ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

Physiohaematological observations in West African dwarf goats with Natural infection of Peste des Petits Ruminants (PPR)

Omeh, Chinenye Nkechi., Ugochukwu, Chukwuebuka Iniobong Ikenna., Ugochukwu, Emmanuel Ikenna.
Department of Veterinary Medicine, University of Nigeria, Nsukka.
iniobongugochukwu@gmail.com, emmanuel.ugochukwu@unn.edu.ng, xhuxhudvm@gmail.com

ABSTRACT
Background: Peste des petits ruminants (PPR) is a contagious viral disease of small ruminants. It is the number one killer viral disease of sheep and goats and it is endemic in Nigeria.
Aim: The aim of this study was to determine the haematological and physiological changes in experimentally infected West African Dwarf (WAD) goats in Nsukka area, Enugu State Nigeria.
Method: 20 adult WAD goats were used for this study. Blood collected into bottles without anticoagulant were used for complement ELISA and haemagglutination inhibition test while the blood collected with anticoagulant was used to carry out tests for Total white blood cell count, differential white blood count, Haemoglobin (Hb) and Packed cell volume (PCV) determination. The major physiological parameters were obtained.
Results: Haematological examination of infected animals revealed a decrease in lymphocyte, neutrophil and white blood cell counts in the goats. There was significant ($P<0.05$) and progressive increase in the packed cell volume before the infection, through the early infection to late infection. There was no significant ($P<0.05$) changes in haemoglobin concentration, percentage number of lymphocytes, neutrophils, monocytes and basophils. There was also diurnal variation in temperature, heart rates and respiratory rates. The temperature of the animals falls within the normal physiology range except in days, 15-17 post infection, when the rectal temperatures were obviously subnormal.
Conclusion: Results of this study indicated that natural infection with PPR in goats provide valuable data about haematological findings and physiological parameter changes that can be used for diagnosis of PPR and this would provide a quick reference to researchers seeking to understand the current state of knowledge about this devastating viral disease.

Keywords: Peste des petits ruminant, haematological, physiological parameters, post infection

INTRODUCTION

The West African Dwarf (WAD) goat is one of the three major breeds of goats in Nigeria and is the largest in number of the goat species in the humid rainforest zone [1]. In addition, it has greater ability to survive in tsetse fly infested rainforest areas compared to cattle [2]. However, the effect of infectious animal diseases seems as great at the start of the 21st Century as it was at the start of the 20th. In the third world countries, these diseases continue to limit productivity, constrain development and aggravate poverty [3]. Peste des petits ruminants virus is of genus morbillivirus, and the aetiologic agent. It was first described in 1942 in Cote d' Ivoire. It has also been reported from the African continental, in the Arabian penisula, certain countries of the Middle East and South Asia [4]. Sheep and goats are the natural host of PPR virus whereas goats have a greater susceptibilty than sheep [5]. In epidemic areas, morbidity rate has been estimated from 80% to 90% accompanied by mortality rate range from 50% to 80% [6].

Transmission occur by close contact, inhalation of aerosol produced by sneezing and coughing of infected animals, direct contact with ocular, nasal, oral secretions, faeces, fomites such as bedding, water and feed troughs [7]. The common clinical findings of the disease are severe pyrexia, depression, salivation, anorexia, diarrhoea, erosive or necrotic stomatitis, purulent ocular discharges, nasal discharges and ulceration of the mucous membranes [8, 9, 10]. At necropsy, Post mortem examination reveals frothy exudates in respiratory tract, congestion and partial consolidation of lungs, congested mesenteric and bronchial lymph nodes, severe congestion, haemorrhages and edema in gastro-intestinal tract [11, 12]. The aim of this study was to determine the haematological and physiological changes in experimentally infected West African Dwarf (WAD) goats.

EXPERIMENTAL DETAILS

Study area

This study was conducted in Nsukka, a town in Nsukka Local Government Area of Enugu State,

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

Nigeria. Nsukka town is the site of University of Nigeria. It shares common borders with Edem-Ani, Orba, Ede-Oballa and Obimo. Nsukka is situated at latitude 6°51'24"N and longitude 7° 23'45"E, has a total Landmass of 17.52 sq.miles (45.38km^2) and an elevation of 1,810ft (550m) above sea level.

