

Retrospective Study of PPR Disease Occurrence in South West Ethiopia Regional State from 2018 to 2022

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Abstract

Peste des Petits Ruminants (PPR) is a notifiable viral transboundary disease, highly contagious in domestic and wild small ruminants. In Ethiopia, PPR was clinically suspected to be present in 1977 and was confirmed late in 1991. A retrospective study design was conducted for describing PPR disease outbreak, associated risk factors, and for assessment of PPR vaccination conducted in sheep and goats from January 2018 to December 2022 in South West Ethiopia People Regional State. Monthly Disease Outbreak and Vaccination activity Report data from all districts of the region were obtained from Mizan Regional Veterinary Laboratory center. Relevant data entered into Microsoft Excel 19 spread sheet that has been organized with a pivot table. The spatial distribution of PPR outbreak occurrence site in the region was displayed by map using arc GIS 10.2. The present study found that ten (22.72%) districts in the region reported twelve PPR outbreaks with a total of 528 cases and 212 deaths. The findings indicated except at Konta zone, PPR is widely distributed and outbreaks had occurred in at least one district of all zones of the region. The morbidity, mortality and case fatality rate of PPR outbreak varied from one district to the other, and it ranges 0.07% to 4.29%, 0 to 1.43%, and 0 to 75% respectively. High number of PPR outbreak (n=6, 50%) were recorded in the early rainy season (March to May) than other season of the year. 883,772 doses of PPR vaccination (551,800 dose as prophylaxis and 331,972 doses for controlling) was conducted in different districts of the region. In conclusion, Occurrence PPR outbreak increased in recent year in the region. Therefore, Commencement of mass vaccination in endemic area during the dry season and risk-based vaccination supported by epidemiological data in high-risk areas should be conducted.

Keywords: Outbreak • Peste des petits ruminants • south west Ethiopia • Spatial • Temporal • Vaccination

Introduction

Peste des Petits Ruminants (PPR) is a notifiable viral transboundary disease, highly contagious for domestic and wild small ruminants. PPR is known as "Kata, pneumo_enteritis_stomatitis syndrome, ovine rinderpest", and "goat plague, plague of small ruminants" in different geographical areas of the world. PPR virus, a member of the genus morbillivirus and family Paramyxoviridae, is the source of this acute, highly contagious, and usually deadly disease of sheep and goats. The genome has a molecular weight of 5.8×10^6 , and the virion's diameter is between 150 and 300 nm. According to Gebre T, et al. [1] and Dundon WG, et al. [2] the virion is extremely susceptible to heat, lipid solvents, non-ionic detergents, formaldehyde, and oxidizing agents.

PPR disease is clinically characterized by fever, bi ocular and nasal discharge, coughing, sneezing, sporadic mouth lesion, foul smelling diarrhea with a high morbidity and mortality rate in the infected flock or herds. Transmission of the disease requires close contact between susceptible animals and infected animals in the febrile stage. Fine infective droplets are released into the air from these secretions and excretions, particularly when affected animals cough and sneeze and animals in close contact inhale the droplets and become infected. Although close contact is the most important way of transmitting the disease, it is suspected that infectious materials can also contaminate water and feed troughs and bedding, turning them into additional sources of infection. Intensive fattening and trade in small ruminants,

at markets where animals from different sources are brought into close contact with one another, enhances transmission of the disease [3].

Peste des Petits Ruminants cause high mortality rate which severely restricts the production of sheep and goat's production. As a result, it is regarded as one of the worst animal diseases throughout Asia, the Middle East, and Africa. The Food and Agricultural Organization with the World Organization for Animal Health lists it as one of the priority diseases for sheep and goats in the Global Framework for the Progressive Control of trans-boundary animal diseases programs.

In Ethiopia, PPR was clinically suspected to be present in 1977 and was confirmed late in 1991. It continues to cause the death of millions of sheep and goats annually and is a constant threat to the livelihoods of subsistence farmers in many agro-ecological zones of the country. The disease is associated with high mortality and morbidity rates in naïve populations, significant economic losses, reduced production and productivity as well as high control costs. The geographic distribution of the PPR disease has increased rapidly in recent years, as it has in much of Eastern Africa, with the emergency of lineage IV during the 2010 outbreak in the country.

Understanding PPR disease occurrence is crucial for the integrated, risk based and effective prevention and control program of the disease and it can be identified either by conducting sero surveillance in unvaccinated population or by retrospective study of PPR disease occurrence from compiled monthly report or from outbreak investigated data. PPR disease sero surveillance were conducted in few weredas of the region and revealed the seroprevalence ranges from 0 to 4.93% [4]. Retrospective PPR disease occurrence information showing spatial, temporal and other risk factors for the occurrence of the disease is crucial for the integrated, and effective PPR disease prevention, control and elimination program, based on its epidemiological unit, however, in South West Ethiopia People Region not such kind of study was conducted, so to fulfil this gap, this study has been conducted.

