

Original Article

## Hemato-biochemical parameters of Pesti-des Petits Ruminants (PPR) affected goats in Chittagong, Bangladesh

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### ABSTRACT

**Objective:** The research work was aimed at assessing the prevalence and risk factors of Peste-des-petits-ruminants (PPR) in goats in some selected areas of Bangladesh along with a comparison of different hemato-biochemical parameters of PPR infected goats.

**Materials and methods:** A presumptive diagnosis of PPR was done based on clinical signs and symptoms. A structured record keeping sheet was used for the estimation of prevalence and risk factors of PPR in goat. A total of 103 blood samples were collected randomly and analyzed for hemato-biochemical parameters using automated hemo-analyzer.

**Results:** Out of 103 cases, Black Bengal (59%) and young goats aging minimum-12 months (43.85%) were recognized as highly susceptible to PPR disease. Strong association was found among all the three factors such as age, breed and sex (RR>1). All the values of hematological parameters such as TEC, TLC, Hb, PCV, and DLC were decreased in PPR affected goat as compared to healthy goats except lymphocyte counts, which was increased significantly ( $P=0.00$ ). The amount of total protein (3.15 gm/L) and albumin (16.88 gm/L) were reduced drastically in PPR affected goats.

**Conclusion:** The lymphocyte content in blood was significantly increased where as the total protein and albumin percent were decreased in the goats affected with PPR. Moreover, this variation in blood profile due to PPR virus infected in goat might be a good indicator in this disease diagnosis.

### KEYWORDS

Goat; Hematology; PPR; Prevalence; Risk factors

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## INTRODUCTION

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PPR (Peste-des petits ruminants) is an acute, highly contagious, fatal viral disease that affects most commonly the goat population in Bangladesh like many other countries of the world. The disease is endemic in the Arabian Peninsula, the Middle East, Indian subcontinent, Turkey, Iraq, Iran, Afghanistan, Pakistan, India, Bhutan as well as Bangladesh ([Muhammad et al., 2010](#)). The World Organization for Animal Health has recently been identified PPR as a serious notifiable and economically important transboundary viral disease of sheep and goats to jeopardize with high morbidity and mortality ([Diallo et al., 2007](#); [Folitse et al., 2017](#); [Birindwa et al., 2017](#)). Clinically, the disease is characterized by high fever, oculo-nasal discharges, necrotizing and erosive stomatitis, diarrhoea, and dyspnea bronchopneumonia followed by either death or recovery from the disease ([Balamurugan et al., 2012](#); [Sharma et al., 2012](#); [Jaisree et al., 2018](#)). Animals that are unprotected by means of devoid of immunization has the morbidity rate can be up to 100% and mortality may be 20% to 90% particularly in goats ([Torsson et al., 2016](#)). In a study found that 74.13% morbidity and 54.83% mortality in Black Bengal goats in some selected areas of Bangladesh ([Das et al., 2007](#)).

Transmission of the PPR virus in nature occurs primarily through direct contact with and goats from low altitude pasture lands to high infected animals and by inhalation of the infectious pasture lands in summers and from high altitude to low aerosol produced by a combination of sneezing and altitude pasture lands in winters is common ([Mahajan et al., 2013](#); [Baazizi et al., 2017](#)). Infection rates in goats rise with age, and the disease, which varies in severity, is rapidly fatal in young animals and has a controversial effect on the sex ([Nargesi et al., 2012](#)). The small stock management practices, seasons, transportation, infected animals that newly introduce into the flock are the major risk factors for the presence or absence of PPR outbreaks. Alongside this, considerations of breed susceptibility, immune-competence of hosts, and existing parasitic infections also jeopardize the condition ([Pope et al., 2013](#)). Often, where epidemics have been reported in the field, clear conclusions from disease studies have been hampered by the lack of diagnostic materials and there are no available established parameters to differentiate between infected with non-infected hematology as an easier tool of diagnosis and comparative study. Different diagnostic tests are used to diagnose the disease varies from simplest form by observing the presenting signs (tentative diagnosis) to a confirmatory diagnosis by means of serology or

molecular approach. Excluding clinical signs, and history, complete blood count can also be used for diagnosis that tends to be more useful in countries where diagnostic cost is considered as a burden ([Tariq et al., 2014](#)).

