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SEASONAL SERO PREVALENCE AND RISK FACTOR ASSESSMENT OF PESTE DES PETITS PPR IN RUMINANTS IN GOATS

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Abstract

Peste des Petits Ruminants (PPR) is a highly contagious viral disease of small ruminants, posing a significant threat to livestock health and rural economies in Pakistan. This study aimed to assess the sero-prevalence of PPR among goats in District Umarkot through area-wise, sex-wise, age-wise, and seasonal analyses. A total of 100 serum samples were collected from four areas: Umarkot, Petoro, Samaro, and Kunri. The overall sero-prevalence was 64%, with the highest positivity in Petoro (76%) and the lowest in Kunri (52%), though differences were not statistically significant (P = 0.6895). Sex-wise analysis revealed significantly higher sero-prevalence in female goats (72.46%) compared to males (48.38%) with a notable difference in Kunri (P = 0.034). Age-wise, goats aged 6–12 months showed the highest prevalence (73.68%), followed by those over 12 months (58.62%), and the lowest in goats aged 0–6 months (51.51%), with no significant statistical association (P = 0.7681). Seasonal analysis conducted over July, August, and September revealed consistently high sero-prevalence rates of 70%, 62.85%, and 65.71%, respectively, with no significant seasonal variation (P = 0.8124). The findings confirm widespread exposure of goats to PPR virus across all areas, sexes, ages, and seasons, indicating the endemic nature of the disease in Umarkot. The higher prevalence in females and young animals highlights the need for targeted vaccination strategies and year-round surveillance. These results underline the importance of timely and comprehensive PPR control measures to safeguard small ruminant populations in endemic regions.

INTRODUCTION

Peste des Petits Ruminants (PPR) is a highly contagious and economically significant viral disease that primarily affects small ruminants, particularly goats and sheep. The disease is caused by the PPR virus (PPRV), a member of the genus Morbillivirus within the family Paramyxoviridae (Banyard et al., 2010). PPR is characterized by fever, ocular and nasal discharge, stomatitis, diarrhea, and pneumonia, often resulting in high morbidity and mortality rates, particularly in naïve or unvaccinated populations (Diallo et al., 2007). The disease has been recognized as a major threat to food security, livelihoods, and rural economies in many parts of Africa, the Middle East, and Asia, including Pakistan. In Pakistan, PPR

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is considered endemic, with frequent outbreaks reported across various provinces, leading to significant economic losses in the livestock sector, which is a critical component of rural livelihoods (Abubakar et al., 2009). The movement of animals, especially during festivals, trade, and seasonal migrations, facilitates the rapid spread of the virus within and between regions. Moreover, climatic factors such as temperature, humidity, and rainfall can influence the epidemiology of PPR by affecting host immunity, vector dynamics, and animal congregation patterns (Munir et al., 2013). Seasonal variations in PPR outbreaks have been observed in several endemic regions, with increased cases often reported during or following the monsoon season. This increase may be attributed to stress induced by environmental changes, scarcity of fodder, and increased animal movement during this period (Khan et al., 2008). However, there is limited data on the seasonal patterns of PPR sero-prevalence in specific geographical areas of Pakistan, such as District Umarkot, Sindh, which is home to large populations of small ruminants and is prone to climatic extremes, including monsoon rains. Understanding the seasonal dynamics of PPR is essential for designing effective control strategies, including the timing of vaccination campaigns and disease surveillance. This study was therefore conducted to assess the seasonal sero-prevalence of PPR in goats in District Umarkot over the monsoon months of July, August, and September. The findings aim to provide evidence-based recommendations for improving PPR control and prevention in this region.

