Hemato-biochemical and electrolyte alterations in a flock of goats affected with peste des petits ruminants

Peer Rayees Aziz, Shiv Kumar Sharma, Shantanu Kumar Kuldeep, Hiteshwar Singh Yadav and Naresh Kuntal

Abstract
A flock having 24 goats with the history of dullness, depression, anorexia, diarrhea, shivering, nasal discharge and matting of eyelids came in the Veterinary Clinical Complex of CVAS, Navania, Vallabh Nagar, Udaipur for treatment. Clinical examination revealed high fever (104°F - 106°F), increased respiratory rate, tachycardia, oculo-nasal discharge, dyspnea, coughing, sneezing, non-haemorrhagic diarrhoea, rough hair coat, halitosis, severe dehydration and emaciation. In one goat there was presence of corneal opacity (Unilateral) which is also an additional sign of PPR. Superficial lymph nodes were also palpable. Because of diarrhea the hind quarters were soiled with feces. Feces were checked for parasitic ova but result was negative. Diagnosis of PPR was done based on clinical signs and symptoms. Blood samples of the affected goats were collected and were examined for hemato-biochemical and electrolytes. All the values of hematological parameters such as Hb, PCV, TLC, Lymphocytes were decreased except Neutrophils which was increased. The biochemical parameters such as ALT, AST, ALKP, BUN, Creatinine and Bilirubin were increased whereas Albumin, Glucose and TP were decreased. The serum electrolytes were analysed among which Sodium and Chloride were increased whereas Potassium was decreased.

Keywords: PPR, goats, hemato, biochemical, electrolyte imbalances

Introduction
India is a vast country with a population of 137.17 million goats and 65.06 million sheep, of which Rajasthan shares 21.67 million and 9.08 million goats and sheep respectively. Goat rearing is an integral part of farming system in India. Peste des petits ruminants is a disease of small ruminants (sheep and goats). It is caused by a Morbillivirus of family Paramyxoviridae. It is a highly contagious, infectious and an economically important disease which causes high morbidity and mortality rates. Kids over 4 months and under 1 year of age are most susceptible to the disease. The World Organization for Animal Health has recently identified PPR as a serious notifiable and economically important trans-boundary 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) [9, 11, 6]. 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) [12, 26, 13]. 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) [28].

Transmission of the PPR virus in nature occurs primarily through direct contact with 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) [18, 11]. 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) [20]. 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, immunity-competence of hosts, and existing parasitic infections also jeopardize the condition (Pope et al., 2013) [21]. 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) [27].
In India, severity of the disease is more pronounced in goats than in sheep with a combined susceptible population of about 200 million and thus it is one of the major threats to the small ruminant population of the country. PPR virus has affinity for lymphoid organs contributing to marked immune-suppression as indicated by leucopenia, monocytes depletion and lymphopenia. These observations are predominant particularly during acute phase of disease (Rajak et al., 2005) [22]. To describe PPR better and to make a fast and accurate diagnosis so that accurate symptomatic and prophylactic treatment may be given, clinical, biochemical and haematological findings need to be examined (Das et al., 2015) [8].

Material and Methods
A flock having 24 goats with the history of dullness, depression, anorexia, diarrhea, shivering, nasal discharge and matting of eyelids came in the Veterinary Clinical Complex of CVAS, Navania, Vallabh nagar, Udaipur for treatment. Further clinical examination revealed high fever (104°F - 106°F), increased respiratory rate, tachycardia, tachypnoea, coughing, sneezing, non-haemorrhagic diarrhea, rough hair coat, halitosis, severe dehydration and emaciation. In one goat there was presence of corneal opacity (unilateral) which is also an additional sign of PPR. Lymph nodes were also palpable. Because of diarrhea the hind quarter was soiled with feces. Feces were check for parasitic ova but result was negative.

