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ORIGINAL ARTICLE

OCCURRENCE AND COMPARISON OF HEMATOLOGICAL AND SERUM BIOCHEMICAL PARAMETERS OF PESTE DES PETITS RUMINANTS' VIRUS (PPRV) INFECTED AND NON-INFECTED BREEDS OF GOATS IN NIGERIA

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Ethical considerations: When reporting experiments on animals Observation of the ARRIVE guidelines 2.0: Updated guidelines for reporting animal research, published in July 14, 2020 (https://doi.org/10.1371/journal.pbio.3000410), is applied. The authors ensure that all procedures were performed in compliance with the guidelines for animal care of their institutions or with national/international guidelines.

ABSTRACT

Peste des Petits ruminant's virus infection (PPRV) is of great economic importance in the small ruminant production industry and is recognized among the top ten diseases threatening small ruminant production and productivity globally and, most especially, in the tropics. This study investigates the occurrence of PPRV and establishes and compares hematobiochemical parameters of PPRV-infected and non-infected Nigerian goats to establish the extent of deviations of these parameters. A total of 58 goats, involving 32 healthy and 26 PPRV-infected goats manifesting clinical symptoms and confirmed with PPRV Antibody Rapid test kit, were analysed. Blood and serum samples were collected aseptically during June to August of 2024 at the Akinyele Livestock Market and the University of Ibadan Teaching and Research Farm, Ibadan, Oyo State, Nigeria. Breeds and sex were morphologically identified, and age was determined using the rostral dentition technique. Hematobiochemical analyses were done by the adoption of standard procedures. Findings revealed that crossbred goats were the breed with the highest incidence (57.1 %), while the lowest incidence was observed in West African Dwarfs (30.0 %). Also, higher incidence was observed in bucks (58.3 %) compared to does (35.3 %). There were no significant differences ($p < 0.05$) observed in all hematological and biochemical parameters, but lymphocytes and neutrophils had p-values of 0.08, respectively, when the values were compared. There was lymphocytosis, neutrophilia, hypoproteinemia, hyperglobulinemia, hypoglycemia, generalized increased liver and kidney enzymes, and an increase in the concentration of sodium and potassium ions detected in PPRV-infected goats compared to non-infected goats.

Keywords: biochemistry; goats; hematology; Nigeria; PPRV

INTRODUCTION

The rearing and production of small ruminant animals are of great global significance, as sheep and goats constitute approximately 56 % of the world's ruminant population, while producing roughly 1.5 million tons of meat and 25.6 million tons of milk [19]. The small ruminant production sector contributes significantly to the preservation of ecological systems and landscapes, aids in biodiversity conservation, and supplies products to niche markets [22]. Several issues hampered optimal production of small ruminants in Nigeria, with diseases being major challenges. One of these major, economically important clinical viral diseases is Peste des Petits Ruminants (PPR). PPR is an acute, infectious, febrile, highly contagious viral disease of small ruminants, which include sheep, goats, and wild ungulates, with a high mortality rate. The disease commonly presented with fever, mucopurulent ocular and nasal discharges, necrotizing and erosive stomatitis, severe enteritis, and pneumonia, ultimately leading to death [5].

There have been reports implicating PPR as the cause of high morbidity and mortality in small ruminants; especially with concurrent bacterial, viral, or parasitic infections, when the morbidity and mortality can be as high as 100 %. The severity and mortality tend to be higher in young animals compared to adults, with high neonatal mortality and abortion rates associated with PPR infection [1, 18].

Studies showed that of the total global population of 2.1 billion sheep and goats, about 80% of their population is at risk of PPR with a global economic loss of about US$ 1.2–1.7 billion annually [14, 21]. A whopping financial loss of about 1.5 million United States dollars (US) has been estimated as annual losses due to PPRV infection in Nigeria [9, 32]. Despite the significant losses associated with this important viral condition, especially at the smallholder, rural/communal level, where access to vaccination is very low in Nigeria. Little is known about the blood picture of PPR-infected goats vis-à-vis its comparison with the apparently healthy goats. The significance of assessment of hematological and biochemical parameters as a diagnostic, prognostic, and analytical tool for treatment options and monitoring the subsequent response to a specific treatment regimen has been previously reported [24, 25].

The examination of the blood components is essential in the investigation of several metabolites and other constituents in the body of animals, which are important in the determination of the physiological, nutritional, and pathological status of an animal [26].

