

Haematological changes in natural and experimental peste des petits ruminants virus infection in goats

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RÉSUMÉ

OBI (T. U.), ODUYE (O. O.). — Modifications hématologiques chez les chèvres d'infections naturelles ou expérimentales avec le virus de la peste des petits ruminants. *Rev. Elev. Méd. vét. Pays trop.*, 1985, 38 (1) : 11-15.

Cette étude porte sur les modifications hématologiques rencontrées chez les chèvres au cours d'infections à virus PPR tant naturelles qu'expérimentales. Les résultats obtenus montrent que le virus induit une leucopénie caractérisée par une lymphopénie, une éosinopénie et une monocytose. Le degré de la lymphopénie semblait dépendant de la gravité de la maladie clinique. Les auteurs suggèrent que la lymphopénie et l'éosinopénie sont peut-être consécutives à une destruction massive des lymphocytes et des processus dégénératifs de la moelle osseuse dus tant au virus qu'aux effets possibles de l'augmentation dans le sang du taux de gluco-corticoïdes, augmentation sous la médiation de l'adrénaline et liée au stress de la diarrhée.

Mots clés : Chèvre - Peste des petits ruminants - Virus - Infection naturelle - Infection expérimentale - Modifications hématologiques.

SUMMARY

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The haematological changes in both natural and experimental peste des petits ruminants virus infection in goats were investigated. Results obtained showed that the virus induced a leucopenia which was characterized by lymphopenia, eosinopenia and monocytosis. The degree of lymphopenia seemed to depend on the severity of the clinical disease. It is suggested that the lymphopenia and eosinopenia may be due to massive destruction of lymphocytes and degenerative changes in the bone marrow caused by the virus as well as the possible effects of adrenaline-mediated increased blood glucocorticoid level due to the stress of severe diarrhoea.

Key words : Goat - Peste des petits ruminants - Virus - Natural infection - Experimental infection - Haematological changes - Nigeria.

INTRODUCTION

Peste des petits ruminants (PPR) is one of the most important health problems encountered in small ruminants in many parts of West Africa. Various workers have reported on the aetiology, clinical features as well as the epidemiology of the disease 3, 7, 8, 9, 10, 14, 15. Most of these investigations excluded the haematological changes that accompany PPR virus infection. However, WHITNEY *et al.* (15) remarked that leucopenia developed one day after the onset of fever while subsequent report indicated a leucopenia in only 50 p. 100

and neutropenia in 90 p. 100 of ten PPR virus infected goats (8).

The present study was therefore carried out to investigate the changes in the blood picture of goats in natural and experimental PPR virus infection.

MATERIALS AND METHODS

Natural PPR virus infection

Forty-two goats which were presented with clinical signs of PPR during a field outbreak of the disease in Ibadan, Nigeria, were used

for this study. About 2 ml of blood were collected from each animal by jugular venipuncture into bijoux bottles containing ethylenediamine-tetra-acetic acid (E.D.T.A.). On the first day each animal was presented to the Large Animal Clinic of the University of Ibadan Veterinary Teaching hospital.

The packed cell volume (P.C.V.) was determined by the microhaematocrit method while the haemoglobin values (Hb) were estimated by haemolysing 0.05 ml of blood in 9.0 ml of 0.05 p. 100 ammonium hydroxide solution. The samples were then read on an E.E.L. portable colorimeter (Evans Electro Selenium, Limited, U. K.) using a 632 green filter. Red blood cell counts (R.B.C.) were done the microscopic method using a haemocytometer while the total leucocyte estimation (W.B.C.) was done by diluting the blood with 2 p. 100 acetic acid in ethyl alcohol and counting was done in the improved Neubauer haemocytometer chamber. Differential leucocyte counts were determined from Giemsa-stained blood smears.

Experimental PPR virus infection

Seven West African Dwarf goats aged about 18 months old were used to study the haematological changes in experimental PPR virus infection. The goats were dewormed with Panacur^(R) (Hoechst, A.G., Frankfurt, Germany) at the rate of 7.5 mg/kg body weight on the day of purchase. The goats were screened and shown to be free of blood parasites by stained blood smear examination. The animals were housed in concrete pens in an insect-proof experimental animal house and fed *ad lib.* on cut forage supplemented by a maize-based concentrate ration. Water was allowed *ad lib.* After a three week quarantine period, five of the goats were each inoculated with $5 \times 10^{4.4}$ T.C.I.D.₅₀/ml of Vero cell adapted PPR virus (N.I.G. 75/1,¹⁴) subcutaneously. The other two control goats, each received 5 ml of uninfected Vero cell suspension in Eagle's medium by the same route.

