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Prevalence and Risk Factors Associated with Peste Des Petits Ruminant (PPR) in Jashore, Bangladesh

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ABSTRACT

The FAO and the WOAH are launching a global effort to eradicate Peste des Petits Ruminants (PPR) which causes high morbidity and mortality in small ruminants. PPR is the number one killer disease of goats in Bangladesh. The objective of the study was to determine the prevalence and risk factors associated with PPR in goats in Sharsha, Jashore, from September 2023 to November 2023. Clinically infected 456 goats were examined during this period. The presumptive diagnosis of the PPR diseases was based on the owner's complaints, clinical history, signs and symptoms, and physical examinations of goats. Statistical analysis was done by Chi-square test, and the P-value was calculated by using SPSS 22 (SPSS, Inc., Chicago, IL). In this study, 97 goats (21.3%) were found to be PPR infected out of 456 visited goats in Upazila Veterinary Hospital. PPR was more observed and significantly more prevalent (<0.001) in Black Bengal goats (76.2 %) followed by 13.4% crossbreeds, 8.2% Jamunapari and 2.0% Beetal goats. The prevalence of PPR is not statistically significant according to sex but highly significant (P<0.001) in un-vaccinated (76.29%) goats and worm-infested goats (79.38%). Age and rearing system were also significant factors (P<0.001) in the prevalence of PPR of goats. 6-24-month-old goats (54.64%) were more susceptible than adults (8.25%) and household-rearing-system goats (70.10%) were more susceptible than intensive-system goats (6.19%) to PPR. These results of the study may be useful in creating a control and eradication program of PPR in Sharsha, Jashore.

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Introduction

The goat is a multipurpose animal crucial to the long-term farming industry, employment opportunities, traditional and pastoral economic growth, and nutritional satisfaction. It comprised 271.17 lakh of Bangladesh's total population in 2023–2024 and contributed 1.80% of the country's GDP along with other livestock (DLS, 2024). Because of are the most significant sources of income for rural families, marginal farmers, children, landless labourers, and troubled women who cannot afford to raise cattle, goats are referred to as "The cow of poor people" in Bangladesh (Parvez *et al*., 2014). Meat and skin of goat make up 38% and 28% of Bangladesh's total livestock meat and skin production, respectively according to the Food and Agricultural Organization (FAO) (Sarker and Islam, 2011). Goat farming offers clear economic and managerial advantages over other livestock species due to its higher prolificacy, early sexual maturity, low input requirements, lower initial investment, and ease of commercialization, good survivability (Bokhtiar *et al*., 2017). But diseases especially PPR (Peste Des Petits Ruminants) cause detrimental effects on smallholder farmers.

Peste des Petits Ruminants (PPR) is a highly contagious viral disease that has a disproportionate effect on the poorest farmers in the world with an estimated of disease $1.45 billion to $2.1 billion in losses each year (Emergence MSD Animal Health, 2024). The disease is closely related to rinderpest virus (RPV), caused by a Morbillivirus from the family Paramyxoviridae, is an OIE-listed disease with morbidity and mortality rates reaching up to 90% (Kumar *et al*., 2014). Peste des petits ruminants (PPR) are an acute or subacute viral disease that affects mostly respiratory and digestive systems characterized by high fever, erosive stomatitis, mucopurulent nasal and ocular discharge, pneumonia, necrosis and ulceration of mucous membranes and inflammation of gastrointestinal tract, leading to severe diarrhea, sometimes death (Sarker *et al*., 2011; Benfield *et al*., 2023). PPR was first identified in 1942 in the Ivory Coast in Western Africa and has since extended its range in Asia, the Middle East, and Africa (Baazizi *et al*., 2017). In Bangladesh, a group of researchers first detected the existence of rinderpest-like disease in goats in western districts of the country in 1994 and later the World Reference Laboratory recognized the PPR virus as the causal agent of the disease (Banik *et al*., 2008). Transmission of the disease occurs through close contact with the droppings of infected animals to healthy animals (Alam *et al*., 2022).