Since PPR has become an endemic disease in Nigeria, with its yearly economic losses and inability to effectively control the disease through proper vaccination, treatment of the condition has become a necessity. The extent of variation in susceptibility to PPRV infection among Nigeria's indigenous goat breeds, sex, and ages has not been previously elucidated. There have been no previous data comparing the hematological and biochemical parameters of PPRV-infected and non-infected Nigerian goats. Considering the evident nearly global economic loss this disease has proven to be responsible for, there is an increasing demand for a thorough understanding of its clinical manifestations, vis-à-vis hematological and biochemical profiling of infected goats and its comparison with non-infected goats. This will guide clinicians in making appropriate diagnostic, prognostic, and therapeutic decisions when confronting PPRV cases in Nigerian indigenous goats.

This study, therefore, highlights the incidence of PPRV infection among different breeds, sexes, and ages of Nigerian goats and compares the levels of hematological and biochemical parameters in Peste des Petits ruminant's virus (PPRV)-infected and non-infected goat breeds in Nigeria.

MATERIALS AND METHODS

Study locations

The study was carried out at two locations, the Akinyele cattle market and the University of Ibadan Teaching and Research Farm, Ibadan, Oyo State, Nigeria. The Akinyele cattle market is located along the Oyo-Ibadan expressway and within longitude 30 45 (E) and 40 0 (E) and latitude 30 15 (N) and 70 30 (N) of the equators. The climatic conditions in the two locations were similar, with a high rainfall pattern (1,200–1,350 mm per year), temperatures varying between 27 °C and 32°C, and relative humidity ranging from 70 % to 90 % [23]. The vegetation pattern is typically that of a rainforest (Fig. 1).