Experimental animals

The animals used in this experiment were West African dwarf goats bought from the Orba Livestock Market, Nsukka from the local livestock rearers. A total of 20 adult (1½ and 2 year old), weighing between 7kg and 12kg were kept in the Department of Veterinary Medicine Animal house, University of Nigeria, Nsukka, allowed to stabilize and acclimatize for two days, screened and dewormed with piperazine - adipate at the dose of 100mg/kg. The animals were also treated with long - acting oxytetracycline at the dose of 10mg/kg body weight. Blood was collected from the external jugular vein into two bottles for each animal, one containing anticoagulant and the other without anticoagulant. The blood collected with bottle not containing anticoagulant, the bottle was placed in a slanting position for the blood to clot at room temperature for 1 hour. The expressed serum was centrifuged at 3000 rpm for 15 minutes to sediment the erythrocytes and clear straw coloured serum was harvested. The supernatant was collected and stored in the refrigerator to be used for complement ELISA and haemagglutination inhibition test. The blood collected with anticoagulant and was used to carry out tests for Total white blood cell count, differential white blood count, Haemoglobin (Hb) and Packed cell volume (PCV) determination.

Physiological parameters

The major physiological parameters namely temperature, pulse rate and respiratory rate were obtained using standard procedures as described by [5;13]. These physiological parameters were obtained in the mornings and evenings, throughout the course of the experiment.

Haematological studies

Blood samples (2-3 mls) were drawn from each of the experimental West African dwarf goats by jugular venepuncture after proper restraint and placed in labelled sterile bijour bottles containing 1 mg ml-1 of an anti-coagulant, ethylene diamine tetracetate (EDTA) for haematological analysis. The following indices were determined using routine laboratory methods. Packed cell volume (PCV) and Haemaglobin (Hb) were determined by the microhaematocrit and haemetin method as described by [13, 14, 15]. Erythrocytes (red blood cells) were counted using the improved Neubauer haemocytometer [15]. Leucocytes counts (WBC) were determined by method described by [17] while differential count was determined as described by [14]. The determination of haematological parameters were carried out pre infection, early infection and late infection.

Natural infection

The goats were infected by introduction of an infected animal into the pen. The animal was in close contact with the healthy ones, after 5 - 7 days the animals started showing clinical signs of PPR. This method of infection was as described by [18].

Tentative diagnosis

Tentative diagnosis was based on clinical signs and post-mortem lesions which are highly suggestive in acute and per-acute cases of PPR.

Serological diagnosis

The serological confirmation of PPR used for this investigation is mainly by c-ELISA in which about 5ml of blood was collected from each animal and emptied into a sterile universal bottle. The bottle was placed in a slanting position for the blood to clot at room temperature for 1 hour. The expressed serum was centrifuged at 3000 rpm for 15 minutes and clear straw colored serum was collected. PPR c-ELISA kit designed to detect antibodies directed against the nucleoprotein of Peste des petits ruminants (PPR) virus, developed by FAO reference laboratory (CIRAD-EMVT, Montpellier, France) was used. The test was performed according to the instructions in the manufacturer's guidelines and haemagglutination inhibition test done following the standard procedures [19].

Statistical analysis

Mean values and standard errors were calculated from the haematological data and the results were compared statistically using students' T-test assessing the mutual statistical differences. Significance was accepted at $P<0.05$.

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

Table 1. The changes in the Heart rate of West African dwarf goats exposed to natural peste des petits ruminants (PPR) infection. Results are presented as Mean ± Standard deviations.

Experimental period (Day)	Heart rate (per minute)	
	Morning	Evening
1	113.20 ±20.93	119.60 ±16.92
3	117.40 ±22.80	129.40 ±23.21
5	126.40 ±33.90	128.40 ±27.29
7	111.70 ±23.97	128.80 ±26.25
9	105.80 ±33.14	120.40 ±35.61
11	108.00 ±30.10	119.00 ±27.16
13	88.70 ±17.46	111.30 ±21.98
15	117.00 ±24.82	111.30 ±24.13
17	119.00 ±24.60	108.00 ±22.04
19	131.00 ±20.11	132.00 ±23.05
21	114.30 ±11.00	116.50 ±18.00
23	127.20 ±16.70	128.50 ±18.0
25	127.30 ±18.31	128.20 ±19.60
27	130.00 ±20.97	132.00 ±22.00
29	137.30 ±15.21	138.40 ±16.20
31	128.00 ±14.61	130.00 ±12.40

