Review On Epidemiology And Economic Importance Of Sheep And Goat Pox

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Abstract: Sheep and goat pox diseases are the most serious viral disease of sheep and goat, caused by the genus Capripox virus. The disease is transmitted commonly by aerosol infection associated with close contact with infected animals. This disease is manifested by skin and internal lesions, fever, conjunctivitis, with oculo-nasal discharge and excess salivation. These diseases are endemic in Asia and Africa. In Ethiopia, the disease is distributed in all regions. These diseases have no effective drug treatment. In enzootic area vaccination and implementation of biosecurity measures are considered the only suitable control measure of the disease. In endemic areas the disease are economically important due to restrict international trades, effect on tannery industry and production losses because of decreased weight gain, milk yield, damage to wool and hides, cause abortion, and increased susceptibility to other disease, while also being a direct cause of death. The diseases are more severe in young animal than adults.

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1. Introduction

Ethiopia is believed to have the largest livestock population in Africa with sheep and goat populations exceeding 49 million, which is one of the largest populations of small ruminants in Africa (CSA, 2013). Small ruminants (sheep and goats) have a unique role in smallholder agriculture as they require small investments; faster growth rates, have shorter production cycles, and greater environmental adaptability as compared to large ruminants. They are important protein sources in the diets of the poor and help to provide extra income and support survival for many farmers in the tropics and sub-tropics (Tibbo *et al*., 2006 and Nottor, 2012).

Sheep and goat plays a significant role in national economy of the country to date the benefit obtained from these livestock are hampered by different constrains. Livestock diseases are among the important technical constraints that have hindered the development of the sector by decreasing production and hampering trade in animal and animal products (Jilo *et al*., 2016 and Abdela, 2016). Of which infectious disease like Sheep and goat pox are major and widely distributed in all region of the country (Tsegaye *et al*., 2013).

Sheep and Goat Pox diseases are caused by infection by genus Capripox virus (Buller *et al*., 2005). Geographical distribution of the SGP has been relatively stable. SGP have seen in North and Central Africa, Middle Eastern countries, Asia and the former Soviet Union (Raoand Bandyopadhyay, 2000; Radostits *et al*., 2006; OIE, 2010). Regarding the Ethiopian situation sheep and goat pox is found all region of the country (ESGPIP, 2009). In recent study around Gondar a total of 1296 ruminants studied for skin disease, the prevalence of sheep and goat pox is 77 (48.12%) or 64(40%) or 13(8.12%) respectively (Daniel, 2016).

The virus enters via the respiratory tract and transmission commonly is by aerosol infection associated with close contact with infected animals. Spread can also occur from contact with contaminated materials and through skin abrasions produced iatrogenically or by insects (Kitching, 2004; Radostits *et al*., 2006; AHA, 2011).

The incubation period varies from 4 to 21 days, but it is usually 1 to 2 weeks. Morbidity rates in indigenous breeds range from 1% up to 75% or higher. Although the mortality rate is often less than 10%, case fatality rates of nearly 100% have been reported in some young animals (AHA, 2011). The first

manifestation of the disease is swelling of nostrils, followed thick discharges from the nose and watery discharges from the eyes. High body temperature (41 to 42°C) is found in infected animals, and keratitis may develop (Daoud, 1997). Lesions occur on un-wooled skin and on the buccal, respiratory, digestive, and uro-genital tract mucosa (Radostits *et al*., 2006), (Iran Veterinary Organization, 2014).

Viral antigens can be detected in tissues by agar gel immunodiffusion (AGID) or various enzyme-linked immunosorbent assays (ELISAs). Counter-immunoelectrophoresis, latex agglutination and indirect agglutination tests (reverse-phase passive hemagglutination, coagglutination, passive hemagglutination and spot agglutination) have also been used (OIE, 2008).

In most countries in which capripox are enzootic, vaccination and implementation of biosecurity measures are considered the only suitable control measure (Rweyemamu et al., 2006; Bhanuprakash, 2011). The objective of this paper is to review the epidemiology, economic impact and control method of sheep and goat pox disease.