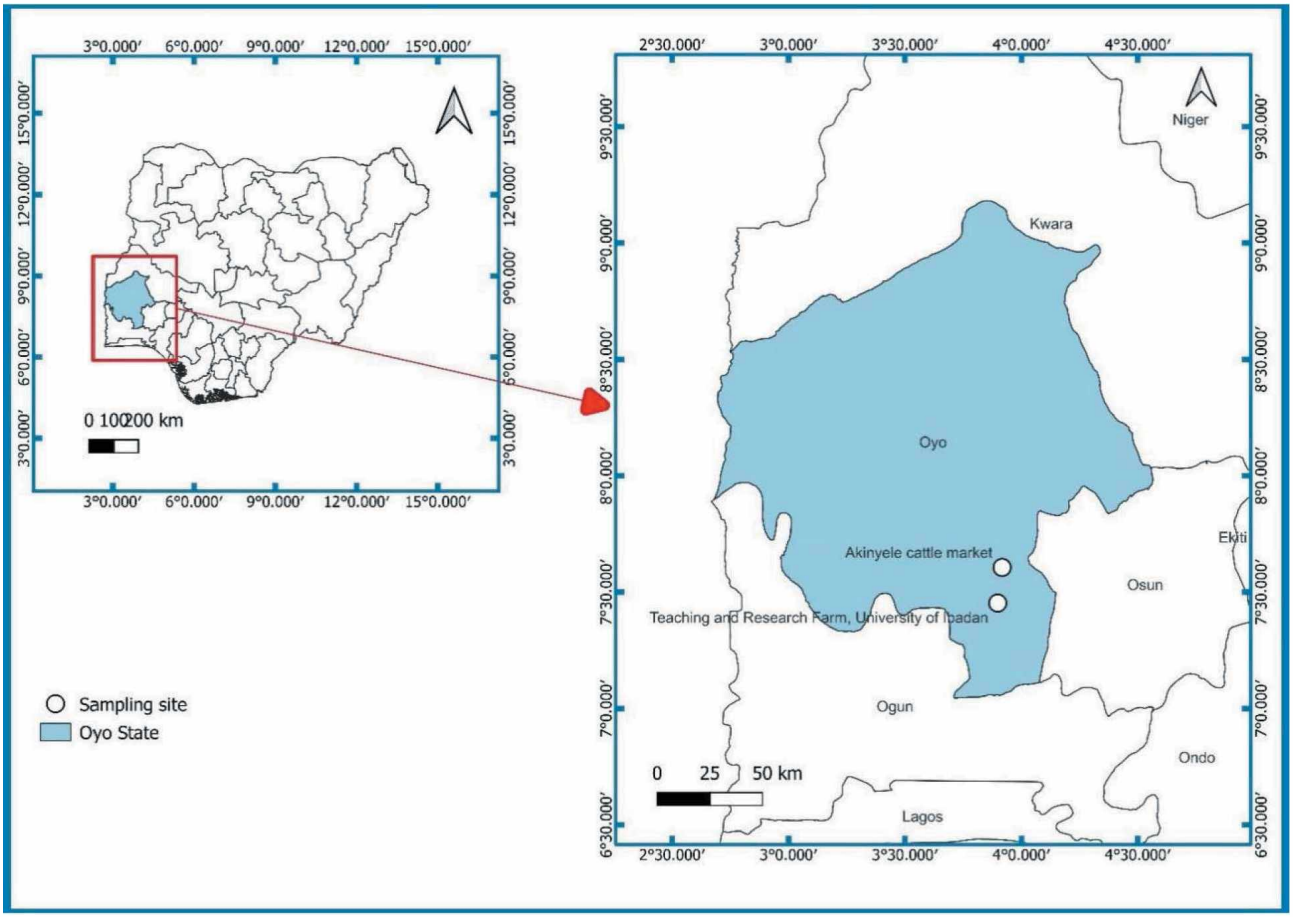

Fig. 1. Map showing the location of the study sites.

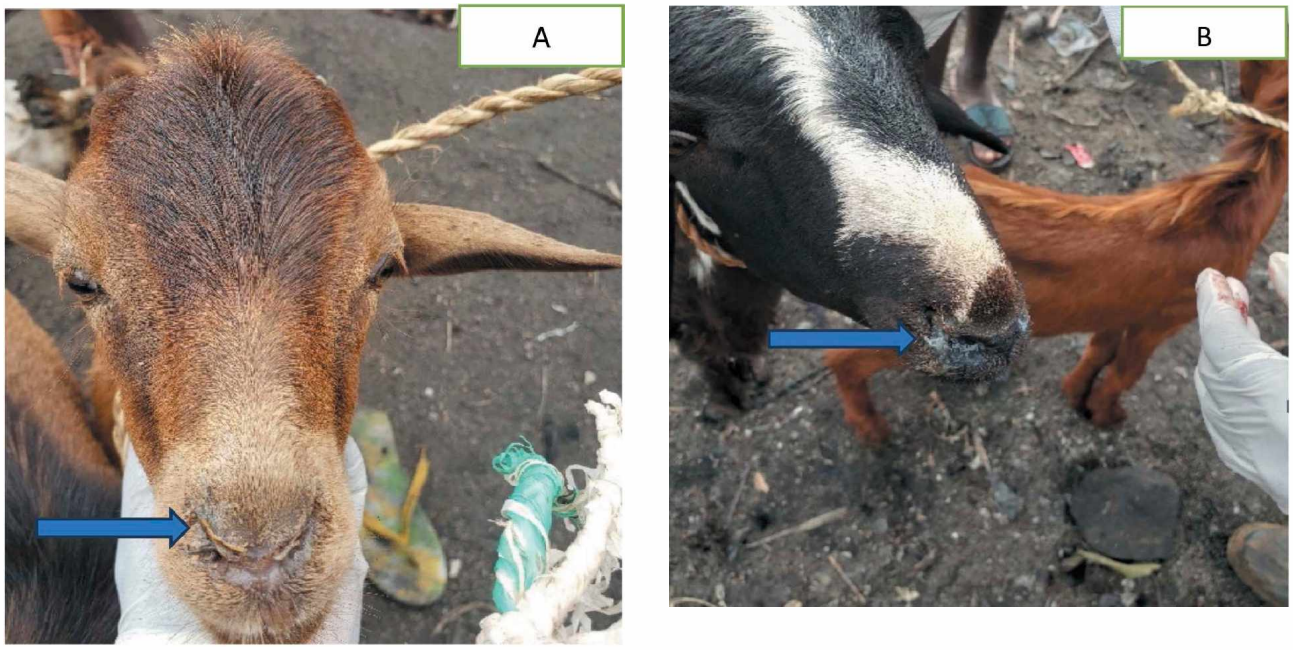

Fig. 2 A, B. PPRV infected goats with arrows showing occulo-nasal discharge.