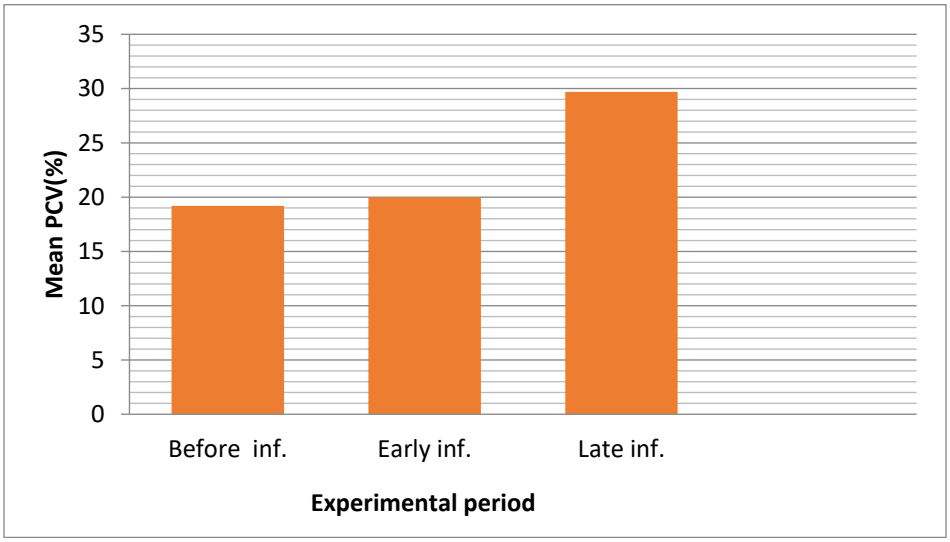

Figure 1. Changes in the mean packed cell volume of WAD goats exposed to Natural PPR infection

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

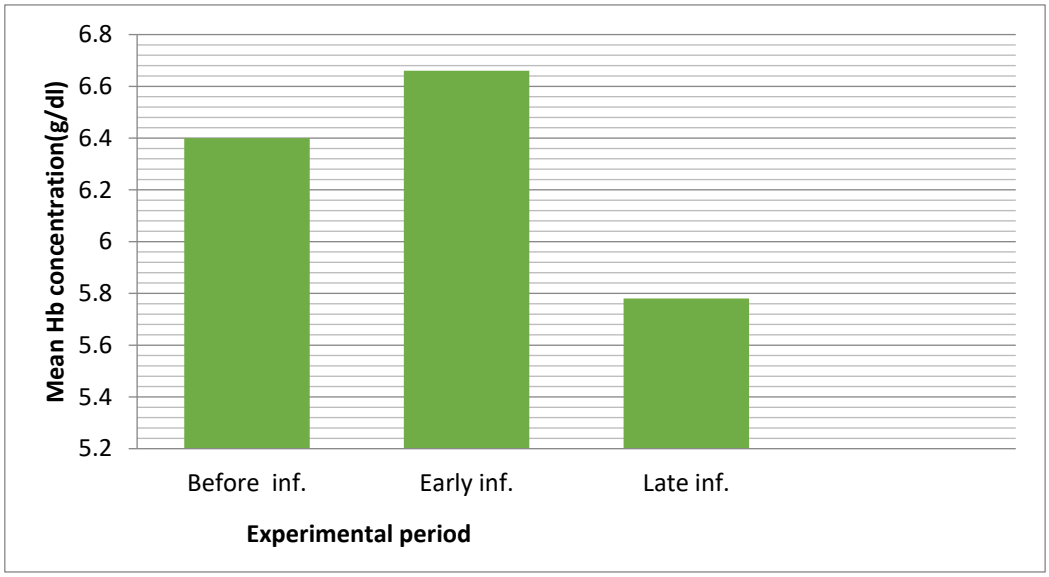

Figure 2. Changes in the mean haemoglobin concentration of WAD goats exposed to Natural PPR infection.

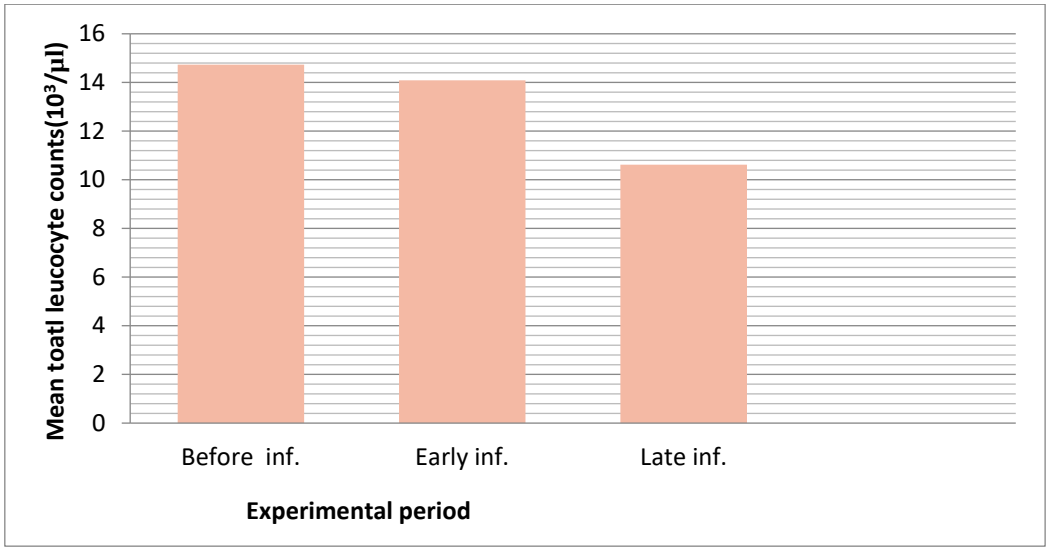

Figure 3. Changes in the mean total leucocyte count of WAD goats exposed to Natural PPR infection