General objective

- Identifying risk factors for the occurrence of PPR disease outbreak and appraise its control and prevention activities conducted in South West Ethiopia region.

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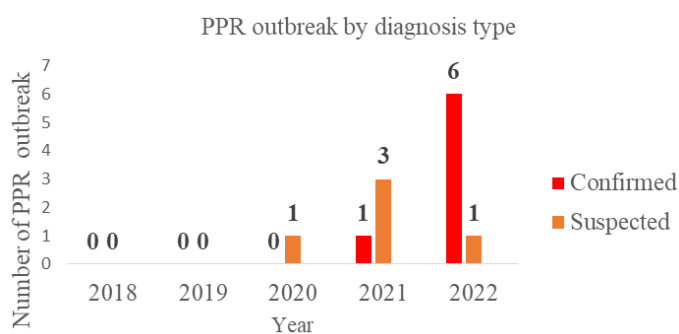


Figure 2. Number of PPR outbreak reported from 2018 to 2022 in south west Ethiopia region.

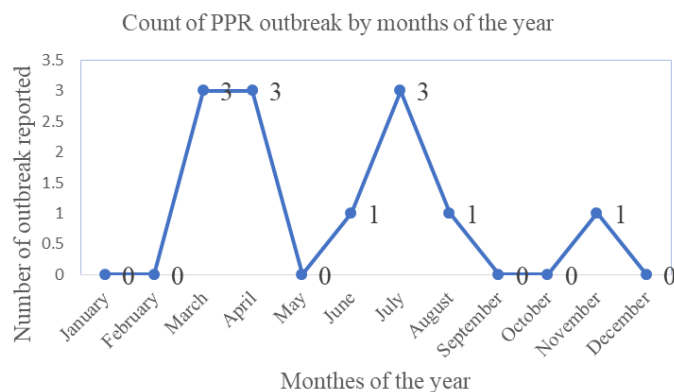


Figure 3. Seasonal occurrence of PPR disease outbreak by months of the year.

Table 1. Morbidity, mortality and case fatality rate of PPR outbreak in the reported district.

District Reported PPR Outbreak	Number of PPR Outbreak	Population at Risk	Number of Cases	Number of Deaths	Morbidity Rate%	Mortality Rate%	Case Fatality Rate %
Bero	1	18972	46	13	0.24	0.07	28.26
Gachit	2	45995	66	20	0.14	0.04	30.3
Gesha	1	3000	6	0	0.2	0	0
Gewata	1	111038	80	60	0.07	0.05	75
Gureferda	1	12000	16	0	0.13	0	0
Masha	1	850	9	4	1.05	0.47	44.44
Meenit Shasha	1	6915	6	0	0.09	0	0
Mizan Aman	1	2500	23	11	0.92	0.44	47.83
Yeki	1	350	15	5	4.29	1.43	33.33
Zaba gazo	2	111433	261	99	0.23	0.09	37.93
Grand Total	12	313053	528	212	0.17	0.07	40.15

883,772 doses of PPR vaccination (551,800 dose as prophylaxis and 331,972 doses as controlling) was conducted in different zones of the region. PPR vaccination conducted in each year of the study period was described below in Figure 7. High number of PPR outbreak (n=6, 50%) were recorded in western part of the region at Mirab omo and Bench Sheko zone.

Discussion

The current retrospective study revealed that out of the forty-four districts found in the South West Ethiopia region, ten (22.72%) districts reported twelve PPR outbreaks with a total of 528 number cases and 212 number deaths during the period between January 2018 and December 2022. Seven (n=7, 58.33%) of the reported PPR outbreaks were confirmed by laboratory investigations.

PPR disease is occurred in a sporadic outbreak form across all zones of the regions, except konta zone (Figure 8). The spatial analysis demonstrated that high number of PPR outbreaks were recorded in Mirab omo and Bench Sheko

Reported PPR outbreak by species

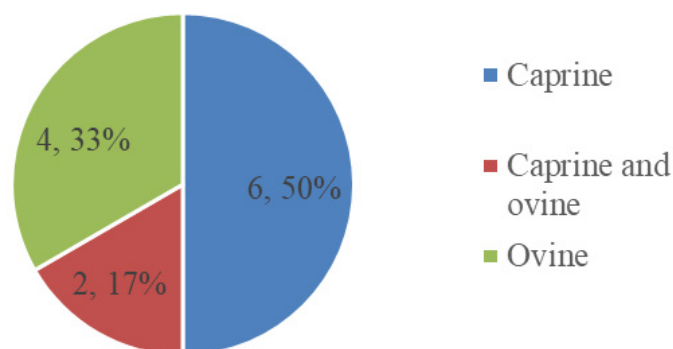


Figure 4. PPR reported outbreaks occurrence based on species category.