Studied animals

Both PPRV-infected and non-infected goats were sampled during the slaughtering of goats at the abattoir beside the market, and some were sampled from the University of Ibadan Teaching and Research Farm. The breeds of goats sampled were Red Sokoto, West African Dwarf, Sahel, and crossbreed goats. Breed and sex were morphologically categorized based on their specific features and sexual organs, respectively [23]. Age was broadly classified into young (0 to 2½ years) and adult (> 2½ years) goats using dentition according to Dubie et al. [13].

A total of 58 goats were sampled, and these include 32 apparently healthy that were negative for PPRV and 26 PPRV positive goats using rapid diagnostic kit. The positive goats were manifesting clinical signs of rough hair coat, occulo-nasal discharge, respiratory distress, and diarrhea, mainly characterized by pasted vent (Fig. 2).

Sample collection

10 mls of blood was collected through jugular venipuncture from each animal using a vacutainer set and subsequently divided into 5 mls each in BD vacutainer® (clot activator tube) and BD vacutainer® (EDTA) for whole blood and serum, respectively. They were then covered and rolled gently before being placed in slanting positions inside the thermos flask containing ice packs to prevent lysing of the cells and transported to the general laboratory of the Department of Veterinary Medicine, University of Ibadan, Nigeria.

Procedure for the rapid test kit

Shenzhen Finder Biotech Co., Ltd. PPRV Antibody Rapid Test Kit was used for the confirmatory diagnosis of PPRV infection in the sampled animals. The test kits work on the principle of immunohistochemistry and capture the antibodies developed during the infection. 3 drops of whole blood from the goats collected via venipuncture were used for the kit following manufacturer's protocol.

Hematological and biochemical analyses

The hematological parameters were analyzed using standard methods such as microhematocrit, cyanomethemoglobin, hemocytometer, and others as previously adopted by Adedokun et al., Olaogun et al. and Olaogun et al. [4, 26, 27]. Biochemical parameters such as total protein, albumin, globulin, glucose, cholesterol, triglycerides, creatinine, aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, sodium, and potassium were analyzed using commercial test kits supplied by Fortress Diagnostics Limited (UK) as previously described by Charles and Adedayo, Olaogun et al. and Olawuwo et al. [10, 28, 29].

Statistical analyses

We used descriptive statistics to summarize the collected data, establish frequencies and percentages, and present them in the tables. The Student's T-test was employed to compare the mean ± SD of PPRV-infected and non-infected cattle. All statistical tests were conducted using the statistical package for social sciences (SPSS) version 26 (SPSS Inc., Chicago).

RESULTS

Out of the 58 animals sampled, 26 (44.8%) were confirmed PPRV positive and 32 (55.2%) were PPRV negative.

Table 1 gives a summary of the numbers and percentages of PPRV-infected and non-infected goats that were studied based on breed classification. Out of a total of 16 Red Sokoto goats sampled, 8 (50.0 %) were positive for PPRV, while 8 (50.0 %) were negative. Out of 20 West African Dwarf goats sampled, 6 (30.0 %) were PPRV positives, while 14 (70.0 %) were negatives for PPRV infection. Out of 8 Sahel goats sampled, 4 (50.0 %) were positive for PPRV, while 4 (50.0 %) were negative. The 14 crossbreed goats sampled revealed 8 (57.1 %) positives and 6 (42.9 %) negatives. Out of 24 bucks sampled, 14 (58.3 %) were positives and 10 (41.7 %) were negatives for PPRV. Out of a total of 34 does sampled, 12 (35.3 %) were positives, while 22 (64.7 %) were negatives for PPRV infection. Out of 26 young goats, 14 (53.8 %) were positives and 12 (46.2 %) were negatives for PPRV infection, while the 32 adult goats sampled indicated 12 (37.5 %) positives and 20 (62.5 %) negatives for PPRV infection.

Table 2 reveals the mean ± SD of the erythrogram values of the PPRV-infected and non-infected goats sampled with their P-values when statistically compared. The mean ± SD values of the erythrogram of the PPRV-infected and non-infected goats were shown as follows: packed cell volume (PCV) 28.54 ± 7.59 and 26.44 ± 6.21, respective-

Table 1. Breed, sex, and age distribution of goats sampled and their percentage of occurrence.

