

## Research Article

# Study on the Prevalence of Peste Des Petits Virus Antibodies in Caprine and Ovine Through the Contrast of Serological Assessments in Sindh, Pakistan

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**Abstract:** Peste-des-petits-ruminants (PPR) is a notifiable, contagious and economically important transboundary viral disease of small ruminant causing high morbidity and mortality. It belongs to negative-sense, single-stranded RNA paramyxovirus of genus Morbillivirus. PPR occurs in populations of immunologically naive sheep and goats, illness and death can be high as >90%. It results in a high rate of morbidity and a moderate rate of mortality. After the eradication of the rinderpest virus, which is closely related to PPRV of small ruminants contaminated with SRMV are diagnosed having pyrexia, oculo-nasal discharges, necrotizing and erosive stomatitis, gastroenteritis, diarrhea and broncho pneumonia, whereas, gross pathology, histological findings along with laboratory confirmation of specific virus antigen, antibodies, genome in the clinical samples through a variety of serological and molecular diagnostic tests can be useful. The goal of this study was to use competitive-ELISA to determine the prevalence of PPR in small ruminants in Sindh province. A total of n=5700 blood samples were taken from sheep (800) and goats (4900) in 06 Sindh districts. In the small ruminant population, the overall prevalence was found to be 27.84%. Goats were found to have a higher prevalence (28.29%) than sheep (25.13%). Prevalence in goats varied by age category, with 27.84%, 24.88%, and 34.29% in three age groups, i.e. less than 1 years, 1-2 years, and more than 2 years and in sheep's 18.75%, 23.95%, and 36.11% respectively. Females had a greater prevalence rate than males. The prevalence of PPR varies across the province's several agro-ecological zones. Tharparkar district had the greatest% age (35.38%), while Hyderabad district had the lowest (18.27%). Because PPR is endemic in Sindh, there is a pressing need for infection prevention through vaccination. PPR can be controlled through mass vaccination program. In the future, the preparation of a marker vaccine with a robust companion test may assist in serosurveillance for the detection of infection in vaccinated animals to control the disease.

**Keywords:** PPR, Sindh, c-ELISA, Prevalence, Goat, Sheep

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## 1. Introduction

PPR (pest of the small ruminants) is a highly contagious viral disease that affects sheep and goats. Fever, anorexia, ulcerative stomatitis, diarrhea, oculo-nasal discharges, cough, and pneumonia are all symptoms of the infection [35, 37]. Mortality and morbidity rates in non-endemic areas vary depending on the vulnerable population, and in severe situations can approach 90 and 100%, respectively [16]. Concurrent bacterial, viral, or parasite infections can worsen the situation and raise fatality rates by up to 100% [19, 34]. PPR was first recorded in the subcontinent in 1987 in southern India [29]. The disease may have existed earlier due to a lack of diagnostic methods to distinguish it from rinderpest [36]. PPR confirming diagnostic methods such as cDNA clones [11], monoclonal antibody-based ELISA [20], and PCR [14] allowed for the confirmatory differential diagnosis. On the basis of clinical and epidemiological observations, PPR was first documented in Pakistan in the early 1990s [8, 26]. However, [5] validated it through scientific experiments. PPR has been proven by serology in many locations of Pakistan [33], and multiple studies have reported an overall prevalence rate of roughly 50% in the small ruminant population [1, 7, 17]. PPRV (Pestides petits ruminant's virus) from multiple outbreaks in Pakistan was also genetically analyzed and confirmed to be of lineage IV [23, 38]. Following the eradication of Rinderpest, the importance of PPR has been highlighted, and the need for PPR eradication is becoming more apparent [2, 4, 6, 10], as an effective vaccine and diagnostic tools are already available. The Food and Agriculture Organization (FAO) and the World Organization for Animal Health (OIE) have developed plans to eradicate PPR globally by 2030 [25]. Only the most recent data on the incidence of PPR in different parts of Pakistan can be used to develop a national eradication strategy. The purpose of this study was to evaluate the current prevalence of the disease in small ruminants across Sindh's several districts.