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

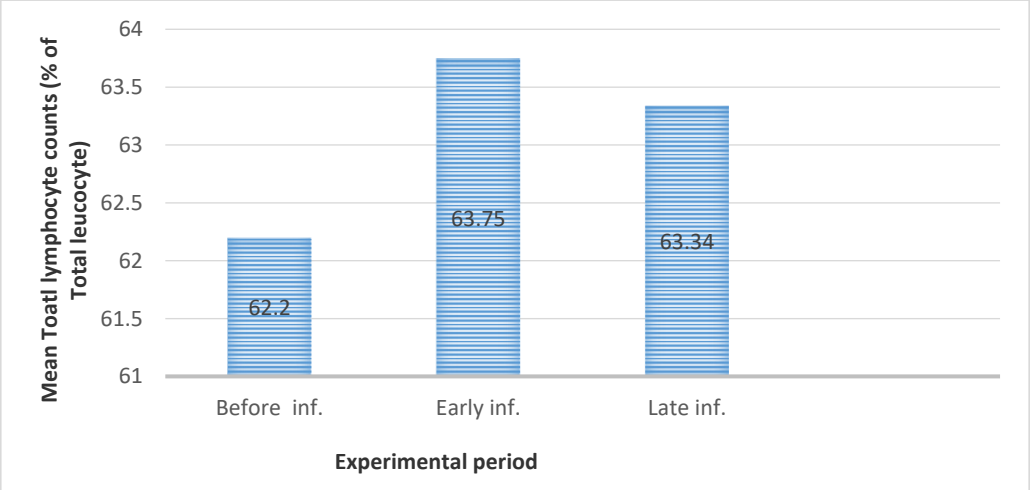

Figure 4. Changes in the mean total lymphocyte count of WAD goats exposed to Natural PPR infection

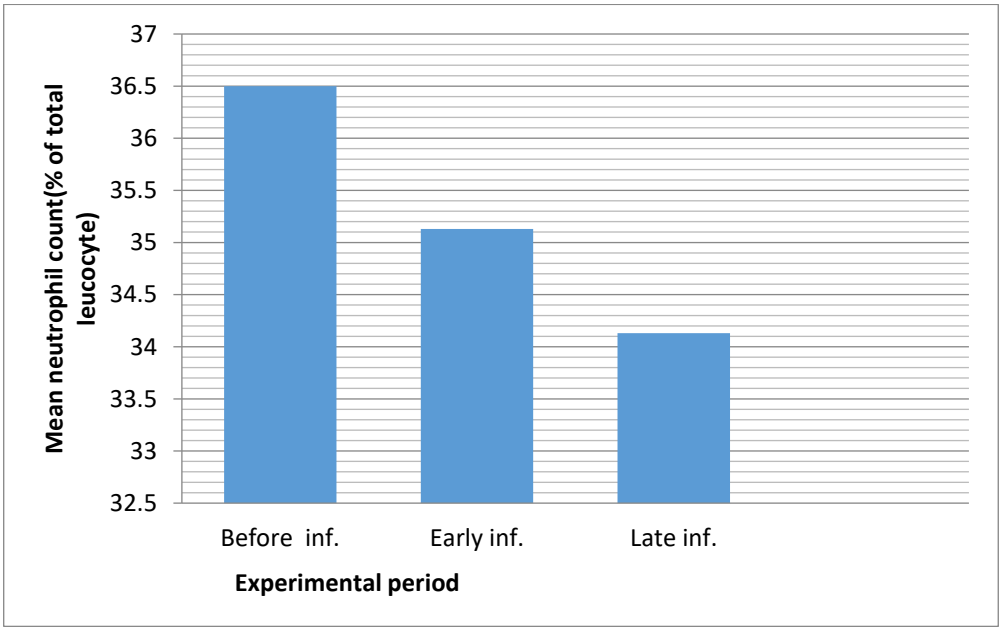

Figure 5. Changes in the mean total neutrophil count of WAD goats exposed to Natural PPR infection