Parameters	Number positive/Percentage n=26	Number negative/Percentage n=32	Total/Percentage n=58
Breeds			
Red Sokoto	8/30.8	8/25.0	16/27.6
West African Dwarf	6/23.1	14/43.8	20/34.5
Sahel	4/15.4	4/12.5	8/13.8
Cross	8/30.8	6/18.8	14/24.1
Sex			
Male	14/53.8	10/31.3	24/41.4
Female	12/46.2	22/68.7	34/58.6
Age			
0 to 2½ (young)	14/53.8	12/37.5	26/44.8
Above 2½ (Adult)	12/46.2	20/62.5	32/55.2

Table 2: The mean values of the erythrogram of the PPRV-infected and non-infected goats (Mean ± SD).

Erythrocytic Parameter	Infected group n=26	Range	Non-infected group n=32	Range	P-values	Normal values Feldman et al. [15]
PCV (%)	28.54 ± 7.59	16.00–39.00	26.44 ± 6.21	15.00–35.00	0.419	22–38
Hb count(g/dl)	9.45 ± 2.50	5.20–12.90	8.69 ± 2.07	4.90–11.50	0.378	8–12
RBC count($\times 10^6/\mu L$)	17.77 ± 8.01	9.82–36.42	15.95 ± 5.80	9.04–26.02	0.484	8–18
MCV (fL)	19.19 ± 9.83	6.34–34.77	18.64 ± 7.86	10.40–31.17	0.866	16–25
MCH (pg)	6.64 ± 3.30	2.06–11.47	6.16 ± 2.58	3.38–10.24	0.595	2.20–8
MCHC (g/dL)	33.02 ± 0.86	31.67–35.60	32.77 ± 0.29	32.00–33.18	0.274	30–36

*$p < 0.05$ = statistical significance between the infected group and non-infected group. PCV = packed cell volume, Hb = Hemoglobin, RBC = Red blood cells, MCV = Mean corpuscular volume, MCH = Mean corpuscular hemoglobin, MCHC = Mean corpuscular hemoglobin concentration, NA = Not available, SD = Standard deviation

ly; hemoglobin concentration (Hb) 9.45 ± 2.50 and 8.69 ± 2.07, respectively; red blood cell count (RBC) 17.77 ± 8.01 and 15.95 ± 5.80, respectively; mean corpuscular volume (MCV) 19.19 ± 9.83 and 18.64 ± 7.86, respectively; mean concentration hemoglobin (MCH) 6.64 ± 3.30 and 6.16 ± 2.58, respectively. While the mean corpuscular hemoglobin concentration (MCHC) is 33.02 ± 0.86 and 32.77 ± 0.29, respectively. None of these parameters showed any statistical significance at $P < 0.05$ when the values were compared between PPRV-infected and non-infected goats.

Table 3 provides the summary of the mean ± SD of the leucogram of the PPR-infected and non-infected goats sampled with their respective p-values that indicated levels of significance. The mean ± SD of the leucogram values of the PPRV-infected and non-infected goats were stated as follows: White blood cell count (WBC), 7.62 ± 2.13 and 8.08 ± 2.05, respectively; lymphocyte, 68.85 ± 4.24 and 65.63 ± 5.10, respectively; neutrophil, 29.77 ± 4.19 and 32.94 ± 5.13, respectively; monocyte, 1.31 ± 0.48 and 1.44 ± 0.51, respectively; absolute lymphocyte, 5.25 ± 1.54 and 5.28 ± 1.36, respectively; absolute monocyte, 0.25 ± 0.52 and 0.22 ± 0.29, respectively; absolute neutrophil, 2.10 ± 0.88 and 2.67 ± 0.84; and platelet, 9.08 ± 1.04 and 8.75 ± 1.00, respectively.

Table 4 reveals summary of the mean ± SD of serum biochemical values of the PPRV-infected and non-infected goats sampled with their respective p-values that implied significances. The mean ± SD of the serum biochemical values of the PPRV-infected and non-infected goats were stated as follows: Total serum protein, 31.8 ± 0.59 and 32.3 ± 0.61, respectively; albumin, 11.8 ± 0.18 and 11.1 ± 0.08, respectively; globulin, 19.6 ± 0.48 and 21.2 ± 0.58, respectively; glucose, 57.33 ± 10.87 and 57.50 ± 6.56, respectively; cholesterol, 29.00 ± 9.24 and 31.38 ± 15.21, respectively; triglycerides, 39.69 ± 9.18 and 40.00±13.66, respectively; creatinine, 15.8 ± 0.45 and 14.5 ± 0.51, respectively; AST, 39.44 ± 6.86 and 38.46 ± 9.83, respectively; ALT, 29.50 ± 6.97 and 29.00 ± 8.51, respectively;

Table 3: The mean values of the total and differential leucocytic counts of the PPRV- infected and non-infected goats (Mean ± SD).