In Bangladesh, PPR has been considered to be prevalent in goats since 1993 ([Islam et al., 2001](#)). Sporadic study based on serological ([Anowar and Nadir, 2004](#)); pathological and molecular ([Rahman et al., 2011](#)) basis were conducted in different selected areas in Bangladesh but no research was conducted in Boalkhali Upazilla and comparison of blood parameters of healthy one with the infected patients is quite a new approach. Evaluating blood parameters for diagnosing diseases in animals and human is a convenient and quick tool but establishing blood parameters differences in PPR affected goat is still to be explored and setting up such type of diagnostic tool is of utmost importance. Therefore, the present study was undertaken to find out the prevalence, risk factors of PPR in goat in some selected areas of Bangladesh along with a comparison of hematological parameters of PPR infected goats.

## MATERIALS AND METHODS

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**Study area and duration:** A cross sectional study was conducted on PPR affected goats in Upazilla Veterinary Hospital Boalkhali and Sahedul Alam Quaderi Teaching Veterinary Hospital (SAQTVH) of Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh for a period of six months (July to December, 2016).

**Population size and tools used for data collection:** A total 103 number of diseased goats irrespective of different age, sex, and breed were registered that came to the hospitals for treatment having presented signs and symptoms such as high fever, stomatitis, oculo-nasal discharges, swollen lymphnode, diarrhea, erosive lesions in mouth cavity and nasal cavity etc. A structured record keeping sheet was used for registration of diseased data of goats with their demographic information (species, age, sex and breed), nature of feeding apart from the owner.

**Collection of samples for hematology:** Five ml of blood was collected aseptically from the jugular vein of each goat by adopting a standard protocol. All samples for hematological analysis were stored in 4°C and tested within 24 h after collection in the Department of Physiology, Pharmacology and Biochemistry, Chittagong Veterinary and Animal Sciences University and analysis were done by the automated analyzer from Roche

Diagnostics (Laval, QC, Canada) according to the manufacturer's specifications.

**Ethical approvals for animal experimentation:** The study was conducted on the goats that were brought to the Teaching Veterinary Hospital, CVASU and Upazilla livestock office, Boalkhali, Chittagong for treatment purpose. During sample collection from the goats, appropriate measures were taken to minimize pain or discomfort. Necessary approvals were taken from concerned hospital authority for conducting the study. Animal dealings and experiments were carried out in accordance with the Guidelines laid down by the Institutional ethics committee and in accordance with local laws and regulations.

**Statistical analysis:** All tested data were recorded in a data recording sheet and obtained data were imported in the Microsoft Excel-2007 and transferred into the statistical software STATA-11 for analysis. A descriptive analysis was carried out for the obtained mean, standard deviation, minimum, maximum, of every hematological parameter where cut off values were set at 0.05. Chi-square tests were done to find out the association of potential risk factors that was included in present study.

## RESULTS

Among the 42 (80.82%) PPR positive cases, highest prevalence (43.86%) was recorded in very young goats aging minimum-12 months, whereas older animals (13-25 months of age) were less susceptible to PPR infection (36.96%). However, within the age groups of animals in terms of the prevalence of PPR, there was no statistical significant ( $P=0.61$ ) relationship (**Table 1**).

Within the two goat breeds, highest prevalence was recorded in Black Bengal amounting 58.82% whereas the lowest prevalence was 23.07% in Jamnapari. The Susceptibility of PPR diseases within the two breeds is statistically highly significant ( $P=0.00$ ). It was shown that prevalence of PPR was higher in female goats (32.56%) in comparison to male goats (30%). There was no statistical

significant ( $P=0.92$ ) relationship within the sex of goat (**Table 1**).

In case of risk ratio, it was recorded that 1.18, 2.54, and 1.23 among the age, breed and sex respectively. A strong association was found among all the three factors because in all the cases, value of RR was more than 1 (**Table 1**).

Different hematological parameters of PPR infected and non-infected goats were stated in **Table 2**. It was revealed that average total erythrocyte count (TEC) was  $12.15 \pm 0.43$  (million/cmm) in healthy goat but TEC drastically decreased  $5.70 \pm 0.52$  (million/cmm) in PPR infected goats which is statistically highly significant ( $P=0.00$ ). Total leukocyte count (TLC) was counted in  $7.71 \pm 0.51$  (thousand/cmm) in normal healthy goat whereas it was slightly decreased  $6.583 \pm 0.48$  (thousand/cmm) in diseased goat and this reduction is statistically insignificant ( $P=0.15$ ).

