Seroprevalence of Peste Des Petits Ruminants in Selected Districts of Siltie and Gurage Zones, South Region, Ethiopia

Gizachew Hailegebreal

Faculty of Veterinary Medicine, Hawassa University, P.O. Box 05, Hawassa, Ethiopia

Abstract: A cross-sectional study to investigate Peste des Petits Ruminants (PPR) seroprevalence was conducted between November 2014 and May 2015 in selected districts of Siltie and Gurage zones, South Region, Ethiopia. A total of 390 serum samples were collected from sheep and goats. Competitive Enzyme Linked Immunosorbent Assay (c-ELISA) was used to detect the presence of antibodies in the sera of animals as indicator of exposure to the PPR virus. The total apparent prevalence was found to be 29.2% (114/390), indicating the spread of PPR virus throughout the study areas with Silti and Meskan Districts experiencing the prevalence of 24.2 and 33%, respectively. Study animals were categorized into two age groups as young and adult with prevalence of 25.9 and 31.8%, respectively. Out of total 390 samples, 240 serum samples were from male and 150 serum samples from female with prevalence of 29.6% (71/240) and 28.66% (43/150), respectively. In the two animal species the distribution of PPR virus was observed with the prevalence of 24.2% (46/190) in sheep and 34% (68/200) in goats. Statistically significant difference (p<0.05) was observed between the two study areas and species whereas the seroprevalence of PPR was statistically insignificant (p>0.05) in other hypothesized risk factors. This study revealed circulation and subsequent endemic establishment of PPR in sheep and goats in the selected study areas. This disease is detrimental to small ruminant welfare and causes substantial economic losses, thereby affecting the livelihood of poor farmers and pastoralists. The need for implementing feasible control measures is therefore, eminent to minimize the losses associated with the disease.

Key words: Competitive (c-ELISA), sheep, goats, PPR seroprevalence, establishment, endemic

INTRODUCTION

The small ruminant population of Ethiopia is about 30.70 million sheep and 30.20 million goats (CSA., 2016). Owing to their high fertility, short generation interval and adaptation even in harsh environments, sheep and goats are considered as an important asset of poor framers. Small ruminants are exploited in the country for diverse purposes (Abebe et al., 2011). However, small ruminant production and productivity and producer's benefits are far below expectations due to different diseases and other factors. Peste des Petits Ruminants (PPR) is one of the important diseases affecting the productivity of small ruminant (Gopilo, 2005). The disease is first described by Gargadennec and Lalanne from Ivory Coast in West Africa (Gargadennec and Lalanne, 1942).

Peste des Petits Ruminants (PPR) is an acute, highly contagious, notifiable and economically important transboundary viral disease of goats and sheep which is listed by the World Organization for Animal Health (OIE). The disease is characterized by high fever, ocular and nasal discharge, pneumonia, necrosis and ulceration of the mucous membrane and inflammation of gastro-intestinal tract leading to severe diarrhea (Gibbs et al., 1979). Morbidity and mortality rates can be as high as 100 and 90%, respectively. The causative agent of this economically important disease of small ruminants is a Morbillivirus, the Peste des Petits Ruminants Virus (PPRV), under the family Paramyxoviridae of order Mononegavirales (Murphy et al., 1999). The virus is closely related to Rinderpest Virus (RPV), another member of Morbillivirus genus which causes similar disease in large ruminants (Couacy-Hymann et al., 1995).

Now a days the disease is recognized as responsible for mortality and morbidity of sheep and goats across many countries of the world. Middle East and Arabian Peninsula; Iraq, Saudi Arabia, United Arab Emirates, Kuwait, Israel, Yemen and Oman are known to have the disease (Mehmood et al., 2009). In Africa, PPR has been reported from different countries (Dhar et al., 2002). Prevalence of 57.6% has been reported in Uganda (Mulindwa1 et al., 2011). Similarly in Tanzania and Nigeria seroprevalence rate of 46 and 55% were reported, respectively (Swai et al., 2009; El-Yuguda et al., 2013).