2. General Features Of Sheep And Goat pox Disease

2.1. Etiology

Sheep and Goat Pox diseases are caused by infection by viruses in the Poxviridae family, Chordopoxvirinae subfamily and Capripox virus genus (Buller *et al*., 2005). These are large (170-260 nm by 300450 nm), double stranded, DNA and enveloped viruses (Tullman *et al*., 2002). In general, capripoxviruses (CaPV) are considered to be very host specific (Babiuk *et al*., 2009). In natural conditions, sheep and goat poxviruses are pathogenic exclusively for the ovine and caprine species respectively. In addition to the isolate Kenya Sheep and Goat Pox virus (KSGPV O-240, only a few other Sheep pox virus and Goat Pox Virus strains have been known to affect both sheep and goats (Yan *et al*., 2012). In general, SGP viruses will be inactivated at 56^0C within 2hour or at 65^0C within half an hour. They can survive at a pH between 6.6 and 8.6. These viruses are susceptible to highly acidic or alkaline pH and as an example, 2% Hydrochloric acid (HCL) or Sulphuric acid (H2SO4) can completely destroy the virus within 15 min. The sheep and goat pox are included in the OIE list as one of the notifiable diseases and OIE should be notified within 24h of confirming of the disease (OIE, 2014).

2.2. Epidemiology

2.2.1. Geographic And Seasonal Distribution

Outbreaks are recorded during all months of the year, but mostly occur between November and May, and the peak outbreaks occurred during March. During cold seasons, sheep are exposed to low temperature exerting stress which could suppress the immune system, and ultimately the sheep become vulnerable to infection. The seasonality of SGP observed could be explained either by the capability of the viruses to survive for many months in wet and cold weather, by association with the lambing season, or by the poor physiological condition of flocks in the autumn (Bhanuprakash, 2005; Yeruham *et al*., 2007; Zangana, 2013).

Geographical distribution of the SGP has been relatively stable. SGP have seen in North and Central Africa, Middle Eastern countries, Asia and the former Soviet Union. These diseases are endemic in Nepal, China, Bangladesh, Equator, Iran, Turkey, Pakistan, Iraq, Afghanistan, Indian subcontinent and Africa. Sporadic outbreaks occur in southern Europe and other parts in the world (Raoand Bandyopadhyay, 2000; Radostits *et al*., 2006; OIE, 2010). Recent outbreaks have been occurred in Mongolia, Kazakhstan, and Azerbaijan in 2008 and 2009; and in Bulgaria, Greece and Turkey in 2013. It has not been identified the source of Mongolian outbreaks, although the gene sequence of Mongolian goat pox (GP) virus 2008 P32 was distinct as compared to sequences of several other goat pox viruses originated from China (Beard *et al*., 2010).

The geographical position of Greece between Europe and Asia makes the rapid and accurate diagnosis and control of SGP and other exotic diseases very important. SGP are considered exotic to the EU and is classified in the notifiable diseases list of the OIE. SGP have been absent from the countries of Central and Western Europe for many years. But considering the recent outbreaks of SGP in southeastern Europe, there is potential for further spread of these CaPVs to the Europe (Mangana *et al*., 2008; AHA, 2011).

According to the AU-IBAR the numbers of African countries affected by Sheep Pox and Goat Pox before 2011 are shown an increasing trend for three consecutive years. Ethiopia is first from the top three countries that recorded the highest number of outbreaks in 2011; Ethiopia (223), Somalia (170) and Algeria (44). Overall, a total of 541 epidemiological units were affected on the continent involving 9932 cases and 1619 deaths, with a case fatality rate of 16.3 % (AU-IBAR, 2013).