The estimated hemoglobin level was  $10.3 \pm 0.53\%$  (gm/dL) in non infected animals but hemoglobin level was significantly reduced  $7.44 \pm 0.25\%$  (gm/dL) in PPR infected goats and this variation is statistically highly significant ( $P=0.00$ ). The Calculated PCV and ESR value was  $30.37 \pm 1.66$  and 0 (mm in 1<sup>st</sup> hour) in healthy animals but in comparatively it was slightly changed  $30 \pm 1.05$  and  $.05 \pm 0.05$  in diseased animals and both values were statistically insignificant ( $P=0.86$  and  $P=0.43$ ), respectively.

The differential count of different white blood cells such as monocytes ( $2.9 \pm 0.31\%$ ), Lymphocytes ( $60.2 \pm 1.14\%$ ) and neutrophils ( $35.7 \pm 1.05\%$ ) was recorded in healthy goats. But it was revealed that monocytes and neutrophils level was drastically reduced during PPR infection such as monocytes ( $2.1 \pm 0.27\%$ ) and neutrophils ( $25.9 \pm 0.62\%$ ) and the result is statistically highly significant ( $P=0.00$ ). Alternatively, during PPR infection second line of defensive cells lymphocytes count was dramatically increased  $68 \pm 0.33\%$  which is also statistically highly significant ( $P=0.00$ ).

**Table 1.** Prevalence and risk ratio of PPR in Boalkhali

Variable	Category	PPR (+ve) (n)	PPR (-ve) (n)	Prevalence (%)	Risk ratio	P-value
Age (Month)	Min-12	25	32	43.86	1.18	0.61
	13-25	17	29	36.96		
Breed	Black Bengal	30	21	58.82	2.54	0.0004
	Jamnapari	12	40	23.07		
Sex	Male	18	42	30	1.23	0.92
	Female	14	29	32.56		

Legend: +ve=Positive, -ve= Negative, Min= Minimum, n=Number of Goat

**Table 2.** Different hematological parameters of PPR infected and non-infected goats

Variable	Category	Mean±SE	95% CI	P-Value
TEC (million/cmm)	Normal	12.15±0.43	11.17-13.12	0.00
	Diseased	5.70±0.52	4.52-6.30	
TLC (thousand/cmm)	Normal	7.71± 0.51	6.54-8.87	0.15
	Diseased	6.583± 0.48	5.5- 7.66	
Hb% (gm/dl)	Normal	10.3± 0.53	9.11- 11.49	0.00
	Diseased	7.44± 0.25	6.86-8.01	
PCV (%)	Normal	30.37±1.66	26.6-34.14	0.86
	Diseased	30 ± 1.05	27.62-32.38	
ESR(mm in 1 <sup>st</sup> hour)	Normal	0	0	0.34
	Diseased	.05 ± 0.05	0.45- 0.55	
Monocyte (%)	Normal	2.9± 0.31	2.19-3.61	0
	Diseased	2.1± 0.27	1.47-2.72	
Lymphocyte (%)	Normal	60.2±1.14	57.61-62.78	0.00
	Diseased	68 ± 0.33	67.24-68.75	
Neutrophil (%)	Normal	35.7±1.05	33.31-38.08	0.00
	Diseased	25.9± 0.62	24.49-27.3	
Eosinophil (%)	Normal	4.2± 0.55	2.95-5.45	0.50
	Diseased	3.7± 0.37	2.87- 4.53	
Basophil (%)	Normal	0.5 ± 0.16	0.12- 0.88	0.44
	Diseased	0.3 ± 0.21	0.18- 0.78	
Total protein (gm/L)	Normal	7.1 ± 0.23	7.1- 0.23	0.00
	Diseased	3.15± 0.16	2.99 - 3.31	
Albumin (gm/L)	Normal	42.77±1.07	40.35- 45.18	0.00
	Diseased	16.88 ± 1.03	14.54-19.22	

The estimated granulocytes such as eosinophils and basophils was recorded  $4.2\pm 0.55\%$  and  $0.5\pm 0.16\%$  in non-infected goats but both the granulocytes level slightly reduced in PPR infected goats amounting  $3.7\pm 0.37\%$  and  $0.3\pm 0.21\%$  respectively and this variation is statistically insignificant ( $P=0.50$ ) and ( $P=0.44$ ).

In case of blood total protein and albumin it was estimated  $7.1\pm 0.23$  (gm/L) and  $42.77\pm 1.07$  (gm/L) in healthy animals but both blood protein levels were crucially decreased during PPR infection which was obtained  $3.15\pm 0.16$  (gm/L) and  $16.88\pm 1.03$  (gm/L) respectively. This variation of protein levels during infection was statistically highly significant ( $P=0.00$ ).