In Ethiopia, clinical PPR was suspected in 1977 in Afar Region, East of the country (Pegram and Tereke, 1981). Clinical and serological evidence of its presence confirmed in 1991 in Addis Ababa (Roeder et al., 1994).

Gelagay (1996) has reported that 14.6% of sheep sampled along 4 roads from Debre Berhan to Addis Ababa were seropositive for PPR. Waret-Szkuta *et al.* (2008) has also reported an overall seroprevalence of 15.3% in Afar, 4.6% in Amhara, 8.0% in Benishangul Gumuz, 1.7% in Oromia, 1.8% in SNNPR and 21.3% in Somalia Regions of Ethiopia. An overall seroprevalence record of 30.9% from sheep and goat in pastoral and agro-pastoral area of Afar and Gambella Region of Ethiopia has been reported (Megersa *et al.*, 2011). Most recently, PPR prevalence of 47.5 and 48.43% has been reported from different parts of Tigray and Oromia Regions of Ethiopia (Afera *et al.*, 2014).

Despite production and disease challenges in Ethiopia farmers prefer to rear sheep and goats including in the current study areas for their low cost of production, prolificacy their adaptive capacity to environment through dynamic feeding behavior and fast reproduction cycle and growth rate. The degree to which sheep and goats survive to marketable age is one of the key indicators of the efficiency of their production. However, there is scarcity of information concerning the disease like PPR which is one of the major constraints in sheep and goat productivity, particularly in the present study areas. There is a need to assess the prevalence of the disease under village condition to recommend possible prevention and control strategies which enhance poverty alleviation program in the country. Therefore the present study was aimed to determine the sero-prevalence and identify potential risk factors of Peste des Petits Ruminant's (PPR) in village sheep and goats.

MATERIALS AND METHODS

Study area: The study was conducted in 4 Kebeles (the lowest administrative level in Ethiopia), distributed in two Districts, Silti District in Siltie administrative zone and Meskan District in Gurage Zone of South Regional State of Ethiopia. Silti District is located 150 km South of Addis Ababa with Kibet being the main town. The district lies at the altitude ranges of 1650 up to 3100 masl and it has two agro-ecologies where 20.3% is highland (2300-3100 masl) and 70.70% mid altitude (1650-2300 masl). The district is dominantly Weyna Dega (mid altitude) in agro-climatic condition. The annual average temperature of the area ranges from 12-25°C. Meskan District is located 130 km South of Addis Ababa with Butajira being the main town. It has varying climates zones from arid dry lowland areas around 1500 m altitude to cool mountainous areas above 2000 m. The main wet season occurs between June and October while the remaining months are predominantly dry. All farmers included in the study use mixed crop-livestock farming.

Study design and sampling strategies: A cross-sectional study was undertaken in Silti and Meskan Districts of Siltie and Gurage Zones, South Regional State of Ethiopia from November 2014-May 2015. A multi stage simple random sampling was utilized for selection of animals from individual households. First the two study districts were selected purposely based on their small ruminant population and importance. Then a list of Kebeles within districts was obtained from the districts agricultural office and sampling Kebeles were selected based on sheep and goat population, representation of the respective districts and accessibility. Villages within Kebeles were selected by purposive sampling on the basis of prior information on the problem, farmer's cooperation, logistics, share of communal grazing land and accessibility. Finally, animals were examined to test the occurrence of the disease in the selected areas. Location, species, age and sex were concerned as hypothesized risk factors. In this study animals were categorized into two age groups. The first category was young between 6-18 months and the second adult category was >18 months, all sheep and goats sampled belong to the local breed. All necessary epidemiological information was collected on individual animal bases using a structured questionnaire format.

Sample size: The sample size required for the present study was determined according to Thrusfield (1995):

$$n = z^2 \times [pexp(1-pexp)/d^2]$$

Where:
z = 1.96
Pexp = 0.5 (expected prevalence 50%, since, no previous study in the areas)
d = 0.05 (the desired level of precision or accuracy)

The required sample size was accordingly calculated as n = 384, however, 390 sheep and goats were sampled for sero survey.

