. The diagnosis of LSD can be established based on the typical clinical signs or generalized nodular skin lesions and enlarged superficial lymph nodes in affected animals combined with laboratory confirmation of the presence of the virus or antigen. The gold standard method for the detection of Capri pox viral antigen and antibody are electron microscopy examination and serum or virus neutralization tests, respectively [27]. The OIE recommended serological tests used for LSD diagnosis are essentially IFAT (Indirect Fluorescent Antibody Test), VNT (Virus Neutralization Test), ELISA and Western Blot Analysis [27].

Economic Importance

LSD is an economically important disease of cattle, serious economic losses from outbreaks that have a high morbidity and can produce a chronic debility in infected cattle. There is a great loss of milk production since the disease is more severe in cows in the peak of lactation and causes a sharp drop in milk yield because of high fever caused by the viral infection itself and secondary bacterial mastitis predisposed by the development of lesions on the teats [20, 28, 29].

Even though the mortality rates of Lumpy Skin Disease are usually low, it is an economically important disease of cattle in Africa because of the prolonged loss of productivity of dairy and beefcattle, use of the animals for traction, decrease in body weight, mastitis, severe orchitis, which may result in temporary infertility and sometimes permanent sterility [4, 17, 28, 29]. Lumpy Skin Disease causes considerable economic losses due to emaciation, hide damage, temporary or permanent infertility in males and females, abortion, mastitis, loss of milk production and mortality of up to 40%, although mortality rarely exceeds 3%(Tuppurainen et al., 2015).

A study conducted in Ethiopia has shown that the annual financial cost calculated as the sum of the average production losses due to morbidity and mortality arising from milk loss, beef loss, traction power loss, and treatment and vaccination costs at the herd level was estimated to be USD 6.43 (5.12–8) per head for local zebu and USD 58 (42–73) per head for HF/crossbred cattle [30]. But now this economic loss was not the same because livelihood style was gradually changed from time to time. Another study also showed that the average cost of a single ox dying from LSD was calculated as 9,000 Ethiopian birr (ETB), equivalent to US$477.7 (USD1 = 18.84 ETB) (Ayelet et al., 2014). but no a day the average cost may increase to more.

Additionally, the quality degradation of skin and hides of LSD induces associated economic losses due to reduction of wool quality, meat, losses as a result of culling and mortalities and related with cost of treatment and prevention of the diseases. Even though there are no specific antiviral treatments for LSD-infected cattle, there will be treatment cost for secondary bacterial infection. Treatment cost represents the expenses incurred by farmers for medication at the local public veterinary clinics when farmers bring their clinically sick animals for treatment [28].

Costly control and eradication measures such as vaccination campaigns as well as the indirect costs because of the compulsory limitations in animal movements also cause significant financial losses on national level [6, 28, 30].

Control and Prevention

Except vaccination no other method was reported for lumpy skin disease. Vaccination will greatly reduce the morbidity and epizootics but may not completely limit the extension. In endemic countries, vaccination is considered the only economically feasible way to control the spread of LSD and improve cattle productivity [4, 28, 29].

Status in Ethiopia

In Ethiopia Lumpy Skin Disease is the one of the most economically important livestock diseases. After the first occurrence in 1981 it has spread widely throughout the country and now it is the problem of almost all the regions and agro ecological zones [5, 13]. Its

spread was mainly enhanced by cattle movements, communal grazing and watering, and pastoralist ways of life [6, 31].

The current status and occurrence of Lumpy Skin Disease is associate with the different agro-climatic conditions and the associated risk factors. There are three variables expected to influence the distribution and occurrence of LSD in Ethiopia: the effect of agro climate, communal grazing/watering management and introduction of new animals. Moreover, Ethiopia has two major seasons of rainfall: a shorter rainy season that usually begins in mid-February and continues up to end of April and the long rainy season (75%) starting mid-June and ending mid-September [32].

In Ethiopia from 2007-2011 totals of 1352 disease outbreaks of Lumpy Skin Disease have been reported and highest frequency was documented in Oromia region and the least in Afar region. Another study also showed that a total 3811 LSD outbreaks reported in Ethiopia between 2000 and 2015. Most of these outbreaks were from Oromia (54.5%), Amhara (27.9%), SNNP (10.1%) and Tigray regional states (3.6%). No out breaks were reported from Harari and Dire dawa. Based on the above information documented in different regions of Ethiopia was high in Oromia, Amhara, SNNP, and Tigray regional states as a list reported(Gumbe,2018). It also shows that LSD affects districts for one or two years and then spreads to other nearby areas with a susceptible cattle population with a trend of LSD outbreaks increased over time [33]. Since the country has no a well-designed control strategy for this disease it is continuing to be a great problem. Even if the animal health authorities undertake vaccination campaigns when outbreak is reported, researches have shown that the different vaccines used in Ethiopia are not fully effective [14, 34].

Conclusion and Recommendations

Livestock production constitutes a vital part of the National agricultural system and it accounts about 40% of the agricultural gross domestic product (GDP) [1]. As different sources of information Ethiopia has a known livestock population in Africa but as population the uses is comparative due to different reasons. Livestock diseases with particular emphasis of lumpy skin disease are known to be the major production constraints in Ethiopia in addition to poor nutrition, low genetic potential of indigenous livestock, lack of marketing infrastructure and water shortages [2].

In concern with diagnosis there are no available commercial diagnostic test kits for LSD virus detection.Thus, the tentative diagnosis of LSD is usually based on clinical signs, differential diagnosis, and confirmation is done by(RT_PCR) and cell culturing.As it was documented by [28, 29, 4, 30] LSDV is an economically important disease of cattle in Africa because of the prolonged loss of productivity of dairy and beefcattle, use of the animals for traction, decrease in body weight, mastitis, severe orchitis ,which may result in temporary infertility and sometimes permanent sterility .Even though the mortality rates of LSD are usually low. As different reports in Ethiopia has documented the annual financial cost calculated as the sum of the average production losses due to morbidity and mortality arising from milk loss, beef loss, traction power loss, treatment and vaccination costs at the herd level was estimated to be USD 6.43 (5.12–8) per head for local zebu and USD 58 (42–73) per head for HF/crossbred cattle (Gari et al., 2011). Finally, different disease outbreak information documented in the year between 2007-2011 the outbreak in Ethiopian was vary from region to region from year to year [35-37]. For instance Oromia was reported to be high following Amhara and SNNPR and there were no reports recorded in Dire Dawa and Harari regions. In line with the above conclusion the following recommendation are forwarded:

- Annual vaccinations should be provided regularly by effective and well managed vaccines
- Prevention of the diseased animals to new areas and vector control should be investigated
- Annual surveillances on the status of the disease should be actively collected.
- Awareness creation for cattle owners to vaccinate healthy animals for control and nourish the diseased ones to prevent death and

disease transmission.

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