MATERIAL AND METHODS

The study on PPR infection in goats in District Umarkot was conducted at the Central Veterinary Diagnostic Laboratory, Tandojam, Sindh and the Department of Veterinary Microbiology, Sindh Agriculture University Tandojam. Sample collection A total of one hundred (n = 100) blood samples were collected from goats in District Umarkot. The animals were categorized based on their age into three groups: 0–6 months (suckler), 6–12 months (young) and over 12 months (adults). The male and female goats were separated into different groups based on their sex. A 5cc syringe was used to draw 5 mL of blood from the jugular vein of each goat. Serum was separated by centrifugation at 100.00 rpm for 5 min. The samples were further confirmed and analyzed using the competitive enzyme-linked immunosorbent assay (C-ELISA) for the detection of PPR antibodies.

Questionnaire-based collection of information

A standardized proforma was used to collect data on the suspected animals, including information on sex, age, location and seasons. The animals were carefully observed for symptoms such as mucosal erosion, respiratory distress, discharge from the mouth, nose and eyes, as well as a coarse coat and filthy hindquarters.

C-ELISA (Competitive Enzyme Linked Immunosorbent Assay)

PPR was diagnosed using commercial C-ELISA kit by using manufacturer's instructions (ID. Vet, 310, rue Louis Pasteur-Grabels-FRANCE) (Nizamani et al. 2015). Briefly, the samples and control were added to the micro-wells as per the instructions provided with the diagnostic kit. The PPR antibodies were diluted using 25 microliters of dilution solution in both the positive and negative control wells of the plate. The samples were then incubated at 37°C for 45 + 4 min and washed three times with 300 mL of wash solution. Following the washes, 100 microliters of conjugate were added to each well and incubated at 21°C for 30 min. The wells were washed again three times using the wash solution. Subsequently, 100 microliters of substrate solution were added to each well and the reaction was allowed to proceed. Finally, the reaction was stopped, and the optical density was measured at 450 nm in each well using the stop solution. Samples with positive PPR antibodies exhibited percentage inhibition values equal to or below 50%, while negative samples had percentage inhibition values equal to or above 60%.

STATISICAL ANALYSIS

The factors relevant to the prevalence of the PPR were examined using the Pearson Chi-square test using SPSS.

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RESULTS

Area-wise Sero-Prevalence of Peste des Petits Ruminants (PPR) in Goats
District Umarkot

Area	No. of Samples	No. of Positive	Positive (%)	P-value
Umarkot	25	17	68%	0.6895
Pithoro	25	19	76%	
Samaro	25	15	60%	
Kunri	25	13	52%	
Total	100	64	64%	

A total of 100 serum samples were collected from goats across four different areas of District Umarkot to determine the sero-prevalence of Peste des Petits Ruminants (PPR). The highest sero-prevalence was recorded in Umarkot with 76% positivity (19/25), followed by Pithoro at 68% (17/25), Samaro with 60% (15/25), and the lowest prevalence in Kunri at 52% (13/25). The overall sero-prevalence across all sampling sites was 64% (64/100), indicating widespread exposure of goat populations to PPR virus in the region. Statistical analysis revealed that the differences in sero-prevalence among the study areas were not statistically significant (P = 0.6895), suggesting that PPR infection is endemic and uniformly distributed across the district. The high prevalence rates in all surveyed locations highlight the persistent circulation of PPR virus and underline the need for regular vaccination campaigns and enhanced surveillance to control the disease.

Table 2: Sex-wise Sero-Prevalence of Peste des Petits Ruminants (PPR) in Goats
District Umarkot

Area	Female Samples	Female Positive	Female %	Male Samples	Male Positive	Male %	P-value
Umarkot	20	15	75.00%	5	3	60.00%	0.034
Pithoro	18	14	77.77%	7	4	57.14%	
Samaro	15	11	73.33%	10	5	50.00%	
Kunri	16	10	62.50%	9	3	33.33%	
Total	69	50	72.46%	31	15	48.38%	