## DISCUSSION

The PPR is an immune deficiency disease which affects most of the organs of the body of the affected animals. In this study, all of the affected goats were found with shooting diarrhea with rise of body temperature. Affected animals appear restless, dry muco-purulent nasal discharge which gave a putrid odor in breath. Diarrhea was followed by progressive dehydration and emaciation. Body temperature of affected goats was varied in between  $104^{\circ}\text{F}$ - $107^{\circ}\text{F}$  which was the indication of infectious diseases. Temperature dropped down in the later stages of diarrhea due to emaciation and

dehydration. Since profuse diarrhea occurs during PPR infection, the affected animal shows arch back due to pain in abdomen from excessive peristaltic movement in the intestine.

The proportionate prevalence was found insignificantly ( $P>0.05$ ) higher in age group Min-12 month's (43.85%) than the age group 13 to 25 months (36.96%) of goats. This result was coincided by [Sarker and Islam \(2011\)](#), [Singh et al. \(2004\)](#). Kids over 4 months and under 1 year of age are most susceptible to the disease but in Pakistan, goat more than 12 months of age was more prevalent to PPR reported by [Zahur et al. \(2011\)](#), [Torsson et al. \(2016\)](#) and [Folitse et al. \(2017\)](#). Young animals are more susceptible might be due to malnutrition, poor immunity and poor management system and adult animal have already been infected from PPR.

Significantly ( $P<0.05$ ) higher prevalence of PPR was found in Black Bengal (58.82%) than Jamnapari (23%) goats. [Sarker and Islam \(2011\)](#) also found the similar result in Black Bengal and Jamnapari goats. Immunosuppression and irregular vaccination practice might be responsible for high susceptibility of Black Bengal goats to PPR.

PPR was more prevalent in female (32.56%) than male (30%) goats. There was no significant association

( $P>0.05$ ) between sex in the occurrence of PPR. This result is not agreed by [Sarker and Islam \(2011\)](#) and [Torsson et al. \(2017\)](#), as they found higher prevalence in male (28.52%) than female (13.04%) in Rajshahi, Bangladesh. Geographical location and variation in stocking density might be the cause of variation in the prevalence.

Total Erythrocyte Count (million/cmm) was significantly ( $P<0.05$ ) higher (11.17 - 13.12) in normal animal than the diseased animal. [Shaikat et al. \(2013\)](#) also found the similar result in healthy goats. There was significantly lower TEC in diseased animal. [Geerts et al. \(2001\)](#) supported the reduction of TEC in diseased animal. In diseased animal TEC reduce due to infection, anemia, abdominal ulcer, immune precipitation ([Durrani et al., 2006](#)).

TLC (Thousands/cmm) was insignificantly ( $P>0.05$ ) higher in healthy animal (6.54-8.87) in contrast with diseased (6.583±0.48) animal. This finding was matched with the results of [Shaikat et al. \(2013\)](#). The lower TLC in diseased animal might be attributed by physiological stress response arising from their social behavior which consists of aggressiveness and hierarchical fights. Physiological stress response is accompanied by increased lymphopenia.

Packed cell Volume (PCV%) was 26.6-34.14 in PPR negative animal and 27.62-32.38 in PPR infected animal and it was not significantly ( $P>0.05$ ) varied with diseased animal. The present finding is nearly similar to [Shaikat et al. \(2013\)](#) and [Aikhuomobhogbe and Orheruata \(2006\)](#). The PCV% remains same both in the healthy and diseased animal because the PPR might have no or less effect on the number of Red blood corpuscles (RBC).

In the present study, the Hb% was significantly lower in PPR infected animal in compared to PPR negative goats. In PPR affected goats the Hb% was similar with the findings of [Shaikat et al. \(2013\)](#), who performed the study in Black Bengal and Jamnapari goats. In case of PPR negative goats, findings were agreed by [Rice and Hall \(2007\)](#) who found 10.8-15.6% in mountain goats of Washington Cascade Range. The variation in PPR infected and non-infected goat might be due to nutritional variation and changes in immunological status. The Hb% and PCV value reflect the downturn of the TEC count ESR count was 0 mm in 1<sup>st</sup> hour in both cases ([Shaikat et al., 2013](#)).