The outbreak of PPR caused 74.13% morbidity and 54.83% mortality in Black Bengal goats in Bangladesh but the rate in an affected goat population can reach 100% and 23-100%, respectively (Das *et al*., 2007; Chowdhury *et al*., 2014). It causes significant economic losses in fast-growing goat production in Bangladesh (Hasib and Chowdhury, 2020). In addition to decreasing genetic resources and jeopardizing breeding policies, high mortality by PPR impacts food security by lowering the availability of meat and milk available for family consumption and the rural economy (Ahmed *et al*., 2017). Applying supportive treatment, mortality may be significantly controlled (Fentabun and Woldic, 2012) and proper vaccination can prevent the outbreak of PPR. The World Organisation for Animal Health (OIE) and the Food and Agriculture Organisation (FAO) prioritised PPR as a high-priority disease for progressive control to eradicate by 2030 due to its economic impact.

As a district in southwestern Bangladesh, Jashore has become a model for successful goat farming, due to its efficient transportation, fertile agricultural lands for cost-effective fodder, and manageable flat terrain for farms and shelters. It is a densely goat-populated area, and goat rearing is a profitable household enterprise for farmers' smooth livelihood. Several research has been conducted on the epidemiology of PPR disease in goats in various parts of Bangladesh, but none have been conducted in Sarsha upazila, Jeshore as of yet. Such data could be useful in understanding the current situation of goat PPR in this region and its economic significance. Improved understanding of prevalence and associated factors can lead to better disease control approaches. The study aimed to estimate the prevalence and investigate associated risk factors of PPR infection in districts of Jashore region, Bangladesh.

Materials and Method

Study area and animals

The study was conducted at Upazila Livestock Office & Veterinary Hospital in Sharsha Upazila in Jashore district of Bangladesh from September 2023 to November 2023. Most of the goats found in the study area are Black Bengal goats. However, other surveyed animals were the genotype of Jamunapari, Beetle and Crossbreed.

Figure 1. The area of study (Sharsha Upazila, Jashore).

Sample size

A comprehensive examination was conducted on a total of 456 cases involving diseased goats over the specified study period. The data collected from these cases provided valuable insights into the prevalence, distribution, and nature of infections affecting the goat population in the study area.

Diagnosis of diseases based on clinical examinations

Data were collected based on the owner's complaints and anamneses, clinical history, clinical symptoms, and physical examination findings of the goats. Heart rate, pulse rate, respiration rate, breathing sound normality test through auscultation, dehydration through skin tenting test, visual inspection, palpation, and percussion were done very carefully and individually found data were conserved very diligently for diagnosis of diseases.

Determination of risk factors through interviews with the owner (Face to face)

A prepared questionnaire was filled out during the examination of goats, containing various types of information regarding demographic (age, sex, breed, rearing system) characteristics and preventive measures taken before. The whole sample of PPR suspected goats was grouped into four as Black Bengal, Jamunapari, Beetle and other crossbreed goats according to breed. Again, the goats were grouped into three different age groups of less than 6 months, 6 to 24 months, and greater than 24 months goats and further grouped into two according to sex (male, female), two according to immune status (vaccinated, unvaccinated), three according to rearing system (household, semi-intensive, intensive).

Data Processing and Calculation:

Data were collected and sorted from clinical records to Microsoft Excel 2010 and exported to analytical software IBM® SPSS® Statistics (Version 27) to calculate Chi-square tests and P-values. Calculated values were considered to be statistically significant when the P value was less than or equal to 0.05.

Results

Clinical manifestations of PPR disease in goats

Among the 456 examined diseased goats, 97 goats were suggestive of PPR infection and other diseases and disorders were observed in 359 cases. Clinically high fever (105-107°F), severe diarrhoea, oculonasal discharge and dehydration were found in all PPR-infected goats (n=97), but sleepy appearance was observed in 76 goats, arched back was observed in 43 goats, ulcers and foul smell from mouth were observed in 32 goats as shown in Figure 2.

Figure 2. PPR infected goats represented lowering head (arrow, A), severe diarrhoea (circle, A) and excessive nasal discharge and sleepy eyes (arrow, B)

Prevalence of PPR and other diseases or disorders of goats

PPR was frequent in 21% whereas other diseases were 79% of the study group represented in Figure 3. In addition, various conditions including parasitic infestation (12.72%) and non-specific diarrhoea (13.82%) were found more and mastitis (0.877%) and fracture (1.54%) were less prevalent presented in Table 1.