2.2.2. Transmission

The virus enters via the respiratory tract and transmission commonly is by aerosol infection associated with close contact with infected animals. Spread can also occur from contact with contaminated materials and through skin abrasions produced iatrogenically or by insects. But there is no evidence about importance of this route of transmission in the field. Viruses are shed in secretions and excretions of

infected animals, but it is believed that they are not important sources of transmission during outbreaks, because it is difficult to recover live virus on tissue culture from scabs materials. Movement of infected animals acts as the main cause of spreading SGP viruses (Kitching, 2004; Radostits *et al*., 2006; AHA, 2011).

Highest level of shedding of infectious virus and viral DNA in secretions of infected animals occurred between about 1-2 weeks post inoculation, and this secretion continued for up to an additional 3-6 weeks (Bowden *et al*., 2008). Stomoxyscalcitrans is considered as one of the important vectors for SGP viruses. The files that were previously infected may transmit pox virus to susceptible goats (Bhanuprakash *et al*., 2006). The presence of antibody in animal species against a virus indicates its susceptibility to the virus. However, animal having antibody against a virus may not produce the infection, and the animal may not transmit the virus (Tuppurainenand Oura, 2012).

2.2.3. Risk Factor

Pathogen risk factor: The poxviruses are thought to have prolonged survival in environment and inactivated by drying, freezing, thawing, and remain viable for months in the lyophilized state. But its sensitive to 1% of formalin and extreme PH. can remain infectious for up to six months in sheep pens, and may also be found on the wool or hair for as long as three months after infection. Capripoxviruses are highly stable in normal environment condition and can survive for prolonged time, with or without susceptible animal. They are inactivated by sun light and heat, but can survive in cool dark environment for up to 6 month (Yune and Abdela, 2017).

Host risk factor: Group of Sheep and goat of all age, breed and sex are susceptible to sheep and goat pox. In areas where sheep pox is enzootic, imported breeds such as Merinos or some European breeds may show greater susceptibility than the native stock. Sheep and goat pox infect only sheep and goat and have no zoonosis. Wild ungulate is not reservoir for this disease (ESGPIP, 2009). Capripoxvirus can affect sheep, goat and cattle. Virus of goat pox is highly host-specific, infecting only goats, but from isolate to isolate host specificity varies. It is possible that the host preference shown by different strains is due to their adaptation to the presence of either sheep or goat alone in a limited geographical area. Isolates of Capripoxvirus are not host-specific; cattle, goats, and sheep who have recovered from infection with Capripoxvirus isolatesfrom a heterologous host have immune to any challenge with a virulent homologous virus (Yune and Abdela, 2017).

There are two types of sheep pox virus (Singari *et al*., 1990), in which, one affects both sheep and goats (Kenyan sheep and goat) strain while the other is host specific. Recent records indicate that strains of sheep pox do pass between sheep and goats, although most cause more severe disease in sheep. Recombination also occurs between strains of SPV producing a spectrum, showing intermediate host preferences and a range of virulence (OIE, 2000).

Environment risk factor: Environmental determinants play a great role in the occurrence of sheep and goat pox. It had impact on the agent, host and vectors as well as interaction between them. These predisposing factors have a great role in maintenance of Stomoxyscalcitrans and the tsetse fly to susceptible animals which are the vectors for transmission of disease (Yune and Abdela, 2017).

2.2.4. Morbidity And Mortality

Morbidity and mortality vary with the breed of the animal, its immunity to capripoxviruses, and the strain of the virus. Mild infections are common among indigenous breeds in endemic areas, but more severe disease can be seen in young or stressed animals, animals with concurrent infections, or animals from areas where pox has not occurred for some time. Reported morbidity rates in indigenous breeds range from 1% up to 75% or higher. Although the mortality rate is often less than 10%, case fatality rates of nearly 100% have been reported in some young animals. Imported breeds of sheep and goats usually develop severe disease when they are moved into an endemic area. The morbidity and mortality rates can approach 100% in newly imported, highly susceptible flocks (AHA, 2011).