Table 2. Age associated risk factors for the occurrence of PPR outbreak in the study area.

Age Category	Sum of Number of Cases	Sum of Number of Deaths	Case Fatality Rate%
Young	9	4	44.44
Adult	23	11	47.83
All age	496	197	39.72
Grand Total	528	212	40.15

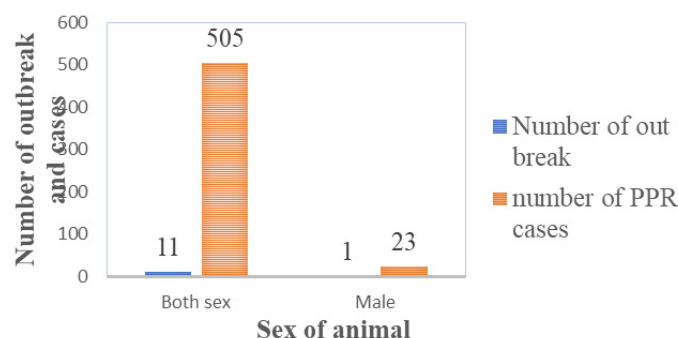


Figure 5. Sex associated risk factors for the occurrence of PPR outbreak in the study area.

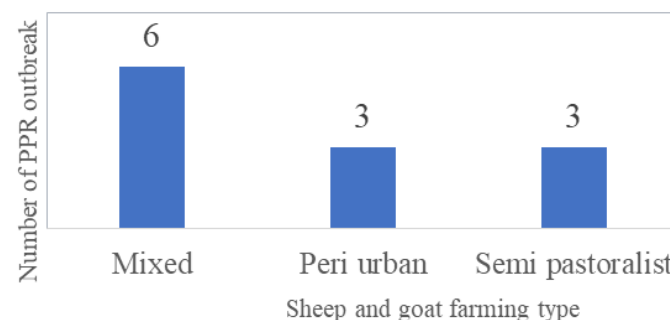


Figure 6. PPR disease outbreak occurrence in different sheep and goats farming system.

zones, and these two zones accounted for 50% (n=6) of the regions, total PPR outbreaks. The high prevalent of PPR outbreaks in these area might be, as Mirab Omo zone share international border with South Sudan and the vice versa uncontrolled long distance livestock movement favors the emergence of frequent new outbreak and it spread to the adjacent Bench Sheko zone. This research supports the findings of Shichibi TH, et al. [4], which showed that PPR is a significant disease in Mirab Omo and Bench Sheko zones indicating the circulation of PPR virus in many districts in that area. According to data on PPR outbreaks throughout the research period, in the year 2022 had more outbreaks than any other year and this might be associated with the increased

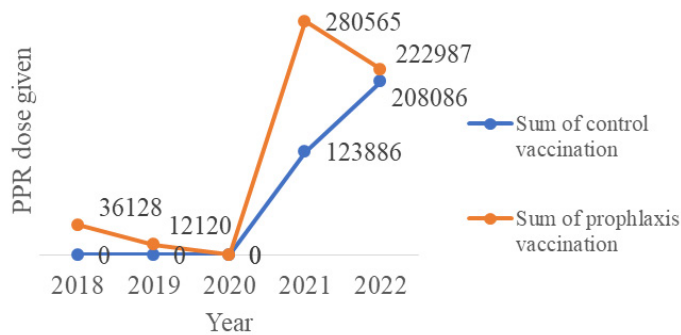


Figure 7. Prophylactic and control PPR vaccination conducted from 2018 to 2022.