## 2. Materials and Methods

### 2.1. Area of Study

Sindh province's 06 districts were included in the current study. Western hilly terrain, eastern Thar and Nara deserts, southern coastal belt, and northern/central irrigated plains are among the agro-ecological zones of Sindh.

### 2.2. Collection of Samples

Between February 2021 to July 2021,  $n=5700$  blood samples from small ruminants, including  $n=4900$  from goats and  $n=800$  from sheep, were obtained from 06 districts in Sindh Province. Field veterinarians took random samples and documented information on the age and gender of each sample. The sera were separated and kept at  $-20^{\circ}\text{C}$  until they were needed. c-ELISA (Competitive Enzyme-Linked Immunosorbent Assay): Anti-PPRV antibodies in serum samples were measured using a commercial competitive enzyme linked immunosorbant assay (c-ELISA) kit that followed the manufacturer's instructions (collectively produced by CIRAD, EMVT, Montpellier, France, distributed by BDS, United Kingdom). The test technique was controlled using negative and positive cut-off values. Using an ELISA plate reader, the optical density (OD) values were read at 492nm (Immunoskan BDSL, Thermo Lab. Systems, Finland). ELISA Data Interchange (EDI) software was used to convert the absorbance to % age inhibition (PI) using the formula:

$$PI = \frac{100 - (OD \text{ control/test serum})}{(OD \text{ monoclonal control})} \times 100$$

PPRV antibodies were found in serum samples with a PI value of 50 or higher, whereas those with a PI value of less than 50 were declared negative.

### 2.3. Data Analysis

The prevalence of PPRV antibodies, as well as 95% confidence intervals (CI) and odd ratios, were computed using normal statistical procedures utilizing the computer application Student Edition of Statistics (SXW), version 8.1. (Copyright 2005, Analytical Software, USA).

## 3. Discussion and Results

The frequency distribution of the PI values of the animals tested for PPR antibodies using c-ELISA. The majority of the samples with PI levels between 10 and 20% were deemed negative for PPRV antibodies ( $PI < 50\%$ ). The peak frequency distribution, on the other hand, was found to be between 80 and 90%. [18] Made similar observations on peak PI value ranges for anti-PPRV antibodies in negative and positive samples. PPR was discovered in 1587 of 5700 serum samples, indicating a prevalence rate of 27.84% in the province's small ruminant population (Table 1).

*Table 1. Prevalence of PPR in Sheep and Goats in Sindh province.*

District	Goats			Sheep's			Overall		
	No of Samples	Positive	Positive%	No of Samples	Positive	Positive%	No of Samples	Positive	Positive%
Hyderabad	605	125	20.66	260	33	12.69	865	158	18.27
Thatta	835	208	24.91	110	35	31.82	945	243	25.71
Umerkot	905	250	27.62	90	35	38.89	995	285	28.64
Badin	780	235	30.13	135	23	17.04	915	258	28.20
Tando Allah Yar	865	258	29.83	120	33	27.50	985	291	29.54
Tharparkar	910	310	34.07	85	42	49.41	995	352	35.38
Total	4900	1386	28.29	800	201	25.13	5700	1587	27.84

These findings are similar to those of [30, 7] who found prevalence's of 33% and 31.25%, respectively, in India and Khyber-Pakhtunkhwa, Pakistan. However, the prevalence of PPR in Sindh province in this study is lower than the 43.33% reported by [17] for Pakistan's Punjab region. The prevalence of PPR in this study is also lower than that reported by [1, 2] in Sindh. The variation in prevalence rates between the two studies could be related to the quantity of serum samples collected and the sampling procedure used. Prevalence rates calculated from samples submitted to laboratories from probable PPR outbreaks, as done in [1, 15], are expected to be greater than those obtained by random sampling. Random samples of sheep and goats were gathered from several districts in Sindh for our research. 1386 Serum samples from goats (28.29%) and 201 serum samples from sheep (25.13%) were confirmed to be positive for PPR in the current