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

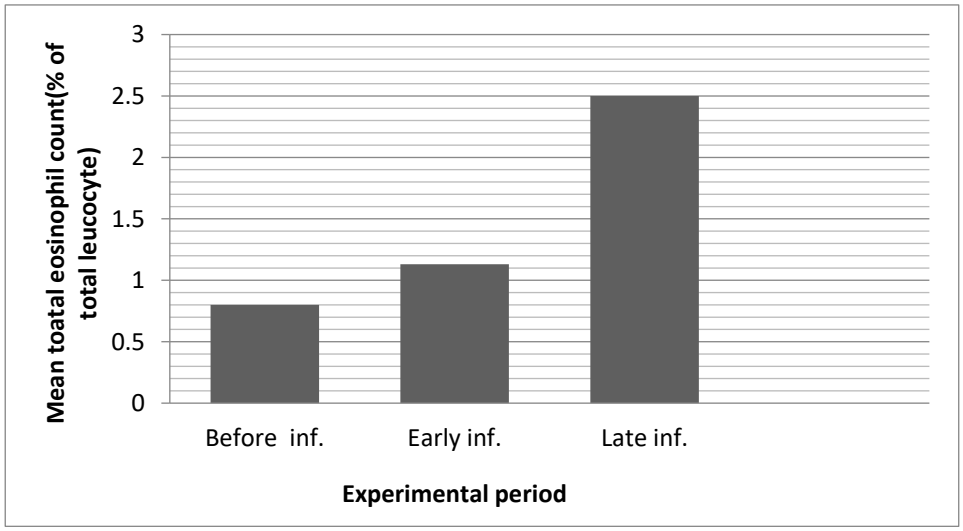

Figure 6. Changes in the mean total eosinophil count of WAD goats exposed to Natural PPR infection

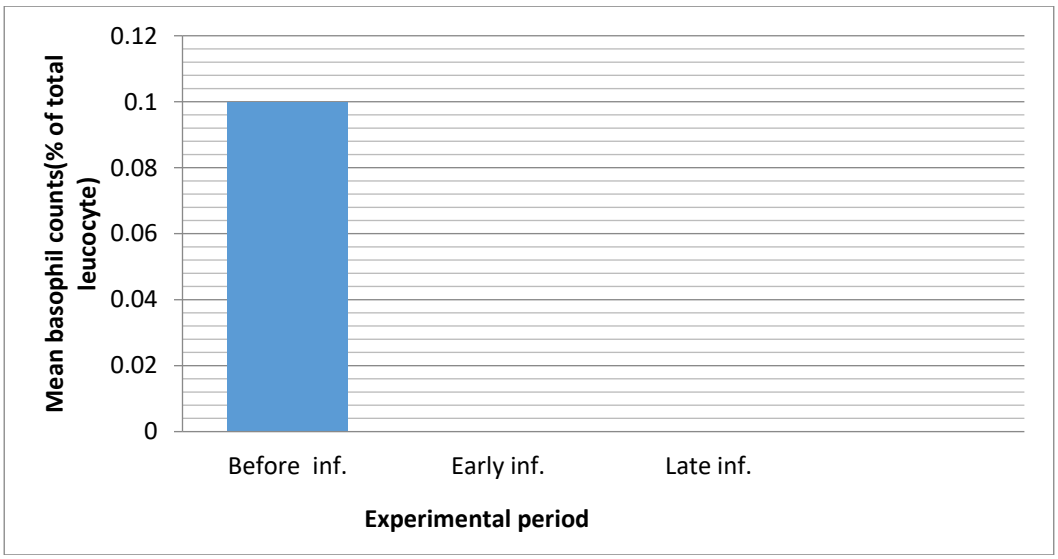

Figure 7. Changes in the mean total basophil count of WAD goats exposed to Natural PPR infection