2.3. Pathogenesis

Incubation period of sheep pox is 4-8 days of that of goat pox is 4-15 days. After it inters, goat pox virus replicates locally in the tissues. Since the virus is epitheliotropic, it will infest the epithelium tissues of the organism. On the 7th day post-inoculation, the virus titer reached to its peak. The virus spread to the regional lymph nodes, after 3-4 days of primary viremia. The viremia spread in the body, and affected spleen, lungs and liver. The virus inhaled may also cause lungs lesions. In skin nodules from 7 to 14 days after inoculation, the virus titers persisted and decreased with the development of serum antibodies. Within 24 hours of the appearance of generalized papules, affected animals develop conjunctivitis, rhinitis and enlargement of all the superficial lymph nodes, in particular the prescapular lymph nodes. Excessive salivation can also occur after infection (OIE, 2016).

There are five stages in the development of pox infection. Roseola stage is stage in which Skin lesions typically begin with small red spots with in three days of infection which is followed by papules. The affected animals are febrile at this stage. The second

stage of pox lesion is Papules which develops after 3 days of roseola stage. Nodular skin lesions that are developed from roseola stage (red spots) those are hard during palpation. Papules within 5-6 days are changed to vesicles and known as vesicular stage. Pustular stage develops after 3 days of vesicular stage. The last stage of pox lesion is scab (Bowden *et al*., 2008).

2.4. Clinical Signs

The incubation period varies from four to 21 days, but it is usually 1 to 2 weeks. Clinical signs generally appear sooner when the virus is inoculated by insects than when it is transmitted in aerosols. After experimental inoculation into the dermis, primary lesions can develop at the site within 2 to 4 days (AHA, 2011).

About a week after clinical signs develop, sheep and goats are the most contagious, as antibodies have yet to develop. After two weeks, viral shedding drastically decreases. Sheep that were infected experientially have shed virus for one to two months (OIE, 2016).

Usually, the first manifestation of the disease is swelling of nostrils, followed thick discharges from the nose and watery discharges from the eyes (Figure 1). High body temperature (41 to 42°C) is found in infected animals, and keratitis may develop (Daoud, 1997).

Figure 1: Swelling of nostrils and thick discharges from the nose and eyes (left), Pox lesions on the face and ears (right), Qom, Iran.

In lambs, malignant form of SP has been recorded as the most common type. There is prostration, high fever, marked depression, and discharges from the eyes and nose. Lesions occur on un-wooled skin and on the buccal, respiratory, digestive, and uro-genital tract mucosa. They commence as papules, and then become nodular, occasionally become vesicular, pustular and finally scab. Pox lesions have seen in the heart muscles in this form of the disease, most rarely (Figure 2) (Radostits et al., 2006).

In the benign form, more common in adults, only skin lesions occur, particularly under the tail, and there is no systemic reaction and animals recover in 3-4 weeks. Abortion and secondary pneumonia are complications (Iran Veterinary Organization, 2014).