Leucocytic Parameter	Infected group n=26	Range	Non-infected group n=32	Range	P-values	Reference values Feldman et al. [15]
WBC (×10³/µL)	7.62 ± 2.13	5.20–11.60	8.08 ± 2.05	4.80–12.60	0.560	3-13
Lymphocytes (%)	68.85 ± 4.24	60.00–75.00	65.63 ± 5.10	57.00–73.00	0.080	50–70
Neutrophils (%)	29.77 ± 4.19	24.00–39.00	32.94 ± 5.13	26.00–42.00	0.084	30–48
Monocytes (%)	1.31 ± 0.48	1.00–2.00	1.44 ± 0.51	1.00–2.00	0.491	0–4
Absolute lymphocyte (%)	5.25 ± 1.54	3.12–8.47	5.28 ± 1.36	3.36–8.69	0.954	NA
Absolute monocyte (%)	0.25 ± 0.52	0.05–1.98	0.22 ± 0.29	0.06–1.18	0.846	NA
Absolute neutrophil (%)	2.10 ± 0.88	0.06–3.24	2.67 ± 0.84	1.34–4.70	0.093	NA
Platelet (x10³/L)	9.08 ± 1.04	8.00–10.00	8.75 ± 1.00	8.00–10.00	0.397	NA

*$p < 0.05$ = statistical significance between the infected group and non-infected group. WBC = White blood cells, NA = Not available, SD = Standard deviation

Table 4: Biochemical parameters of the PPRV- infected and non-infected goats (Mean ± SD).

Biochemical Parameter	Infected group n=26	Range	Non-infected group n=32	Range	P-values	Reference values. Feldman et al. [15]
Total serum protein (g/L)	31.80 ± 0.59	21.30–43.20	32.30 ± 0.61	22.00–4.21	0.843	34.9–83.5
Albumin(g/L)	11.80 ± 0.18	10.10–10.80	11.10 ± 0.08	10.00–1.25	0.174	22.3–55.1
Globulin(g/L)	19.60 ± 0.48	12.20–30.11	21.20 ± 0.58	11.90–3.10	0.436	9.9–50
Glucose (mmol/L)	57.33 ± 10.87	40.00–72.00	57.50 ± 6.56	42.00–66.00	0.960	1.3–6.8
Cholesterol (mg/dl)	29.00 ± 9.24	10.00–46.00	31.38 ± 15.21	10.00–56.00	0.607	NA
Triglycerides (mg/dl)	39.69 ± 9.18	22.00–55.00	40.00 ± 13.66	20.00–62.00	0.942	NA
Creatinine (µmol/L)	15.80 ± 0.45	10.00–20.15	14.50 ± 0.51	10.00–2.32	0.489	11.4–221
AST(U/l)	39.44 ± 6.86	26.00–52.00	38.46 ± 9.83	24.00–54.00	0.756	7.9–299
ALT(U/l)	29.50 ± 6.97	16.00–44.00	29.00 ± 8.51	18.00–44.00	0.863	2.3–49
ALP (U/l)	33.31 ± 7.09	22.00–48.00	32.69 ± 6.70	22.00–42.00	0.812	7.7–950
Sodium (mmol/L)	49.13 ± 6.37	34.00–57.00	48.31 ± 10.88	30.00–64.00	0.803	120–180
Potassium (mmol/L)	39.69 ± 7.12	25.00–48.00	38.31 ± 11.11	22.00–55.00	0.688	3.7–6.3

*$p < 0.05$ = statistical significance between the infected group and non-infected group. NA = Not available, AST = Aspartate aminotransferase, ALP = Alkaline phosphatase, ALT = Alanine aminotransferase, SD = Standard deviation. The reference interval is as referenced in F e l d m a n et al. [15]

ALP, 33.31 ± 7.09 and 32.69 ± 6.70, respectively; sodium ions, 49.13 ± 6.37 and 48.31 ± 10.88; and potassium ions, 39.69 ± 7.12 and 38.31 ± 11.11, respectively. There were no significant differences in all the biochemical parameters when comparisons were made between PPRV-infected and non-infected goats.