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

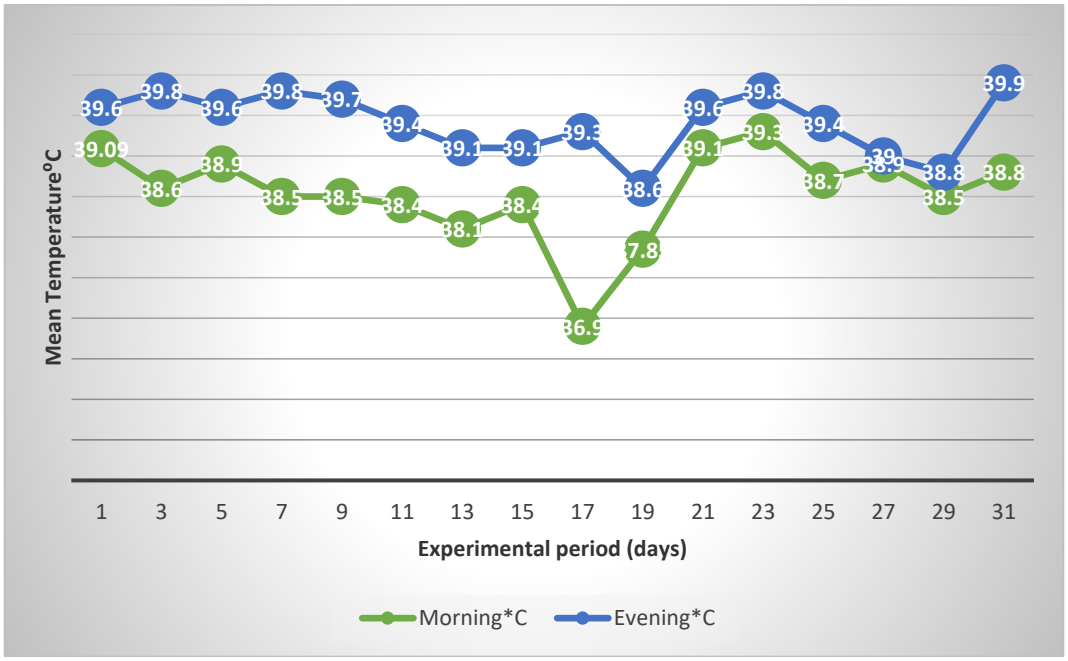

Figure 8. Trends of mean temperature changes in West African dwarf goats exposed to natural peste des petits ruminants (PPR) infection.

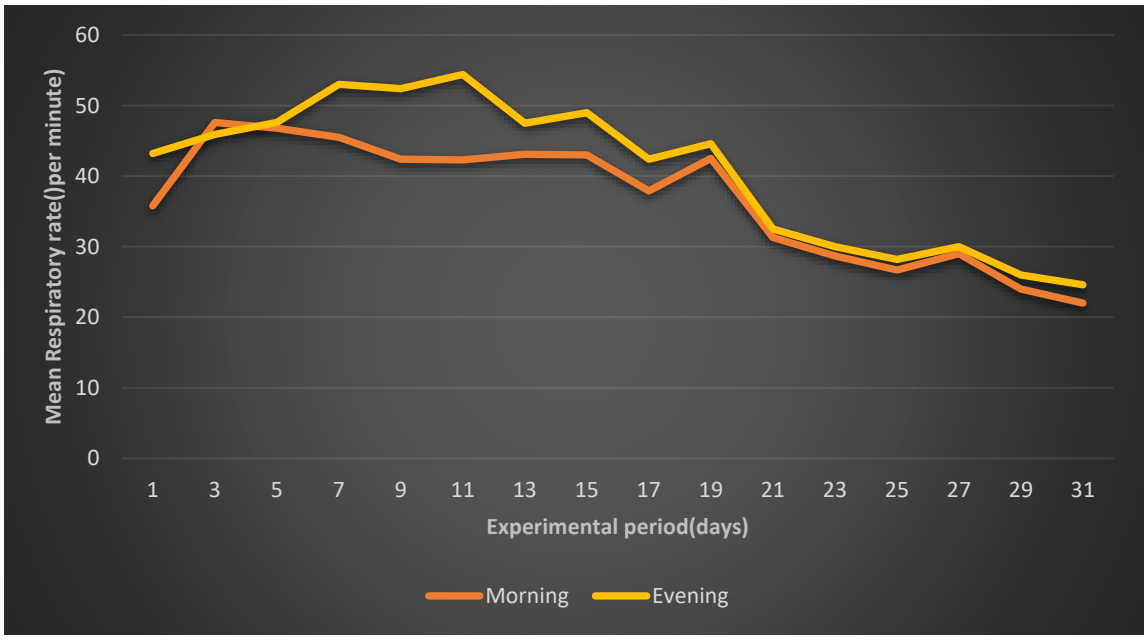

Figure 9. Trends in the changes in the mean respiratory rate of West African dwarf goats exposed to natural Peste des petits ruminants (PPR) infection.

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

RESULTS

The results of the haematological observation in West African dwarf goats with natural infection of PPR are presented in Figure 1, 2, 3, 4, 5, 6 and 7 while the morning and afternoon values of physiological parameter, Heart rate is presented in Table 1 and the trends in the changes of respiratory rates and temperature are presented in Figure 8 and 9.

There was significant and progressive increase in the packed cell volume ($P<0.05$) before the infection, through the early infection to late infection (Figure 1).There was decrease in percentage neutrophils before infection, through early infection to late infection, although this was not statistically significant ($P>0.05$). There was no significant changes in haemoglobin concentration, percentage number of lymphocytes, neutrophils, monocytes and basophils ($P>0.05$). There was also diurnal variation in temperature, heart rates and respiratory rates.