A total of 100 serum samples from goats were analyzed to assess the sex-wise sero-prevalence of Peste des Petits Ruminants (PPR) in District Umarkot. Out of 69 female goats, 50 were sero-positive, yielding a prevalence rate of 72.46%, whereas among 31 male goats, 15 were sero-positive with a lower prevalence of 48.38%. Area-wise analysis showed that the highest prevalence in females was recorded in Umarkot (77.77%) and Pithoro (75%), while the lowest was observed in Samaro (62.50%). In males, the highest prevalence was found in Umarkot (57.14%), and the lowest in Kunri (33.33%). The overall prevalence in females consistently exceeded that of males across all study sites. The observed difference in sero-prevalence between female and male goats was found to be statistically significant (P = 0.034) in Kunri suggesting a potential higher susceptibility or longer exposure of female goats to PPR virus, possibly due to their longer retention in herds for breeding and milk production purposes. This trend, though not statistically tested in other areas, was consistently observed. The findings emphasize the importance of considering sex-related factors when designing vaccination strategies and disease control programs for small ruminant populations in endemic regions.

Table 3: Age-wise Sero-Prevalence of Peste des Petits Ruminants (PPR) in Goats
District Umarkot

Area	0–6 Month	Positive	% Positive	6–12 Month	Positive	% Positive	>12 Month	Positive	% Positive	P-value

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	Samples			Samples			Samples			
Umarkot	9	6	66.66%	10	8	80.00%	6	4	66.66%	0.7681
Pithoro	7	4	57.14%	8	7	87.50%	10	6	60.00%	
Samaro	9	4	44.44%	11	8	72.72%	5	4	80.00%	
Kunri	8	3	37.50%	9	5	55.55%	8	3	37.50%	
Total	33	17	51.51%	38	28	73.68%	29	17	58.62%	

The present study assessed the age-wise sero-prevalence of Peste des Petits Ruminants (PPR) among goats from different areas of District Umarkot. The animals were grouped into three age categories: 0–6 months, 6–12 months, and above 12 months.

Across all areas, the highest sero-prevalence was recorded in goats aged 6–12 months (73.68%), followed by animals aged >12 months (58.62%), while the lowest prevalence was observed in the youngest group aged 0–6 months (51.51%). In Umarkot, the sero-prevalence in the 6–12 month category was notably high at 87.50%, while in Pithoro, the older goats (>12 months) showed the highest prevalence of 80.00%. The lowest prevalence was found in Kunri, where goats aged 0–6 months had only 37.50% positivity. The statistical analysis (P = 0.7681) indicated that these differences were not statistically significant, suggesting that PPR exposure occurs across all age groups without a sharp age-dependent pattern. However, the relatively higher sero-positivity in the 6–12 months group could reflect increased susceptibility after the waning of maternal immunity, combined with increased movement or exposure at this age.

These findings emphasize the need for early and timely vaccination of goats, particularly before reaching the most susceptible age group, to achieve effective disease control and prevention in endemic regions.

Table 4: Seasonal Sero-Prevalence of Peste des Petits Ruminants (PPR) in Goats in District Umarkot

Month	No. of Samples	No. of Positive Samples	Positive (%)	P-value
July	30	21	70.00%	0.8124
August	35	22	62.85%	
September	35	23	65.71%	
Total	100	66	66.00%	

A total of 100 serum samples were collected from goats during the months of July, August, and September to assess the seasonal sero-prevalence of Peste des Petits Ruminants (PPR) in District Umarkot. The results revealed that the highest sero-prevalence was observed in the month of July (70.00%), followed by September (65.71%), and the lowest prevalence was recorded in August (62.85%). The overall sero-prevalence across the three months was 66.00%, indicating continuous circulation of the PPR virus throughout the peak monsoon season. Statistical analysis showed no significant difference (P = 0.8124) in the sero-prevalence among the different months, suggesting that PPR infection remains relatively stable across this period. The slightly higher prevalence in July may be associated with increased animal movement, congregation, and environmental stress due to the onset of the monsoon season, which can potentially exacerbate disease spread. These findings highlight the importance of year-round disease surveillance and the implementation of timely vaccination programs prior to the rainy season to reduce the risk of PPR outbreaks.