Reported PPR outbreak site and their diagnosis type

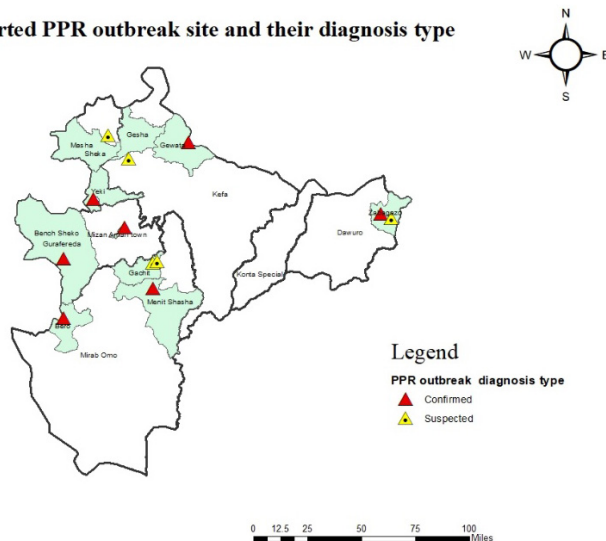


Figure 8. Map shown the spatial distribution of PPR outbreak in south west Ethiopia region.

reporting rate of DOVAR by its quality as well as by quantity from the districts, and the increment of regional laboratory response for confirming reported suspected outbreak by laboratory diagnosis.

Occurrence of PPR outbreak is related with age, sex and species of animal's shows no remarkable difference (Figures 4 and 5 and Table 2). Although there have been occasions when sheep have been more seriously affected than goats in generally, goats appear to be more vulnerable to and more significantly affected by clinical diseases than sheep [6].

More PPR outbreaks ($n=6$, 50%) than any other season of the year were noted during March to April. The movement of sheep and goats to market, particularly during the popular religious holidays of Easter for Christians and Arefa for Muslims, in March and April, may be linked to the occurrence of more PPR outbreaks in these months. The seasonality of animal movements could be responsible for the PPR incidence in Ethiopia, which mostly occurs between the months of March and June. On the other hand, from April to August, there is a lot of rain, a number of sheep and goats are maintained on only a small area of land, and more animals will come into contact, which is conducive to the spread of the disease. This finding is in line with Mbyuzi AO, et al. [7] who reported a significant higher incidence of PPR as reported by farmers in the rainy season than dry season in Tanzania.

The current study showed that disease occurred in a high proportion in mixed sheep and goat farming system than the pastoral and peri urban farming system. This result is consistent with research by Ruget AS, et al. [8], who showed that highlands had a higher risk of PPR outbreaks than lowland pastoral areas by asserting that the pastoral production system, which is mainly found in the lowlands, acts as a PPRV reservoir and that the virus frequently spreads to the highlands through herd movements.

The morbidity, mortality and case fatality rate of PPR outbreak varied from one district to the other, and it ranges 0.07% to 4.29%, 0 to 1.43%, and 0

to 75% respectively. The variation of PPR disease morbidity shown might be associated with the farming system of sheep and goats, flock and herd size present, the biosecurity linked with the knowledge, attitude and practice of disease prevention and control of the producer. This finding is in agreement with Alzuheir IM [9] who reported PPR mortality rate range from 0.9 to 3.5%, in Palestine. However comparatively higher mortality and morbidity rates were reported by Jember WT, et al. [10] from north Ethiopia during an outbreak study with 50.3% and 21.6% respectively in sheep and 51.3% and 25.1% respectively in goats in the study flocks.

883,772 doses of PPR vaccination (551,800 dose as prophylaxis and 331,972 doses as controlling) was conducted in different zones of the region. Commencement of PPR vaccination increased in 2021 and 2022 G.C. The increased commencement of PPR vaccination in the aforementioned year may be associated with for the controlling many outbreaks and for prevention the spread into the adjacent area by considering the risk analysis. Vaccination of all susceptible small ruminants would be excessively costly and wasteful of possibilities for better epidemiological knowledge of the disease. Therefore, it is recommended to target endemic populations as well as high-risk areas using epidemiological data and effective surveillance [11].

Conclusion and Recommendation

PPR outbreak has been widely occurred in the region and more prevalent, especially in 2022 G.C., and occurred in a sporadic outbreak form in ten districts of five zone the Region. More PPR outbreak were recorded from March to July, which is more of the rainy season of the year, and in the mixed crop livestock farming system than the other production system. The economic impact associated with morbidity and case fatality of the disease is relatively high and varies among districts. Commencement and coverage of PPR vaccination in sheep and goats increase in the region as more outbreak cases confirmed in recent year. Based on this conclusion the following recommendations are forwarded:

- Precaution should be taken in this identified risk factor for the occurrence of PPR disease outbreak,
- Strengthening surveillance and awareness creation to the producer and for kebele and district animal health officer for notifying suspected PPR outbreak immediately to the regional veterinary laboratory service for ensuring timely outbreak investigation to avoid reporting of suspected PPR outbreak by monthly DOVAR.
- Appropriate controlling and prevention strategy of PPR disease should be implemented as the outbreaks reported in most zone of the region.
- Further research on PPR disease epidemiology should be conducted.

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Conflict of Interest

None.

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