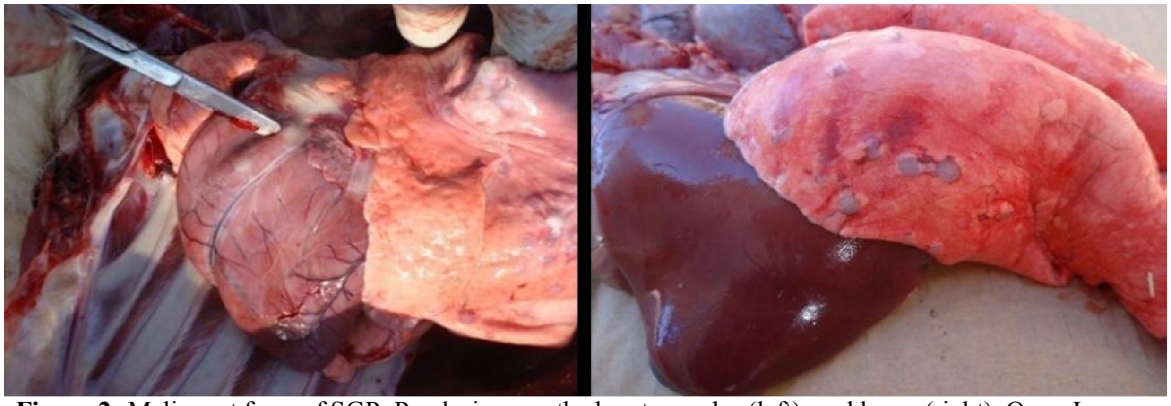

Figure 2: Malignant form of SGP: Pox lesions on the heart muscles (left), and lungs (right), Qom, Iran.

Postmortem lesions usually include tracheal congestion, lentil-sized, bullet-shaped nodules and white patches on lungs, inflamed spleen and lymph nodes with greying white necrotic lesions and increased quantity of blood-tinged pleural fluid. In some animals, lesions develop in the lungs as multiple consolidated areas (Isloor *et al*., 1991).

The lesions in the lungs are irregularly shaped grey foci of 5-50 mm in diameter, which appear as a result of spread in the blood stream. Lesions start as red foci of inflammation; they enlarge and gradually become infiltrated with the inflammatory cells, which are characteristic for sheep pox lesions wherever they occur in the animal (Saha et al., 1991).

Furthermore, affected lung tissue is characterized by congestion, red hepatization and exudation, coagulative necrosis surrounded by a marked zone of inflammatory reaction and thickening of interlobular septae. Depletion of lymphocyte population in paracortical regions and absence of germinal centres in spleen and lymph nodes are also observed. The lymph nodes in cases of SGP are grossly enlarged by up to 5-times, with oedema, cellular proliferation, congestion and haemorrhage. The lesions may be found in the oesophagus, rumen, abomasum, and large and small intestine (Gitao *et al*., 2017).

The liver and kidney may have whitish lesions of 3-15 mm in diameter. There may be lesions in the urogenital tract, heart, muscle, in the prepuce and sheath, in the vulva and vagina. Rarely, abortions may occur in pregnant females and the stillborn foetuses may have skin lesions caused by the SGP virus (Isloor *et al*., 1991; Saha *et al*., 1991).

2.5. Diagnosis

2.5.1. Clinical

Sheep and goat Pox can be diagnosed based on observable clinical sign like, fever, dyspnea and pox lesion in different parts of the unwoolen skin (Gitao *et al*., 2017). Clinical pathology and species of affected host are also important in the diagnosis of this disease. Epidemiology of the disease is also important in diagnoses of sheep and goat pox. As the virus of sheep and goat pox are very closely related it's indistinguishable by serologically. It appears that the host preference shown by these viruses with respect to either sheep or goats, accompanied by the case history, may be regarded as partially affirmative for either sheep pox or goat pox, but confirmatory diagnosis requires laboratory studies (Yune and Abdela, 2017).

2.5.2. Differential Diagnosis

The differential diagnoses include contagious ecthyma (contagious pustular dermatitis), bluetongue, dermatophilosis/ streptothricosis, mange (e.g., psoroptic mange/sheep scab), photosensitization or urticaria, peste des petits ruminants, parasitic pneumonia, multiple insect bites and caseous lymphadenitis (Rao and Bandyopadhyay, 2000).

2.5.3. Laboratory Tests

Sheep or goat pox can be tentatively diagnosed by electron microscopy; because the morphology of the virus particle is characteristic, capripoxviruses can be differentiated from most poxviruses that cause lesions in small ruminants. Histopathology can also be helpful (Rao and Bandyopadhyay, 2000).

A definitive diagnosis can be made by recovering the causative viruses. SPV and GPV can be isolated in lamb testis, sheep or goat kidney cell cultures, as well as in other (less sensitive) sheep, goat or bovine cell lines. Inhibition of the cytopathic effect by specific antibodies in the medium provides presumptive identification. Capripoxviruses can be identified to at least the genus level by immunofluorescence or immunoperoxidase staining, nucleic acid recognition methods and other techniques. In some circumstances, these viruses have also been recovered by inoculation into sheep or goats (Rao and Bandyopadhyay, 2000).