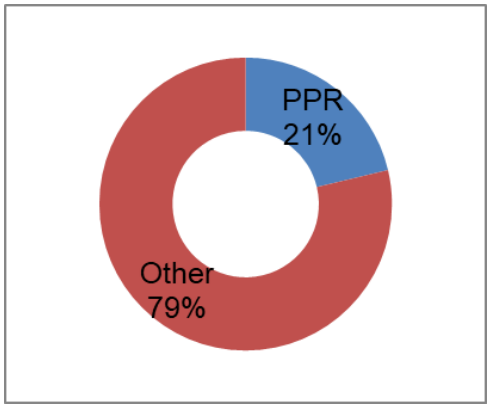

Figure 3. The overall prevalence of PPR in examined goats

Table 1. Prevalence of diseases in goats at Sharsha Upazila

Diseases or disorders	Number of Cases	Percentage (%)
PPR	97	21.27
Parasitic Infestation	58	12.72
Diarrhea (Non-specific)	63	13.82
Pneumonia	33	7.24
Metabolic acidosis	59	12.94
Dog bite	43	9.43
Mastitis	4	0.877
Bloat and Tympany	31	6.8
Abscess and cyst	12	2.63
Fracture	7	1.54
Others	49	10.75
Total examined cases	456	100

Risk factors associated with PPR disease

PPR was more observed in Black Bengal goats (76.2 %) followed by 13.4% cross breed, 8.2% Jamunapari and 2.0% of Beetal goats. PPR was significantly more prevalent in Black Bengal goats (<0.001) than the other three breeds. PPR was significantly higher (P<0.011) prevalent in female goats (62.89%) than male goats (37.11%). Among age groups, the highest prevalence of PPR within goats was recorded in the 6 to 24 months aged goats (72.17%) followed by less than 6 months aged goats (19.59%) and greater than 24 months goats only 8.25% were affected. The prevalence of PPR was significantly highest (P<0.001) in the ages of 6 to 24 months. The highest PPR in goats were recorded in household rearing system 70.10 % followed by semi-intensive system 23.71% and intensive system 6.19%. PPR was significantly more prevalent in house hold rearing system (<0.001) than other two rearing systems. Based on their immune status, unvaccinated goats had a higher rate of PPR infection (76.29%) than vaccinated goats (23.71%). Table 2 showed the PPR-infected goats that were not dewormed had the highest prevalence, at 79.38%, compared to 20.62% of dewormed goats. PPR has a significant difference in immune and anthelmintic-treated goats.

Table 2. Prevalence of PPR according to the age, sex, breed, rearing system, immuned status, deworming status

Parameters		No of Affected goats	Prevalence (%)	P - value
Age (Months)	<6 (Kid)	19	19.59	<0.001
	6-24 (Young)	70	72.17	
	>24 (Adult)	08	8.25	
Sex	Male	36	37.11	<0.011
	Female	61	62.89	
Breed	Black Bengal Goat	74	76.29	<0.001
	Jamunapari	8	8.25	
	Beetle	2	2.06	
	Others (crossbreed)	13	13.40	
Rearing system	House hold	68	70.10	<0.001
	Semi-intensive	23	23.71	
	Intensive	6	6.19	
Immuned status	Vaccinated	23	23.71	<0.001
	Unvaccinated	74	76.29	
Deworming	Yes	20	20.62	<0.001
	No	77	79.38	

*P value: Probability value

Discussion

The findings of numerous research showed that the PPR trend in Bangladeshi goats was becoming more positive, even though the Food and Agriculture Organization (FAO) and the World Organization for Animal Health (OIE) plan to eradicate the disease by 2030. The prevalence of PPR in goats was 21.27% in the study. The outcome was lower than the prevalence reported by Alam *et al.* (2022), Islam *et al.* (2012), Al–Dubaib *et al.* (2009) and Swai *et al.* (2009) who reported 44% in Chuadanga (Bangladesh), 50.27% in Patuakhali (Bangladesh). But Ahmed *et al.* (2017) and Parvez *et al.* (2014) reported 18.09% in Sylhet and 8.99% in Chittagong district (Bangladesh). Different management techniques, study periods, and geographic locations could all be contributing factors to this discrepancy.