investigation. Numerous additional studies have also found that sheep had a higher prevalence than goats [2, 17, 22, 27, 30]. Although disease incidence may not differ much between sheep and goats, goats infected with PPRV have a greater fatality rate than sheep [8, 31]. Because sheep have a greater recovery rate and live longer than goats, a higher proportion of sheep test positive for anti-PPRV antibodies [30]. Furthermore, because goats have a greater fecundity rate, the herd is quickly replenished by younger goats, who are more susceptible to PPRV [30]. However, the results of this study contradict those of [9, 28], who reported that sheep have a lower prevalence than goats. PPR was shown to be more common in females than in males in our study. Prevalence was 21.76% in male goats and 29.65% in female goats. In sheep, males had a prevalence of 19.55% while females had a prevalence of 27.24% (Table 2).

**Table 2.** Sex wise prevalence PPR in Sindh.

Sex	No of Sample	Positive	%	Sex	No of sample	Positive	%
<b>Goat</b>				<b>Sheep</b>			
Male	850	185	21.76	Male	220	43	19.55
Females	4050	1201	29.65	Females	580	158	27.24

Some studies have reported a higher prevalence of small ruminant females [17, 18, 24], whereas others have found no significant difference [12, 21, 22]. Most studies quantifying PPR prevalence, including ours, have a varying sample size of two sexes, with fewer samples of male animals, making comparisons difficult. The physiological demands on females in the form of breastfeeding, pregnancy, and estrus can

increase susceptibility to infections [32], and it may possibly be the cause of a higher prevalence of PPR in female small ruminant populations. PPRV antibody prevalence differed between the three age groups studied. PPR prevalence was higher in goat (24.88%) and sheep (23.95%) in the age group >2 years than in the other two age groups (Table 3).

**Table 3.** Age-wise prevalence PPR in Sindh.

<b>Age Groups</b>						
Age	<b>Goats</b>			<b>Sheep</b>		
	No of Sample	Positive	%	No of Sample	Positive	%
less the 1 year	970	270	27.84	240	45	18.75
1-2 Year	2460	612	24.88	380	91	23.95
More than 2 Year	1470	504	34.29	180	65	36.11

This is consistent with the findings of multiple earlier research, which found a higher prevalence of PPRV antibodies in sheep and goats beyond the age of two [1, 2, 15]. The presence of PPRV antibodies increases with age in both sheep and goats. A minority of small ruminants aged >2 years were exposed to PPR when they were young but survived. PPR prevalence rates vary among Sindh province's districts. The prevalence of PPR was found to be lower in the districts of Hyderabad (18.27%) and Thatta (25.71%), but greater in district of Tharparkar (35.38%) and Umerkot (28.64%) (Table 1). These findings are consistent with those of [3, 4], who discovered a greater prevalence of PPR antibodies in Sindh's south-eastern regions. [30] Discovered a greater incidence of PPRV antibodies in India's south and south-western regions. Multiple factors, such as animal migrations and dietary inadequacies, have been proposed as causes for variable prevalence [13, 30]. Due to lower immunological response, poor nutrition in arid and semi-arid zones may increase illness incidence. Small ruminants are relocated from barren highland portions of Sindh, as well as the Thar and Nara deserts, to river irrigated areas

of Sindh, where they are in close contact with vulnerable local small ruminant populations, when drought strikes. Similar findings have been reported for Punjab province, with PPRV frequency being highest in the southern and western regions of the province, including the Cholistan desert [17, 18, 21].

## 4. Conclusion

PPR is found across Sindh, although it is more common in female goats over the age of two in the eastern Thar and Nara desert zones, as well as nearby irrigated areas. PPRV vaccine development on a local level is critical for control and eradication efforts.

## Conflict of Interest

The authors declare that they have no conflict of interest with respect to the research, authorship, and/or publications of this article.

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