PCV value was highest during late PPR infection and lowest before infection, this could be due to severe diarrhoea leading to haemo-concentration. Although, there was no significant difference in the haemoglobin concentration, it was highest during early infection and lowest during early and late infection (Figure 2). There was reduction in the percentage number of neutrophils in early and late infection (Figure 5). There was reduction in the percentage number of eosinophils in early and late infection of PPR (Figure 6). The temperature of the animals falls within the normal physiology range except in days, 15-17 post infection when the rectal temperatures were obviously subnormal. The evening temperatures were within the normal range although higher than the morning temperatures (Figure 8).

DISCUSSIONS AND CONCLUSIONS

The pre-infection blood values obtained, showed that some goats were anaemic. This may have been due to poor nutritional condition and helminth infestation of the goats pre-experiment. The PCV values obtained when the infection was severe (late infection) was higher than that obtained before and at the early infection. This can be attributed to severe diarrhoea, dehydration and their depressive effect on the fluid portion of the blood relative to the cellular components [20]. There was decrease in the number of leucocytes even though it was not significant ($P>0.05$). This is in line with the observation made by [20, 21] and is consistent with the findings of [18] and in agreement with the observation that the aetiologic agent of Peste des petits ruminants is antigenically related to the cause of bovine rinderpest which is also associated with severe leucopenia [18, 5]. The slight increase in the number of lymphocytes during early infection was because of the task of producing antibodies and engaging in other immunological functions to enable the body resist the scourge of the disease while the lymphopenia which characterized the course of the disease, this also agrees with the findings of [20, 21, 22, 23] . Lymphopenia in this study may be in part, due to degenerative changes in the bone marrow [21]. The decrease in the number of neutrophils observed does not agree with [22] and [23] who recorded an increase, this may be because of broad spectrum antibiotics administered to eliminate secondary bacterial infection. The fall in the mean haemoglobin concentration was indicative of the possible presence of hypochromic anaemia [24].

The differences observed in hematological parameters may be due to the different phase of disease, presence of secondary infection, nutrition and dehydration degree [25, 26, 23].

Since the environmental temperature in the tropics is not only high but variable, this may have been responsible for the diurnal variation in the rectal temperature, heart rate and respiratory rate of the WAD goats naturally infected with PPR.

The high respiratory rates, may be because of pneumonia which is a constant clinic-pathological manifestation of the disease. The present study also recorded a higher heart rate and respiratory rate in PPR–positive goats than negative. This may be the results of severity of dehydration due to diarrhoea, this will give rise to compensatory physiological re-adjustment of the cardiovascular system giving rise to pathologic tachycardia and also due to the nutritional status of the PPR–positive animals. On the other hand respiratory rate might have increased in the PPR affected goats because of pneumonic condition. Similar high respiratory rate in PPR–goats was reported by [22, 5]. Increase in respiratory rate which has given rise to dyspnoea and hyperpnoea in the early and late infection, this does not agree with the findings of [18] but agrees with [27], who also recorded increase in respiratory

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

rates although they worked on a mixed infection of PPR and *Mannheimia haemolytica.*

In Conclusion, it is recommended that more work should be geared towards finding out more about the disease especially the temperature variation in the course of the disease. In addition, the haematological parameters should help in the provision of supportive evidence in diagnosis of PPR outbreaks in West African dwarf goats especially in Enugu State, Nigeria.

ACKNOWLEDGEMENT
We are grateful to Mr Ngene of the Department of Veterinary Medicine for his expert technical help and advice.

ETHICAL CONSIDERATIONS
The ethical conditions governing the use and conduct of experiments with live animals were strictly observed and the experimental protocol was approved by the University of Nigeria, Nsukka Senate committee on Medical and Research ethics.

REFERENCES

[1] Bourn D.W., Blench, W.R., Wooley E. (1994) Nigerian livestock resources survey. World Animal Review; 78(1): 49-58.

[2] Otesile E.B. (1993) Studies on West African Dwarf sheep: The influence of age of ewe and parturition interval on neonatal lamb mortality rate. Bull. Anim Hlth. Prod Africa; 41:251-55.

[3] Perry B.D., Randolph T.F., McDermott J.J., Sones K.R., Thornton P.K. (2002) Investing in Animal Health Research to Alleviate Poverty. ILRI (International Livestock Research Institute): Nairobi, Kenya.

[4] Taylor W.P., Al Busaidy S., Barrett T. (1990) The epidemiology of peste des petits ruminants in the Sultanate of Oman. Veterinary Microbiology; 22 (4): 341-52.

[5] Radostits O.M., Blood, D.C., Gay C.C., (2000) Veterinary Medicine. 9th ed., Bailliere and Tindall, London.