Polymerase chain reaction (PCR) assays can detect capripoxvirus genomes in tissue samples or cultures, but cannot identify whether the virus is SPV or GPV. However, these two viruses can be distinguished if PCR is combined with a restriction fragment length polymorphism assay (Balinsky*et al*., 2008). Recombination between SPV and GPV can complicate identification of the virus. Viral antigens can be detected in tissues by agar gel immunodiffusion (AGID) or various enzyme-linked immunosorbent assays (ELISAs). Counter immunoelectrophoresis, latex agglutination and indirect agglutination tests (reverse-phase passive hemagglutination, coagglutination, passive hemagglutination and spot agglutination) have also been used. In the AGID test, cross– reactions occur between capripoxviruses and parapoxviruses; however, these two groups of viruses can be distinguished with electron microscopy (OIE, 2008).

Serology can identify GPV and SPV as capripoxviruses, but cannot distinguish these two viruses from each other. Antibodies to capripoxviruses can be found approximately one week after the skin lesions appear. Serological tests include virus neutralization, AGID, the indirect fluorescent antibody test (IFA), ELISAs and immunoblotting (Western blotting). Virus neutralization is the most specific serological test, but it is not sensitive enough to detect infections in all animals. Cross–reactions occur with other viruses in the AGID and IFA tests (OIE,2008).

2.6. Prevention And Control

The countries that are considered as capripox free control the importation of sheep and goats and their products from enzootic areas. Control of the disease, once it has entered, is usually by early detection and notification, prompt movement restriction of animals, culling affected and in-contact animals, and ring vaccination with a dead vaccine. Sentinel animals could be used prior to re-stocking culled herds (Radostits *et al*., 2006; EFSA Panel on Animal Health and Welfare, 2014). Routine control measures include the cleaning and disinfection of depopulated premises and establishment of protection and surveillance zones, with a radius of 3 and 10 km, respectively, around the outbreak, as recommended by EU Council Directive (Mangana *et al*., 2008).

Uncontrolled movement of infected animals in SGP-endemic areas poses serious difficulties in efficient control of the disease. Therefore, it is essential to vaccinate sheep and goat flocks regularly, on an annual basis, with a safe and efficient vaccine, for the control of this serious and economically important disease in endemic regions (Yeruham *et al*., 2007).

In most countries in which capripox is enzootic, a slaughter policy would be impracticable and movement controls impossible to enforce. In these countries vaccination and implementation of biosecurity measures are considered the only suitable control measure (Rweyemamu *et al*., 2006).

The best feasible, economic and viable method is considered as implementation of mass vaccination program. For control and eradication of SGP, it can be adopted the same strategy as followed in case of rinderpest, as per the guidelines of OIE. This may include an initial mass vaccination followed by serological surveillance for a period of 2 years, and then cessation of vaccination progam. After that, some serological surveys are necessary to be conducted. In general, about ten years is required officially to declare a country free from SGP (Rweyemamu *et al*., 2006; Bhanuprakash, 2011). In endemic areas, mass vaccination against SGP to total susceptible population may cause to dying out the circulating virus (AHA, 2011). In hyper-endemic areas, ring vaccination should be undertaken for about 3 years, to try to eradicate the disease (Bhanuprakash, 2005).

2.7. Economic Importance

Sheep and goat pox is highly devastating viral systemic disease of sheep and goat. Sheep and goat pox are among the commonest disease of sheep and goat entailing a huge economic loss of the country. These two diseases are limiting international trade of animals and animal product (OIE,2008). This disease is fatal in newly introduced animal, but may be mild in indigenous breeds from endemic region. The outbreak of sheep and goat pox may cause serious stock and economic loss in sheep and goat industries (Garener and Lack, 1995).

