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Short communication

Peste des Petits Ruminants (PPR) in Pakistan: Analysis of a national level serological data

Muhammad Abubakar[a,b,*,1], Aamir Bin Zahur[b,c], Muhammad Afzal[d], Qurban Ali[a], Jose Gonzales[e]

[a] National Veterinary Laboratory, Park Road, Islamabad, Pakistan
[b] PARC Institute of Advance Studies in Agriculture (PIASA), NARC,Park Road, Islamabad, Pakistan
[c] Animal Science Institute, National Agriculture Research Centre,Park Road, Islamabad, Pakistan
[d] Progressive control of PPR in Pakistan (GCP/Pak/127/USA), Islamabad, Pakistan
[e] Wageningen Bioveterinary Research, Houtribweg 39, 8221 RA, Lelystad, the Netherlands, the Netherlands

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ABSTRACT

The study was aimed to obtain baseline information about the presence and distribution of Peste des petits ruminants (PPR) in Pakistan by quantifying the sero-prevalence of this infection in all provinces/regions in the country. There are ongoing activities towards the progressive control and eventual eradication of PPR from Pakistan. To design a suitable control program and monitor its progress, baseline information on the occurrence of the disease in the target population is needed. Using a cluster sampling approach a total of 19575 serum samples from sheep and goat were collected from all provinces of the country. These samples were analyzed for the presence of antibodies against PPR virus using a competitive ELISA. Out of 19575 samples tested, 5389 were classified as sero-positive. The prevalence (95% confidence intervals (CI)) at the province level ranged 9.93% (0.027%–0.151%) in Azad Jammu & Kashmir to 38.16% (0.366%–0.466%) in Balochistan. Difference in sero-positivity could be attributed to animals' movement, agro-climatic conditions of areas. Risk factors covered in the study were season as well as age and sex of the animals. PPR is endemic and it is distributed across all provinces in the country. This study provides basic information for the identification of disease hotspots for implementation of a control programme in Pakistan.

1. Introduction

Peste des petits ruminants (PPR) is a highly infectious and economically important transboundary viral disease of small ruminants, notifiable to World Organization for Animal Health. The etiological agent of the disease is the PPR virus (PPRV) that belongs to genus Morbillivirus, family Paramyxoviridae. The genome of PPRV is a negative sense, single-stranded, non-segmented RNA, which comprises of 15948 nucleotides (Munir et al., 2012a,b). PPRV possesses a single serotype, and it is genotypically classified into four distinct lineages (I, II, III, and IV) on the basis of partial sequencing of the fusion (F) and nucleoprotein (N) genes (Dhar et al., 2002). The lineage I and II viruses are exclusively isolated from the West African countries (Munir et al., 2012a), Lineage III is limited to East Africa and Arabia, but the virus belonging to this lineage has also been isolated once from southern India. The newly emerging viruses are associated with Lineage IV, which is considered to be a new lineage and is prevalent in most of the Asian countries (Banyard et al., 2010; Munir et al., 2012b).

The PPRV primarily affects sheep and goat; cattle and buffaloes show asymptomatic infection whereas clinical signs and mortality is exhibited by wild ruminants and camels (Albina et al., 2013). Clinically, the disease is characterized by pyrexia, nasal and ocular discharges, diarrhea (Abubakar et al., 2011) and necrotic stomatitis. The disease largely resembles Rinderpest in cattle. In naïve sheep and goat populations, mortality and morbidity rates are as high as 90% and 100% respectively (Abu-Elzein et al., 1990).

Presently, the disease is endemic in Morocco, Sub-Saharan Africa, Arabian Peninsula, Turkey, Middle East, Iraq, Iran, Pakistan, Bangladesh, India, Nepal, Tibet and China, Tajikistan and Kazakhstan (Zahur et al., 2014). In Pakistan, the disease was first recorded in the year 1991 (Athar et al., 1995), and there is limited information reported about the epidemiology and prevalence of PPR virus in different regions of the country (Abubakar et al., 2008; Zahur et al., 2008). Since the infection is one of the leading causes of morbidity and mortality in sheep and goat population, it poses a serious threat to food security and the rural economy in Pakistan. The current study was therefore

* Corresponding author at: National Veterinary Laboratory, Park Road, Islamabad, Pakistan.
E-mail addresses: mabnvl@gmail.com, hayee42@yahoo.com (M. Abubakar).
[1] Also affiliated with PIASA.

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Table 1
An overview of province wise population of sheep and goats and sampling along with PPR sero-prevalence.

Area	Goat Population[a]	Sheep Population[a]	No. of samples from Goats (% positives)	No. of samples from Sheep (% positives)
KPK	9599017	3363249	14.9976	20.987
Punjab	19831039	6361767	34.5368	25.4271
Sindh	12572221	3958508	30.2896	33.4215
Baluchistan	11784711	12804217	41.6296	38.9913
AJK	1026204	199324	8.9016	3.2159
GB	254223	145869	23.9676	18.4701

[a] Livestock census 2006.