Collection of samples for hematology
Blood was collected aseptically from the jugular vein of each goat by adopting a standard protocol. The haematological parameters like Haemoglobin (Hb), Packed Cell Volume (PCV), Total Erythrocyte Count (TEC), Total Leucocyte Count (TLC) were estimated by Auto-analyser (IDEXX Vet Autoread) and Differential Leucocyte Count (DLC) was carried out by Wright’s staining technique. For serum biochemical analysis, blood was collected in a sterilized vacutainer from the affected goats. Serum samples were separated and all the serum samples were subjected to evaluate Total Protein, Albumin, Bilirubin, Glucose, Creatinine, Alkaline Phosphatase, Aspartate Transaminase, Alanine Transaminase, Blood Urea Nitrogen and serum electrolytes (Sodium, potassium and chloride ions) were analyzed by automatic analyzer (IDEXX Vet Test) as per standard diagnostic protocol.

Results and Discussion
The mean values of haematological and biochemical parameters in PPR affected and healthy goats are presented in the table. Present investigation showed significant decrease in values of Hemoglobin, Total Erythrocyte Count and Packed Cell Volume in the PPR affected goats as compared to healthy goats, this could be attributed to the erosion, necrosis and congestion associated with PPR, and also to the different phases of the disease, presence of secondary infections and nutritional status. Similar findings were also reported by Sahinduran et al., 2012 [23] Das et al., 2015 [8] Bari et al., 2018 [6] Begum et al., 2018 [1].

The total leucocyte count was significantly decreased in PPR affected goats as compared to healthy goats. Similar findings were also recorded by other several workers in PPR affected goats as compared with apparently healthy goats (Kataria et al., 2007, Yarim et al., 2006, Sahinduran et al., 2012, Sharma et al., 2012, Bari et al., 2018, Islam et al., 2018) [15, 31, 26, 4, 12] which was due to the lymphotropic nature of the virus and also the inhibition of peripheral blood lymphocytes proliferation by PPR virus (Maina et al., 2015) [19]. In differential leucocytes count there was decrease in lymphocyte count and corresponding increase of neutrophil count in the PPR affected animals as compared to healthy goats. Similar observations was also made by several workers (Kataria et al., 2007, Kul et al., 2007, Yarim et al., 2006, Sahinduran et al., 2012, Sharma et al., 2012, Maina et al., 2015, Balogun et al., 2017, Ugochukwu et al., 2018) [15, 16, 31, 26, 19, 3, 29]. This was due to necrosis of the lymphocytes in lymph nodes, spleen and peyer’s patches as the virus was lymphotropic like that of rinderpest virus (Scott 1981, Jones 1997) [25, 14].

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameters</th>
<th>Normal Range</th>
<th>Range in case of PPR</th>
<th>Test (PPR Cases) Value (Mean±SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hb (g/dl)</td>
<td>8-12 (10)</td>
<td>3.9-6.6</td>
<td>5.47±0.1439</td>
</tr>
<tr>
<td>2.</td>
<td>PCV (%)</td>
<td>22-38 (30)</td>
<td>15-21.03</td>
<td>17.88±0.3572</td>
</tr>
<tr>
<td>3.</td>
<td>TEC (×10^6/µL)</td>
<td>8-18 (13)</td>
<td>2.5-4.4</td>
<td>3.33±0.1144</td>
</tr>
<tr>
<td>4.</td>
<td>TLC (×10^3/µL)</td>
<td>4-13 (8.5)</td>
<td>2-3-13</td>
<td>2.51±0.1178</td>
</tr>
<tr>
<td>5.</td>
<td>Lymphocytes (×10^3/µL)</td>
<td>3-9 (6)</td>
<td>1.98-4</td>
<td>2.55±0.1397</td>
</tr>
<tr>
<td>6.</td>
<td>Neutrophils (×10^3/µL)</td>
<td>1-5 (3)</td>
<td>4-9</td>
<td>6.44±0.2248</td>
</tr>
<tr>
<td>7.</td>
<td>TP (g/dl)</td>
<td>6.4-7.0 (6.7)</td>
<td>3-6</td>
<td>4.18±0.1582</td>
</tr>
<tr>
<td>8.</td>
<td>Albumin (g/dl)</td>
<td>2.7-3.8 (3.25)</td>
<td>1-2</td>
<td>1.72±0.0895</td>
</tr>
<tr>
<td>9.</td>
<td>Bilirubin (mg/dl)</td>
<td>0-0.9 (0.45)</td>
<td>1-2.99</td>
<td>1.74±0.1222</td>
</tr>
<tr>
<td>10.</td>
<td>Glucose (mg/dl)</td>
<td>50-75 (62.5)</td>
<td>26-44</td>
<td>33.96±1.0555</td>
</tr>
</tbody>
</table>