DISCUSSION

The distinct variation observed in hematological and biochemical parameters in PPRV-infected and non-infected Nigerian goats confirmed the importance of blood indices in assessing the general health status of animals. PPR is an important endemic disease of goats in Nigeria. The outcome of this present study becomes very germane in making therapeutic, prognostic, and diagnostic decisions about PPRV infection. This agrees with prior findings of T a m b u w a l et al. [31], who also identified that because the life of all flesh is in the blood, therefore, its role in the assessment of the health status, chemical evaluation for the survey, physiological and pathological conditions, and diagnostic and prognostic disease evaluation in animals is indisputable.

The West African Dwarf (WAD) breed of goats was observed to constitute the highest population of goats in the sampled locations. This supports the earlier observation of Y a k u b u et al. [35], who reported that WAD goats were the most widely distributed goats in Nigeria. The greater percentage of PPRV infection among crossbred goats seen in this study may be because crossbred goats were generally more prevalent in the sampled locations, and it may also be associated with the genetic characteristics or inherited

traits that may make them more susceptible compared to other breeds.

The smaller percentage of occurrence of PPRV infection among WAD goats compared to other breeds, as seen in this study, does not agree with the findings of Victor et al. [34], who reported the highest PPRV infection among WAD goats compared to other breeds. These differences may be associated with the differences in locations and period/season of the two studies. The demographic data revealed that there was a higher population of female animals than male animals, and this may be a result of the preference for the rearing of female animals by farmers for breeding and milk production. The occurrence of PPRV in Nigerian breeds of goats appeared to be higher in male goats than in female goats, as revealed by the findings in this study. This, however, contradicts the observation of Saeed et al. [30], who reported more seroprevalence among females than males. This may be due to generally higher stress in the male animals compared to female animals that can lead to immunosuppression and subsequent exposure. It may also be related to differences in breeds and locations of the two studies.

According to the demographic data, the population of adult animals sampled was higher than that of the young animals. This could be because adult animals were generally being brought to the market for sale. The observation of more PPRV cases in young animals compared to adult animals may be attributed to the fact that older animals have acquired post-exposure immunity to the infection following repeated exposure to the virus compared to naïve young goats with inadequate immune defenses, especially after the colostral antibodies have waned. This also corroborates the previous findings of more PPRV infection in young goats compared to adult goats as reported by Abubakar et al. [2].

Also, according to the results obtained, animals obtained from the open market showed a higher prevalence rate than those sampled at the farm. This agrees with the report of Victor et al. [34], who reported open markets as a major risk factor for PPRV infection in small ruminants in Benue State, Nigeria. This may be because a good number of goats obtained at the open livestock market are generally compromised in health, which owners put up for sale to minimize their loss. Another reason are animals that become infected with the disease via contact with infected animals in the market before being bought since the PPRV is transmitted via close contact with secretions and excretions of infected animals as previously described by Abu-Elzein et al. [3].

Though the PCV and Hb concentrations of the infected goats were within the normal range, they were, however, observed to be higher than that of the non-infected group. This is in tandem with the findings of Maina et al. and Ugochukwu et al. [20, 33], who also reported increased PCV and HbC in PPRV infection in goats. Hemoconcentration associated with diarrhea in the later stage of PPR infection in goats may be the cause of these increases. This also agrees with the report of another study that recorded an increase in total RBC count and Hb concentration, which may be because of diarrhea causing dehydration and polycythemia or hemoconcentration [16].

The WBC of the PPRV-infected goats is slightly lower than that of the non-infected goats as observed in this present study. This agrees with the findings of Begum et al. [7], who also reported a significant decrease in WBC in PPRV-infected goats compared to non-infected Bengal goats in Bangladesh.

The lymphocyte count of the infected goats was higher than that of the non-infected goats. This agrees with the result of Begum et al. [8], who attributed this increase to the immune reaction triggered by the PPR virus. But this disagrees with the observation of Islam et al. [16], whose report shows lymphopenia, probably attributed to necrosis of the lymphocytes in lymph nodes, spleen, and Peyer's patches, as the virus is lymphotropic, like that of the rinderpest virus.

However, the neutrophilia observed in PPRV-infected goats compared to non-infected goats as observed in this study agrees with the findings of Das et al. and Kataria and Kataria [12, 17]. This may be due to stress and viral effect and secondary bacterial superimposition.