ESR (mm in 1<sup>st</sup> hour) was 0.45-0.55 in PPR positive goats and this result was agreed by [Banik et al. \(2008\)](#) and

higher Erythrocyte sedimentation rate (mm/hr) 1.33+0.34 in controlled goats reported by ([Aye, 2013](#)). The variation might be due to nutritional variation and management of goats ([Aye, 2013](#)).

The monocyte percentage was significantly ( $P<0.05$ ) higher in PPR negative (2.19-3.61%) goats than PPR positive goats. This finding was similar with the result of [Shaikat et al. \(2013\)](#), [Aikhuomobhogbe and Orheruata \(2006\)](#) and [Rice and Hall \(2007\)](#).

In the present study, the lymphocyte percentage in PPR negative goat was 57.61-62.78% and 67.24-68.75 in PPR infected goats. The significant difference in lymphocyte percentage was coincided by [Aikhuomobhogbe and Orheruata \(2006\)](#), [Rice and Hall \(2007\)](#), [Aye \(2013\)](#) but higher than the findings of [Shaikat et al. \(2013\)](#) who found 15.2-51.2% in non-diseased goats and presence of acute and chronic infection might increase the lymphocyte percentage.

In this study, there was significant ( $P<0.05$ ) variation of the neutrophil percentage between the control and PPR infected goats which is agreed by [Aikhuomobhogbe and Orheruata \(2006\)](#) and [Rice and Hall \(2007\)](#) but it was higher than [Aye \(2013\)](#) in West African Dwarf Goats ranged 29.25+3.25. The variation may be due to presence of infection and geographical variation ([Aye, 2013](#)).

Eosinophil was insignificantly ( $P>0.05$ ) varied with the presence of PPR infection in goats. PPR infected animal contains 2.87-4.53% eosinophil where others disease affected goats contain 2.95-5.45% eosinophil, that is agreed by [Aikhuomobhogbe and Orheruata \(2006\)](#); [Rice and Hall \(2007\)](#) and [Aye \(2013\)](#).

In this study, basophil percentage was insignificantly ( $P>0.05$ ) decreased in PPR affected goats in comparison to goats infected by other diseases. as described by [Aikhuomobhogbe and Orheruata \(2006\)](#); [Rice and Hall \(2007\)](#) and [Aye \(2013\)](#).

Total protein and albumin (gm/L) were significantly ( $P<0.05$ ) lower in PPR infected goats than non PPR goats. This results contradict with [Shaikat et al. \(2013\)](#) who found 62.9-100.5 gm/L total protein and 32.5-60.1 gm/L albumin in non-diseased goats. [Aikhuomobhogbe and Orheruata \(2006\)](#) also reported lower value of total protein and albumin than ([Shaikat et al., 2013](#)). The drop in total protein and albumin might be due to anorexia when infected with PPR. Feed intake, nutritional difference, environment and hormonal factors has also

found related with total protein and albumin contents in goats ([Chineke et al., 2002](#)).

In the current study, Hb (gm%) and PCV (%) was significantly decreased in PPR affected goats which might be due to the sufferings of the animal from dehydration and anemia in diseased condition. In differential leukocyte counts, percentage of various leukocytes counts were decreased in affected goats but only increased lymphocyte counts this finding is agreed by [Rice and Hall \(2007\)](#). The value of Hb, PCV, lymphocyte, TEC and neutrophil, TP, Albumin counts were significantly differed in between PPR negative and PPR affected goats. This was because the change in immunological status of goats when affected with PPR.

## CONCLUSION

PPR is an endemic disease in Bangladesh and causes great economic losses to farmers. The prevalence and risk factors of PPR; alteration of hemato-biochemical profile in PPR affected goats is recorded in this study. Among the hematological parameters, the lymphocytes count was increased and at the same time vehement reduction of total protein as well as albumin level was revealed during PPR infection in goat. However, it is highly recommended that coordinated efforts from all the farmers as well as government with proper control program will be needed to achieve the goal of PPR-free goat in Bangladesh. In addition, availability of an efficacious vaccine will be the most important cost-effective way of simultaneously launching control measures against PPR disease.

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## CONFLICT OF INTEREST

There is no conflict of interest to declare.

## AUTHORS' CONTRIBUTION

MSB and EAR planned the study, analyzed as well as interpreted the data, and drafted the current manuscript. AZ and TD collected the data and also assisted in the

preparation of the manuscript. TH and AAM helped in preparing, drafting and correcting of this manuscript.

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