Sample collection: Blood samples (4 mL) from the jugular vein of each animal were collected, using sterile needles and plain vacutainer tubes labelled with individual animal identification number. The blood samples were put at room temperature for about 24 h in tilted position to obtain the serum. Sera were decanted into cryo-vials, identified and stored at -20°C until screened for antibodies against natural PPR virus exposure using serological analysis.

Laboratory examination: Serum samples were analyzed by the National Veterinary Institute (NVI, Debreziet, Ethiopia) using a competitive ELISA kit according to the

instructions of the manufacturer (Institute for Animal Health, Pirbright Laboratory, UK). The ELISA micro-plates were read with an immunoskan reader (Flow Laboratories, UK) with an inference filter of 492 nm. The reader was connected to a computer loaded with ELISA Data Information (EDI) Software (FAO/IAEA, Vienna, Austria) which was used to automate the reading and calculation of the competitive percentage values (S/N%). The samples result with competitive percentage (S/N%) $\leq 50\%$ were considered as positive.

Data management and analysis: Recorded data were entered into excel for the analysis of different attributable factors. The descriptive statistics was employed to quantify the results of seroprevalence of PPR antibodies. The association of potential risk factors such as different location, species, sex and age were assessed using logistic regression employing Windows Stata 13.

RESULTS AND DISCISSUION

Overall prevalence: A total of 390 serum samples were collected from two selected districts, Silti and Meskan. Out of which 29.2% (114/390) were found to be seropositive for PPR antibody.

In both districts, the distribution of PPR virus was observed with the prevalence ranging from 41-73% and significance difference was seen statistically (p>0.05) (Table 1).

Out of total 390 samples, 240 serum samples were from male and 150 serum samples from female with prevalence of 29.6% (71/240) and 28.66% (43/150), respectively. The prevalence appeared between sex was not statistically significant (p>0.05) (Table 2).

In this study animals were categorized into two age groups. The first category was young between 6-18 months and the second adult category was >18 months with their respective prevalence of 25.9% (44/170) and 31.8% (70/220). There was also no statistically significant difference between the two age groups (p>0.05) (Table 3).

Out of total 390 serum samples collected, 190 samples were from sheep and 200 samples from goats with prevalence of 24.2% (46/190) and 34% (68/200), respectively. The seroprevalence difference between the two species, goats having high prevalence was statistically significant (p<0.05) (Table 4).

The cross sectional study conducted on sheep and goat population of the present study revealed an overall seroprevalence of 29.2% (114/390), indicating the spread of PPR virus throughout the study areas. This result indicated that the PPR virus is circulating in the study

Table 1: Seroprevalence of PPR in relation to study districts

Location	Number of samples	AHS positive	Prevalence (95% CI)	OR (95% CI)	p-values
Meskan	221	73	33	1.657 (1.055-2.600)	0.028
Silti	169	41	24.2		
Total	390	114	29.2		

Table 2: Seroprevalence of AHS in relation to sex

Sex	Number of samples	AHS positive	Prevalence (95% CI)	OR (95% CI)	p-values
Female	150	43	28.66	1.04 (0.665-1.626)	0.86
Male	240	71	29.6		
Total	390	114	29.2		

Table 3: Seroprevalence of AHS in relation to the age groups

Age groups	Number of samples	AHS positive	Prevalence (95% CI)	OR (95% CI)	p-values
Young	170	44	25.9	0.771 (0.495-1.202)	0.25
Adult	220	70	31.8		
Total	390	114	29.2		

Table 4: Seroprevalence of PPR in relation to species

Species	Number of samples	AHS positive	Prevalence (95% CI)	OR (95% CI)	p-values
Goats	200	68	34	1.67 (1.07-2.60)	0.022
Sheep	190	46	24.2		
Total	390	114	29.2		