DISCUSSION

The present study provides valuable insights into the sero-prevalence of Peste des Petits Ruminants (PPR) among goat populations in District Umarkot, Sindh, Pakistan, considering area-wise, sex-wise, age-wise, and seasonal variations. The overall sero-prevalence of 64% indicates widespread exposure of goats to PPR virus, underscoring the endemic nature of the disease in the region. Area-wise analysis revealed that the highest sero-prevalence was observed in Pithoro (76%) followed by Umarkot (68%), Samaro (60%),

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and Kunri (52%). Although these variations were not statistically significant (P = 0.6895), the consistent detection of antibodies in all areas suggests that the virus is uniformly circulating across the district. This finding aligns with previous studies from other endemic regions, which have reported similarly high prevalence rates of PPR in small ruminants. The relatively lower prevalence in Kunri may be attributed to localized differences in animal management practices, herd immunity, or recent vaccination efforts (Zahoor et al., 2011). The sex-wise sero-prevalence showed a significantly higher positivity in female goats (72.46%) compared to males (48.38%), with a statistically significant difference observed in Kunri (P = 0.034). This trend is consistent with previous literature indicating higher infection rates in female animals, potentially due to their prolonged retention in herds for breeding, milk production, and economic value, leading to greater cumulative exposure to the virus over time. Male goats, which are often sold or culled at younger ages, may have reduced exposure risk. These findings suggest the need to consider sex-specific factors in designing targeted vaccination and control strategies, especially in rural settings where herd composition is influenced by traditional practices (Munir et al., 2013 and Khan et al., 2008). The age-wise sero-prevalence demonstrated that goats aged 6–12 months exhibited the highest positivity rate (73.68%), followed by those over 12 months (58.62%) and the youngest age group of 0–6 months (51.51%). Although the observed differences were not statistically significant (P = 0.7681), the relatively higher prevalence in the 6–12 month age group may be explained by the waning of maternal antibodies, increased animal movement, and greater exposure to communal grazing areas (Khan et al., 2008). The findings highlight the critical importance of timely vaccination, preferably before 6 months of age, to provide effective protection during the most susceptible period (Nizamani et al., 2015). Similar age-related susceptibility patterns have been reported in other endemic regions, supporting the need for strategic vaccination scheduling. Seasonal analysis indicated relatively stable sero-prevalence across the monsoon months of July (70.00%), August (62.85%), and September (65.71%), with an overall prevalence of 66.00%. No significant association was observed between sero-prevalence and seasonality (P = 0.8124), suggesting that PPR virus transmission in this region may not exhibit a sharp seasonal trend (Banyard et al., 2010). However, the slightly higher prevalence observed in July may reflect the increased stress associated with the onset of the monsoon season, including factors such as nutritional stress, overcrowding, and increased vector populations. These environmental and management-related stressors can exacerbate the spread of infectious diseases, including PPR (Muhammad et al., 2024 and Wiley, 2020). The high sero-prevalence rates across all studied variables confirm the endemic presence of PPR virus in District Umarkot and highlight the need for robust control measures. The persistence of the virus in the population despite ongoing vaccination efforts may be due to gaps in vaccine coverage, improper cold chain management, or the presence of unvaccinated animal reservoirs. Regular vaccination campaigns, particularly targeting young and female animals before peak susceptibility periods, coupled with continuous surveillance and community awareness programs, are essential to control the spread of PPR (Abubakar et al., 2009). Furthermore, molecular studies are recommended to identify circulating PPR virus lineages and to monitor any potential genetic shifts that could impact vaccine effectiveness. The integration of such findings into policy frameworks can greatly enhance the control and eventual eradication of PPR in endemic regions like District Umarkot.

CONCLUSION

It can be concluded that PPR infection is widespread among goats in district Umarkot, with higher sero prevalence observed in certain areas, among female goats, and in the age group of 6 to 12 months. The season of August showed the highest sero-prevalence, indicating the impact of environmental factors on PPR transmission.

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