Blood was collected from all the infected and control goats into heparinized vacutainer tubes (Becton-Dickinson, France) by jugular venipuncture before infection and then on days 5 and 9 after inoculation when the inoculated goats were showing overt clinical signs of PPR disease. The haematological values were determined according to the methods described under natural PPR virus infection.

The haematological results were analysed by the Student « T » test.

RESULTS

Natural PPR virus infection

The haematological picture in natural PPR virus infection is shown in table I. The mean packed cell volume (P.C.V.) was 30.2 ± 1.3 , the mean haemoglobin concentration (Hb) was 7.9 ± 0.3 gm p. 100 while the red blood cell count (R.B.C.) was $11.9 \pm 0.5 \times 10^6$. The mean total white blood cell count (W.C.B.) was 9.814 ± 592 (range 3.200 to 18.050) while differential W.B.C. counts showed that the mean neutrophil count was 5.319 ± 443 (range 2.352 to 13.538), eosinophil, 118 ± 42 (range 0 to 1.071). The mean lymphocyte count was 3.868 ± 228 (range 1.008 to 6.950) and the mean monocyte count, 503 ± 41 (range 89 to 1.071). Analysis of the haematological values of fifteen goats which had severe clinical PPR disease and died and 27 goats which survived PPR virus infection showed that the red cell values of both groups were essentially similar. On the other hand, the mean total WBC count of the dead goats was 8.983 ± 1.138 while that of the survivors was 10.278 ± 671 . The neutrophil counts of both groups were essentially similar i.e. 5.428 ± 916 (dead goats) and 5.258 ± 479 (survivors). In contrast, the mean lymphocyte count of the dead goats (2.967 ± 309) was significantly lower (p. 0.05) than that of the surviving goats (4.372 ± 267).

Experimental PPR virus infection

The haematological values of the infected and uninfected control goats are summarized in table II. There were no significant changes in both the P.C.V. and Hb values of the infected goats before and after infection. Conversely, the mean total W.B.C. count fell from a pre-infection value of 13.326 ± 861 to 10.780 ± 655 on day 5 and 11.052 ± 937 on day 9 post-infection. The observed differences in the mean total W.B.C. count were statistically significant by the « t » test (p. 0.02). Although the mean neutrophil count dropped from 6.915 ± 835 to 5.705 ± 614 on day 5 and 6.367 ± 1221 on day 9 post-infection, the differences were not statistically significant.

TABLE N° I - The mean haematological values of dwarf goats naturally infected with the PPR virus

	PCV (p.100)	Hb.gm (p.100)	RBC x 10 ⁶	Total WBC	Neutrophil	Eosinophil	Lymphocyte	Monocyte
PPR goats (42)*	30.2 ± 1.3**	7.9 ± 0.3	11.9 ± 0.5	9815 ± 592	5319 ± 443	118 ± 42	3868 ± 228	503 ± 41
PPR-infected Dead goats (15)	30.9 ± 1.8	8.3 ± 0.4	12.1 ± 0.6	8983 ± 1138	5428 ± 916	136 ± 90	2967 ± 309	447 ± 73
PPR-Infected Surviving goats (27)	29.8 ± 1.8	7.9 ± 0.3	11.8 ± 0.6	10278 ± 671	5258 ± 479	108 ± 43	4372 ± 267	540 ± 48
Normal goats ¹¹ (85)	26.1 ± 0.4	8.6 ± 0.1	12.3 ± 0.3	16098 ± 49.0	7534 ± 189	757 ± 79	7566 ± 203	145 ± 16

* Number of animals used for the study. ** ± standard error of mean.