CI = Confidence Interval; OR = Odds Ratio

areas and needs particular attention, since, it is one of the 6 most economically important disease affecting both production and productivity of small ruminant. The overall seroprevalence of 29.2% observed in the current study was lower than Waret-Szkuta *et al.* (2008), Afera *et al.* (2014) which have been reported 52.5, 46.53 and 48.43% from Somalia, Tigray and Oromia Regions of Ethiopia, respectively. Moreover, the result of the current study is also lower, compared to the findings of 55% in Nigeria (El-Yuguda *et al.*, 2013), 55.2% in Uganda (Mulindwal *et al.*, 2011), 55.95% in Saudi Arabia (Elshemey and Mahmoud, 2011), 61.8% in Sudan (Abdalla *et al.*, 2012). The seroprevalence reports of 46% in India and 45.8% in Tanzania were also higher than the current report (Swai *et al.*, 2009; Balamurugan *et al.*, 2011). On the other hand, the current finding is relatively higher compared to the report by Banik *et al.* (2008) in Bangladesh with the prevalence of 25%. The difference in agro climatic conditions, management of animals, veterinary service, cultural and social practices could be a reason for the variation between the current report and the mentioned other reports.

In this study statistically significant variation was observed between the study districts. The high seroprevalence of 33% and relatively lower 24.2% was

registered in Meskan and Silti Districts, respectively. This could possibly be explained as bordering of Meskan District with areas which have high movement of animals and farmers management difference. The current finding also revealed approximately equal prevalence of 29.6% in male and 28.66% in female which may resulted from equal exposure of male and female because they are herded together and communal grazing. The high seroprevalence of 31.8% registered in adult animals than young ones in the present study is in agreement to a report by Gari *et al*. However, there was no statistically significant difference in prevalence as far as sex and age categories were concerned. This is in agreement with previous finding (Afera *et al*., 2014). The seroprevalence of PPR between the two species showed high prevalence of 34% in goats and 24.2% in sheep which was statistically significant (p<0.05). This is because goats are affected more severely to PPR virus exposure compared to sheep and they exhibit striking clinical sign while sheep undergo mild form of the disease (Taylor, 1984).

CONCLUSION

The presence of PPR virus such a devastating virus poses a serious hindrance to small ruminant productivity, since, they are the means of subsistence for millions in the least privileged parts of the country. In addition, most of the farmers in the study sites rear sheep and goats as means of income generating and the vaccination coverage of the region is very minimal which might be the reason for contributing the high prevalence of the disease. Therefore, awareness should be created to farmers in small ruminant rearing practices and control measures should be put in place to minimize the loss associated with the disease.

ACKNOWLEDGEMENT

REFEERENCES

Abdalla, A.S., A.A. Majok, K.H. El Malik and A.S. Ali, 2012. Sero-Prevalence of Peste des Petits Ruminants Virus (PPRV) in small ruminants in Blue Nile, Gadaref and North Kordofan States of Sudan. J. Pub. Health Epidemiol., 4: 59-64.

Abebe, R., M. Tatek, B. Megersa and D. Sheferaw, 2011. Prevalence of small ruminant ectoparasites and associated risk factors in selected districts of Tigray Region, Ethiopia. Global Vet., 7: 433-437.

Afera, B., D. Hussien and K. Amsalu, 2014. Seroprevalence of peste des petits ruminants in goats of Southern parts of Tigray Region. Global Veterinaria, 12: 512-516.

Balamurugan, V., P. Saravanan, A. Sen, K.K. Rajak, V. Bhanuprakash, P. Krishnamoorthy and R.K. Singh, 2011. Sero-epidemiological study of peste des petits ruminants in sheep and goats in India between 2003 and 2009. Rev. Sci. Tech., 30: 889-896.

Banik, S.C., S.C. Podder, M.A. Samad and M.T. Islam, 2008. Sero-surveillance and immunization in sheep and goats against peste des petits ruminants in Bangladesh. Bangladesh J. Vet. Med., 6: 185-190.

CSA., 2016. Federal democratic Republic of Ethiopia, Centralstatistical Agency, Agricultural Sample survey. Central Statistical Agency, Horn of Africa.

Couacy-Hymann, E., K. Bidjeh, A. Angba, J. Domenech and A. Diallo, 1995. Protection of goats against rinderpest by vaccination with attenuated peste des petits ruminants virus. Res. Vet. Sci., 59: 106-109.