This study revealed that the young goats were significantly (P<0.001) more affinity to the PPR virus than kids and adults which agreed with the results of Rahman *et al.* (2017), Parvez *et al.* (2014), Islam *et al.* (2012), and Singh *et al.* (2004) who described that the disease is commonly present in the young goats. Less than 6 months kids are less susceptible due to the presence of maternal immunity. The increased susceptibility to young animals is supposed to be due to early weaning, malnutrition, poor immunity, and poor management systems. Prevalence of female goats (63.89%) was higher than that of male goats (37.11%) according to the study. Female goats go through several types of stress conditions like pregnancy, lactation time etc. That's why, they are prone to susceptible to diseases than males. This result is consistent with Mohanto *et al.* (2018), Rahman *et al.* (2017), Rahman *et al.* (2016) and Abdalla *et al.* (2012). Females are more prone to the disease than males, which may be due to their physiological differences.

The disease primarily afflicted Black Bengal goats (76.29%), indicating a significant (P<0.001) breed susceptibility in the current study. This finding was corroborated by Ahmed *et al.* (2017), Naznin *et al.* (2014), Islam *et al.* (2012) and Mondal *et al.* (1995) who discovered that Black Bengal goats have a greater prevalence of PPR than other breeds. In comparison to crossbreeds, Black Bengal goats may have a higher incidence of PPR due to immunosuppression and inconsistent vaccination (Mondal *et al.,* 1995) as well as region and population. People are fond of crossbreeds due to their larger size and cost value. According to the current study's findings, unvaccinated goats had a greater prevalence of PPR than vaccinated goats. There was a statistically significant difference in prevalence (P <0.001) in this study. This outcome confirms the findings of Islam *et al*. (2013), and Solaiman *et al.* (2022) who discovered that unvaccinated goats had a greater prevalence of PPR. Due to the highly contagious nature and viral shedding of PPR, outbreaks of disease rapidly happened among the unvaccinated herd. Vaccinated goats also infected with PPR due to improper cool chain maintenance of vaccines, stressed conditions, mixed rearing of diseased and healthy animals or seasonal outbreaks of diseases. Vaccination not only protects individual goats but also reduces the circulation of the virus in the environment. In unvaccinated populations, the virus continues to circulate and pose a constant threat.

Open grazing systems showed a higher prevalence than semi-intensive and intensive systems in various rearing systems, which was consistent with the findings of Saeed *et al.* (2018). This could be because of movement stress, flock mixing, and sharing pasture and water resources. In contrast, another study found that the pastoralist system had the highest prevalence (68.1%) compared to other systems (Salih *et al.,* 2014). The number of infected animals with PPR without deworming indicated that the goat's deworming status was statistically significant (P<0.001). It was in line with the findings of Rabbi *et al.* (2014), who found statistically significant differences in goat breeds with deworming. By impairing immune system function, parasitic burden raises the risk of PPR disease.

Conclusion

The study's findings demonstrated the current state of PPR disease with its risk factors in the Sharsha Upazila of Jasore district. According to this study, a greater proportion of goats had PPRV infection (21%) than other clinical cases. Young goats (6-24 months) were more prone to PPR than other age groups. Female goats were more susceptible to PPR than male goats. Black Bengal goats were highly infected with PPR than other goat breeds. The rearing and management system must be developed to minimize the prevalence of PPR because the prevalence of PPR is highest in house hold rearing systems. Vaccination should be done carefully as it markedly reduces the chance of infection. As the vaccination of goats reduces the chance of infection, and so properly regular and mass vaccination is recommended. A great portion of poor people depend on goats economically in Jashore. PPR causes heavy economic losses in the country every year and also remarkably decreases production. To eradicate the fatal disease, appropriate surveillance and consistent immunization campaigns must be put in place.

Conflict of Interest

There is no conflict of interest

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