Fig 1: Nasal discharge in an affected goat

Fig 2: Corneal opacity in an affected goat

Table 1: Hemato-biochemical and electrolyte levels in the PPR affected goats.
In biochemical study, Total Protein and Albumin level were significantly lower in PPR affected goats as compared to healthy goats which is due to nephritic damage to the glomeruli that causes increase in permeability of capillary walls of the glomerulus leading to passage of high level of protein from blood to urine. Similar findings were also recorded by others workers (Kataria et al., 2007, Das et al., 2015, Bari et al., 2018, Islam et al., 2018, Begum et al., 2018) [15, 8, 4, 12, 5].

Bilirubin was significantly higher in PPR affected goats as compared to healthy goats. Similar findings were also recorded by Yarim et al., 2006 [31] and Das et al., 2015 [8].

The high values for Blood Urea Nitrogen and Creatinine in the serum are indicative of a functional damage to the kidney. Under normal conditions, these substances are not supposed to be present in the blood at high levels, because the function of the kidneys is to excrete them through the urine. But when there is any functional defect or damage to the kidney, such as in PPR infection (possibly due to disruption of the Na⁺-K⁺ pump), these substances are found at high levels in the serum; this is in consonance with the findings of Kataria et al., 2007 [15], Sahinduran et al., 2012 [23], Sharma et al., 2012 [26], Balogun et al., 2017 [3]. An increased level of the creatinine highlight an increased tropism of the virus towards kidneys.

There was a sharp drop in the blood glucose level (hypoglycaemia), this condition occurs whenever there is a disturbance in the conversion of glycogen to glucose (glycogenolysis). The liver is normally a principal store house for glycogen, but due to the functional impairment as a result of PPR infection, hence the short fall (FAO 1999, Kataria et al., 2007, Das et al., 2015, Saliki 2015, Balogun et al., 2017, Begum et al., 2018) [10, 15, 8, 24, 3, 5].

Liver damage, as a result of PPR infection is further confirmed by an excessively high level of AST, ALT and ALKP when compared with the normal physiological values (Daramola et al., 2005, Waziri et al., 2010, Sahinduran et al., 2012, Balogun et al., 2017, Begum et al., 2018) [7, 30, 23, 3, 5], these are serum enzymes ordinarily found in the liver, but when there is damage to the liver they are found at high levels in the serum.

The low levels of potassium ions in the infected goats resulted from the dehydration arising from the symptomatic diarrhoea due to PPR infection, this will lead to metabolic acidosis as a result of the drop in pH level in the gastrointestinal tract (reason for increase in serum chloride level). This pH change will in turn stimulate a compensatory mechanism leading to respiratory alkalosis, and hence the rapid respiration for the expiration of carbon dioxide. This condition will result in an increase in blood sodium that will bind to bicarbonates to serve as buffer during PPR infection to aid in the reduction of the pH (Lewis 2016). This drop in potassium will automatically affect the Na⁺-K⁺ pump mechanism which will evidently disrupt the functionality of most of the systems (especially nervous, cardiovascular and urinary systems) (Das et al., 2015) [8].

**Conclusion**

In the present study, PPRV infection alter haemato-biochemical and electrolyte parameters in goats which is manifested as anaemia, low hematocrit value, hypoalbuminemia, hypoglycemia, lymphocytopenia, hypo proteinemia, azotemic, hypokalemia, neutrophilia, hyper bilirubinaemia, hyper chloremia, hypernatremia. Besides this high level of AST, ALT and ALKP were also evaluated. These valuable data obtained in the present study may be helpful in the diagnosis and treatment (symptomatic) of the disease. In addition to these clinical, and haematobiochemical parameters, veterinary practitioners should kept in mind for the possible occurrence of new outbreaks and for its diagnosis.

**References**