[6] Debnath N.C. (1995) Peste des petits ruminants (PPR); an overview proceeding of the BSVER Symposium on Eradication of Rinderpest and Related Diseases. 2nd December, 1995, Dhaka; 9-13.

[7] Ozkul A., Akea Y., Alkan F. (2002) Prevalence, distribution, and host range of peste des petits ruminants virus, Turkey. Emerg. Infect Dis.; 8 (7): 708-12.

[8] Aruni A.W., Lalitha P.S., Mohan A.C., Chitravelu P., Anbumani S.P., (1998) Histopathological study of a natural outbreak of peste des petits ruminants in goats of Tamil nadu. Small Rum. Res; 28: 233-40.

[9] Çam Y., Gençay A., Beyaz L., Atalay O., Atasever A., Özkul A., Kibar M. (2005) Peste des petits ruminants in a sheep and goat flock in Kayseri province, Turkey. Vet Record; 157: 523-24.

[10] Aytekin I. (2008) A subclinical Peste des Petits Ruminants case in a lamb. Atatürk Üniversitesi Veteriner Bilimleri Dergisi; 3: 8-10.

[11] Aiello S.E. (1998) Merck Veterinary Manual. 8th ed., Merck and Co., Inc. Whitehouse Station, N.J, U.S.A.

[12] Kumar G.S., Rathore B.S., Mehrotra M.L. (1999) Epidemiological observations on Peste-des petits ruminants in north India. Indian J. Anim. Sci; 69:365–368.

[13] Chakrabarti A. (2006) Textbook of Clinical Veterinary Medicine, 3rd Ed. Kalyani Publishers, New Delhi.

[14] Schalm O.W., Jain, N.C., Carrol E.J. (1975) Veterinary Haematology. 3rd ed., Lea and Febiger, Philadelphia.

[15] Baker F.S., Silverton R.E. (1982) Introduction to Medical Laboratory Technology. 5th Edition, Butterworth Publication, London

[16] Dacie J.V., Lewis S.M (1991) Practical haematology 7th edition. Churchill Livingston, Edinburgh, Melbourne and New York.

[17] Jain N.C. (1986) Schalm's Veterinary Haematology. 4th ed. Lea and Febiger, Philadelphia, USA

[18] Nduaka O., Ihemelandu E.C. (1975) The Control of pneumo-enteritis complex in dwarf goats of Eastern states of Nigeria by use of Chloroform-inactivated tissue vaccine. Bull. Anim. Health. Prod. Africa; 23: 341-48.

[19] Wosu L.O., Ezeibe M.C.O., (1991) Haemagglutination inhibition technique for definitive diagnosis of PPR virus specific antibody. Biomed. Letters; 46: 173 – 77.

[20] Ugochukwu E.I. (1983) Haematological Observation of Goats suffering from natural infection of pneumo-enteritis complex. Bull. Anim. Health. Prod. Africa; 31: 337-41.

ISSN: 0975 – 8704
IJBLST (2017), 9(2):8-17

[21] Obi T.U., Oduye O.O. (1985) Haematological changes in natural and experimental peste des petits ruminants virus infection in goats. Rev. Elev. Méd. vét. Pays trop; 38 (1): 11-15.

[22] Islam K., Ahad, A., Altaf, M., Mizanur R., Islam Z., Md. Hazzaz B.K., Mukti B., Chowdhury S., K.N. Muhammad K.N., Paritosh K.B. (2014) Prevalence and Clinico–Pathological Features of Peste des Petits Ruminants in Different Breeds of Goats and their Response to Antimicrobials. J Inf. Mol. Biol; 2 (3): 43 – 8.

[23] Maina S.M., Gitao, C.G., Gathumbi P.K. (2015). Hematological, serological and virological findings in sheep and goats experimentally infected with lineage III peste des petits ruminants virus isolates in Kenya. J. Exp. Bio. Agric. Sci; 81-8.

[24] Igwebuike M.U., Ugochukwu E.I. (1997) Haemogram of West African dwarf sheep suffering from Natural clinical PPR. Bull. Anim. Health. Prod. Africa; 45:51-3.

[25] Heaney J., Barrett, T., Cosby S.L. (2002) Inhibition of in vitro leukocyte proliferation by morbilliviruses. Journal of Virology; 76: 3579-84.

[26] Kataria A.K., Kataria N., Gahlot A.K. (2007) Large scale outbreaks of Peste des petits ruminants in sheep and goats in Thar desert of India. Slovenian Vet. Res; 44: 123-32.

[27] Emikpe B.O., Akpavie S.O. (2012). Clinicopathological observations in experimental Peste Des Petit Ruminants virus and *Mannheimia Haemolytica* A:2 co-infection in goats. Niger. J. Physiol. .Sci;27:129–136.