In endemic areas the disease are economically important due to production losses because of decreased weight gain, milk yield, damage to wool and hides, cause abortion, and increased susceptibility to other disease, while also being a direct cause of death. In naïve animal's mortality and morbidity rates can be very high, approaching 100% (Bhanugrakash *et al*., 2006). In India mortality rate had been 49.5 % and took 6 years to recover from an outbreak (Garner *et al*., 2000).

Sheep and goat pox disease can affect trade, import, export and intensive production of animals. Flock size, number of adult animals and number of days of illness play significantly in influencing the economic losses due to Sheep Pox (Senthilkumar and Thirunavukkarasu, 2011).

The prevalence of sheep and goat skin defects in Bahir Dar tannery, out of the rejected skins from goats and sheep 18.8% of them contained sheep and goat pox (Assefa *et al*., 2012). In recent study at the Sheba Tannery and Leather Industry in Tigray region the major pre-slaughter defects include lesions from pox or lumpy skin disease is 6.1% (Kahsay *et al*., 2015).

3. Situation Of Sheep pox And Goat pox In Ethiopia

Sheep Pox and Goat Pox are one of the most important diseases of sheep and goats in Ethiopia following Peste des Petits Ruminants and Contagious Caprine Pleuropneumonia. In Ethiopia, the disease is found in all regions. In 2007/2008, the Animal and Plant Health Regulatory Directorate received 893 sheep and goat pox outbreak reports from all regions except Gambella, Harari and Diredawa. A total of 57,638 sheep and goats contracted the disease and 4,853,347 sheep and goats were at risk in areas where outbreaks occurred. Out of the 57,638 sick sheep and goats, 6,401 animals died. In the outbreak areas, 1, 271,484 sheep and goats that were in contact with the sick animals were vaccinated against SGPP. As a prophylactic measure, an additional 650, 993 animals were vaccinated against SGPP throughout the country. The diseases reporting rate in Ethiopia are only about 35-40%. The actual figures in terms of affected, vaccinated and dead animals are, therefore expected to be higher than the reported figures (ESGPIP, 2009).

According to Woldemeskel and marsha, from 1432 sheep and 1128 goats examined the prevalence of pox (22% in sheep and 18% in goats) (Woldemeskel and Marsha, 2010). In recent study around Gonder a total of 1296 ruminants studied for skin disease, the prevalence of sheep and goat pox is

77 (48.12%) or 64 (40%) or 13(8.12%) respectively (Daniel, 2016). According to Nigusie the sero prevalence of sheep and goat pox in South Gondar (20.91%) followed by Awi (19.41%), Eastgojjam (14.03%), and North Gondar and West Gojjam (11.92% each). The overall sero prevalence in western Amharais 15.5% in both sheep and goat (Nigusie, 2016).

Conclusion And Recommendation

Among infectious disease, sheep and goat pox disease are the most serious viral diseases of sheep and goat pox. It is economically important disease as it causes high morbidity and mortality rate in sheep and goat industries. These diseases are widely distributed in Middle East, Africa, central Asia and Indian content. Direct or indirect contact with infected animal or fomite, and vectors are some important means of this disease. The disease is considered to be economically the most important in the tanning sector due to its slow and permanent scar formation, and the disease can affect production, trade, and intensive production of animals.

From the above conclusion the following recommendation were forwarded:

- ❖ The sheep and goat flocks should be vaccinated regularly in annual basis with a safe and efficient vaccine.
- ❖ Movement of animals and animal products should be restricted during disease outbreak.
- ❖ Carcass and any skins, wool or fiber which may have been contaminated should be either burned or buried.
- ❖ Insects that are potential vectors to transmit virus should also be controlled.
- ❖ Control programs should be monitored by active surveillance especially for the detecting viruses.
- ❖ Advice farmers/pastoralists to quarantine newly purchased sheep and goats for three weeks.
- ❖ Advise farmers/pastoralists to isolate animals showing signs of sheep and goat pox immediately and to move their healthy sheep and goats to other areas.

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