Dhar, P., B.P. Sreenivasa, T. Barrett, M. Corteyn, R.P. Singh and S.K. Bandyopadhyay, 2002. Recent epidemiology of Peste des Petits Ruminants Virus (PPRV). Vet. Microbiol., 88: 153-159.

El-Yuguda, A.D., S.S. Baba, A.G. Ambali and G.O. Egwu, 2013. Seroprevalence of peste des petits ruminants among domestic small and large ruminants in semi-arid region of North-Eastern Nigeria. Vet. World, 6: 807-811.

Elshemey, T.M. and M.A. Mahmoud, 2011. Seroprevalence of antibodies against Peste des Petits Ruminants (PPR) virus in sheep and goat in Kingdom Saudi Arabia. Alex. J. Vet. Sci., 32: 175-182.

Gargadennec, L.A.L.A.N.N.E. and A. Lalanne, 1942. [Peste des petits ruminants (In France)]. Bull. Serv. Zoo. AOF., 5: 15-21.

Gelagay, A., 1996. Epidemiological and serological investigation of multi-factorial ovine respiratory disease and vaccine trial on the high land of North Shewa, Ethiopia. Ph.D Thesis, University of Calgyary, Calgary, Canada.

Gibbs, E.P., W.P. Taylor, M.J. Lawman and J. Bryant, 1979. Classification of peste des petits ruminants virus as the fourth member of the genus *Morbillivirus*. Intervirology, 11: 268-274.

Gopilo, A., 2005. Epidemiology of peste des petits ruminants virus in Ethiopia and molecular studies on virulence. Ph.D Thesis, Institut National Polytechnique de Toulouse, Toulouse, France.

Megersa, B., D. Biffa, T. Belina, E. Debela and A. Regassa *et al*., 2011. Serological investigation of Peste des Petits Ruminants (PPR) in small ruminants managed under pastoral and agro-pastoral systems in Ethiopia. Small Ruminant Res., 97: 134-138.

Mehmood, A., Q. Ali, J.A. Gadahi, S.A. Malik and S.I. Shah, 2009. Detection of Peste des Petits Ruminants (PPR) virus antibodies in sheep and goat populations of the North West Frontier Province (NWFP) of Pakistan by competitive ELISA (cELISA). Vet. World, 2: 333-336.

Mulindwa, B., S.P. Ruhweza, C. Ayebazibwe, F.N. Mwiine and D. Muhanguzi *et al.*, 2011. Peste des Petits Ruminants serological survey in Karamoja Sub Region of Uganda by competitive ELISA. Vet. World, 4: 149-152.

Murphy, F.A., E.P.J. Gibbs, M.C. Horzinek and M.J. Studdert, 1999. Classification and Nomenclature of viruses. In: Veterinary Virology, Murphy, F.A. (Ed.). 3rd Edn., Academic Press, New York, USA., pp: 413-416.

Pegram, R.G. and F. Tareke, 1981. Observation on the health of Afar livestock. Ethopian Vet. J., 5: 11-15.

Roeder, P.L., G. Abraham, G. Kenfe and T. Barrett, 1994. PPR in Ethiopian goats. Trop. Anim. Health Prod., 26: 69-73.

Swai, S.E., A.M. Kapaga, F. Kivaria, D. Tinuga and G. Joshua *et al.*, 2009. Prevalence and distribution of Peste des petits ruminants virus antibodies in various districts of Tanzania. Vet. Res. Comm., 10: 927-936.

Taylor, W.P., 1984. The distribution and epidemiology of peste des petits ruminants. Prev. Vet. Med., 2: 157-166.

Thrusfield, M.V., 1995. Veterinary Epidemiology. 2nd Edn., Blackwell, Oxford, UK., ISBN: 9780632040360, Pages: 479.

Waret-Szkuta, A., F. Roger, D. Chavernac, L. Yigezu and G. Libeau *et al.*, 2008. Peste des Petits Ruminants (PPR) in Ethiopia: Analysis of a national serological survey. BMC. Vet. Res., 4: 1-10.