Table 2
Risk of PPR infection expressed as adjusted odd ratios. Mean odd values and lower (LCL) and upper (UCL) confidence limits are presented.

Factor	Categories	Odd ratio	LCL	UCL
Sex	Female	1		
	Male	0.69	0.64	0.75
Age	< 1 year	1		
	[1,3] years	0.73	0.66	0.81
	> 3 years	1.36	1.25	1.47

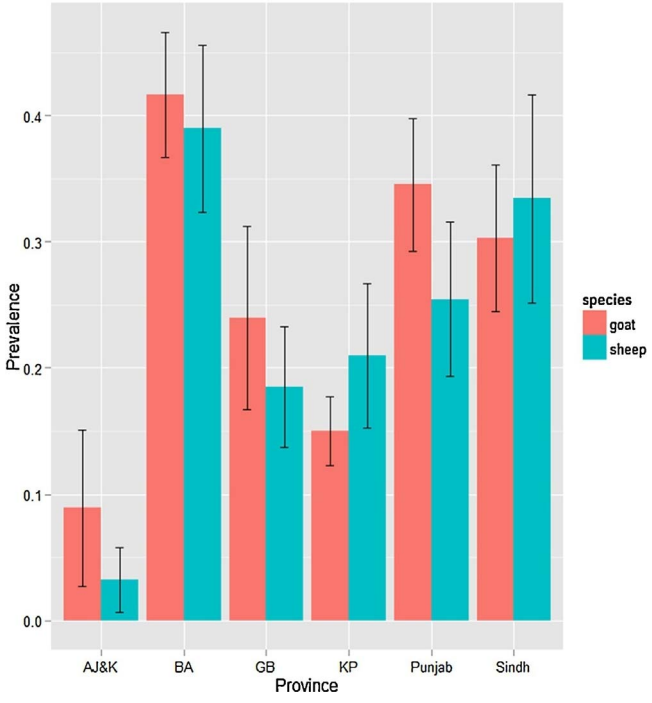

Fig. 1. Province-wise Prevalence of PPR in Sheep and Goat.

designed to provide baseline information about the presence and distribution of PPR in Pakistan by quantifying the sero-prevalence of this infection in all provinces/regions in the country.

2. Materials and methods

Serum samples from sheep and goats, collected during the Rinderpest Eradication Campaign (2005–06) from all the provinces/regions of the country, were included in this study. These samples were collected using a cluster sampling approach and a total of 19575 samples were taken, out of which 6113 were from sheep and 13462 were from goats with no history of previous vaccination against PPR. During sampling information on location, age and sex of the animal sampled was also recorded. An overview of the sheep and goat population and samples taken in each of the provinces in Pakistan is given in Table 1.

A commercial competitive ELISA test (BDSL, Flow Laboratories and Institute for animal health Pirbright, Surrey, England), was used for testing the serum samples. This test is expected to have both a high specificity (99.4%) and sensitivity (94.5%) (Libeau et al., 1995). Tests procedures were performed following the suppliers recommendations. The kit is designed on principle of a standard competitive enzyme linked immunosorbant assay (cELISA) for detection of anti-PPR antibodies in the serum (Abubakar et al., 2010; Munir et al., 2012). Test samples with a percentage inhibition > 50% were considered positive.

For the estimation of prevalence, a cluster sampling design approach was used where the districts and the species (sheep or goat) within the districts were treated as clusters. The design effect and 95% confidence intervals were estimated using the Cochran's method. Prevalence estimates were done per province and regions/areas within each province. Separate estimates of prevalence were obtained for sheep and goats. The sheep and goats population within each clusters were used as weights for the estimation of the "population" prevalence. The library Survey of the statistical software R was used for this analysis.

For the identification of risk factors, a generalized linear mixed model (GLMM) with a binomial error distribution was used. In this model, district was used as a cluster variable and factors: species, age and sex and any interaction between these factors were used as fixed effects. This analysis was done using the library lme4 from the statistical software R.

3. Results

3.1. Sero-prevalence of PPR

The analysis was done for the country in general and by province. A total of 5389 out of 19575 (27.53%) samples tested were classified as positive for PPR antibodies (Table 2). The information from the laboratory results and population size (Table 1) were used to estimate the prevalence in the different provinces and regions/areas within each province. The estimated prevalence for each province and species is shown in Fig. 1. By observing at the estimated confidence intervals, significant differences in the overall prevalence between provinces and species could be identified. It can be observed that the prevalence (both sheep and goats) in Azad Jammu & Kashmir is significantly lower than the rest of the provinces. In contrast the prevalence of Balochistan is significantly higher than the rest of the provinces (Fig. 1).