Decreased levels of total protein and globulin in infected compared to non-infected goats, as seen in this present study, agree with the hypoproteinemia observed by Begum et al. [7] in PPRV-infected compared to non-infected goats in black Bengal goats in Bangladesh. This also corroborates with the earlier findings of Islam et al. [16], who also reported hypoproteinemia in infected goats and stated that nephritic damage to the glomeruli that results in increased permeability of capillary walls of the glomerulus leading to excretion of high levels of pro-

tein from blood to urine may be the probable reason. The relative hypoglycemia observed in PPRV-infected goats compared to non-infected goats is similar to the observation of Balogun et al. [6], who also reported reduced glucose levels in PPRV-infected goats. This could be attributed to the occurrence of diarrhea and glycogenolysis impairment, associated with the pathogenesis of PPR in general. A relatively higher levels of creatinine observed in PPRV-infected goats compared to non-infected goats may be due to the involvement of kidney dysfunction by the virus. This agrees with the observations of Begum et al. and Ugochukwu et al. [7, 33], who reported an increase in the level of creatinine in PPRV-infected goats.

Relatively higher levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (AP) observed in PPR-infected goats compared to non-infected goats may be due to the deleterious effects of PPRV on the liver. This agrees with the observation of Begum et al. [7], who reported a gradual increase in the levels of all four liver and kidney enzymes assayed for in PPRV-infected compared to non-infected goats in their experimental study.

Also, higher levels of sodium (Na) and potassium (K) ion concentrations were detected in the serum of PPRV-infected goats compared to non-infected goats. This corroborates with the observation of a significant increase in the concentration of sodium and chloride ions in PPRV-infected goats compared to non-infected goats. The probable reason had been attributed to severe diarrhea and dehydration [8, 11]. Higher potassium ion concentration in PPRV-infected goats recorded in this study compared to non-infected goats is also in agreement with the findings of Islam et al. [16], who reported higher serum potassium ion in PPRV-infected goats compared to non-infected. This may probably be linked to renal disease, which causes excessive potassium retention, or may be because of electrolyte imbalance due to diarrhoea-induced dehydration, associated with PPR in goats.

CONCLUSION

This study further confirmed the endemicity of PPRV infection in Nigerian goats using clinical symptoms and a rapid diagnostic kit. The highest incidence of PPRV was observed in crossbred goats, males, and young goats compared to other breeds, females, and adult goats, respectively. There was generalized lymphocytosis, neutrophilia, hypoproteinemia, hyperglobulinemia, hypoglycemia, generalized increased liver and kidney enzymes, and an increase in the concentration of sodium and potassium ions in PPRV-infected goats compared to non-infected goats.

Recommendation

Generalized lymphocytosis, neutrophilia, hypoproteinemia, hyperglobulinemia, hypoglycemia, generalized increased liver and kidney enzymes, and an increase in the concentration of Na^+ and K^+ ions should be considered when making treatment plans and management protocols for PPRV in goats. The endemicity of PPR in southwest Nigeria is real, and more strategic approaches should be formulated by the stakeholders to mitigate against the deleterious effect of the condition.

DATA AVAILABILITY STATEMENT

The raw data of this article will be made available by the authors, without undue reservation.

ETHICAL STATEMENT

All applicable national and institutional guidelines for the care and use of animals were duly adhered to. The study was carried out in accordance with the recommendation of the ethical standard of the University of Ibadan's Research Ethics Committee (UI-ACUREC). The protocol and procedures employed were reviewed and approved by the Ethical Standard of Research Committee (Ref. No. NHREC/UIACUREC/05/12/2022A Date: 18/11/2024).

CONFLICT OF INTEREST

None declared.

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GENERATIVE AI STATEMENT

The authors declare that no Gen AI was used in the creation of this manuscript.

AUTHORS CONTRIBUTIONS

Conceptualization: S.C.O., O.P.I., O.A.A., A.O., A.C.A., B.H.A.; Sampling and methodology: S.C.O., O.P.I., O.A.A., A.O., A.C.A., B.H.A., A.E.A.; Formal analysis: S.C.O., O.P.I., O.A.A.; Writing – original draft preparation: S.C.O.; Writing – review and editing: S.C.O., O.P.I., O.A.A., A.O., A.C.A., A.E.A., B.H.A.

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