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TABLE N° II - The mean haematological values of dwarf goats experimentally infected with the PPR virus and uninfected control goats

Day post infection	PCV (p.100)	RBC x 10 ⁶	Total WBC	Neutrophil	Eosinophil	Lymphocyte	Monocyte	
0	Infected	27.6 ± 0.9	10.8 ± 0.2	13326 ± 861	6915 ± 835	341 ± 145	5935 ± 319	135 ± 87
	Control	29 ± 1.0	11.0 ± 0.2	14000 ± 900	6913 ± 192	354 ± 49	6552 ± 712	182 ± 52
5	Infected	28 ± 0.8	10.8 ± 0.3	10780 ± 655	5705 ± 614	148 ± 79	4495 ± 475	379 ± 103
	Control	29 ± 2.0	11.0 ± 0.3	14675 ± 2275	7390 ± 1934	147 ± 23	6366 ± 414	173 ± 95
9	Infected	29.2 ± 1.2	10.8 ± 0.3	11052 ± 937	6367 ± 1221	21 ± 21	4262 ± 403	400 ± 60
	Control	28 ± 2.0	10.8 ± 0.2	14975 ± 1975	8132 ± 1361	153 ± 153	6337 ± 614	355 ± 155

± Standard error of mean.

In contrast, the mean eosinophil count fell from a pre-infection value of 341 ± 145 to 148 ± 79 on day 5 and 21 ± 21 on day 9 post-infection. Similarly, the mean lymphocyte count dropped from 5.935 ± 319 to 4.495 ± 475 and 4.262 ± 403 on days 5 and 9 post-infection respectively. The mean monocyte count increased from 135 ± 87 to 379 ± 103 and 400 ± 60 . The drop in the mean lymphocyte and eosinophil counts was highly significant (p 0.01) and so was the increase in the mean monocyte count (p 0.02).

When the haematological values of the infected were compared to those of the control goats, there were significant differences between the total W.B.C., the mean neutrophil, lymphocyte, eosinophil and monocyte values of the two groups. Although there was an increase in the mean monocyte count and a decrease in the eosinophil count of the control goats during the period, these differences were not statistically significant.

DISCUSSION

Studies on the haematological changes in natural and experimental PPR virus infection showed that the virus induces a leucopenia which consists essentially of lymphopenia, eosinopenia and slight monocytosis. Leucopenia has been reported in PPR virus infection (8). These workers reported that leucopenia developed a day after the onset of fever and persisted for 10 days. The rinderpest virus, a virus that is closely related to the PPR virus, is known to induce an initial mild leucocytosis which is quickly replaced by a leucopenia characterized by lymphopenia and eosinopenia (6, 12).

Although the pathogenesis of PPR virus infection is scarcely documented, it is unlikely to differ from that of bovine rinderpest. In rinderpest, following infection by the nasopharyngeal route, the virus passes through the mucosa of the upper respiratory tract to its associated lymph nodes. Dissemination of the virus occurs through the lymphatic vessels and

also haematogenously with the virus firmly attached to the leucocytes (6, 13). During the phase of multiplication in the various tissues, there is massive destruction of lymphocytes. The lymphopenia seen in rinderpest virus infection results from this destruction of lymphocytes (1). It is very likely that this mechanism accounts partly for the lymphopenia observed in PPR virus infection.

In addition, gelatinous degenerative changes in the bone marrow has been reported at necropsy in rinderpest virus infection (13). Although in adult animals, peripheral lymphoid tissues, associated with the gastrointestinal tract, are responsible for majority of the lymphocytes, lymphopoiesis also occurs in the bone marrow (2). The lymphopenia seen in rinderpest and possibly in PPR virus infections may also be partly due to the degenerative changes in the bone marrow.

It is known that in diarrhoeas, like colibacillosis, the plasma corticoid levels are increased due to the stress (4, 5). One of the features of PPR virus infection is severe enteritis. It may well be that the stress of diarrhoea in PPR virus infection may lead to adrenaline release, followed by an increase in the blood glucocorticoid level. This increased glucocorticoid level may modify leucocyte regulation leading to eosinopenia and lymphopenia. The monocytosis is consistent with changes associated with inflammatory disease with tissue destruction.

The haematological values, obtained with the goats that were naturally affected with PPR virus, are higher than those reported previously (8). These workers in fact observed leucopenia in only 50 p. 100 of the ten goats they examined. In the present study, 42 infected goats were examined and almost all the goats showed leucopenia.

The differences in the white blood cell counts of the dead and the surviving goats, were significant. The goats that died, showed more marked lymphopenia and less monocytosis than the survivors. It seems therefore that in PPR virus infection, the degree of lymphopenia may be related to the severity of the disease.

RESUMEN

OBI (T. U.), ODUYE (O. O.). — Modificaciones hematológicas en las cabras durante enfermedades naturales o experimentales con el virus de la peste de los pequeños ruminantes. *Rev. Elev. Méd. vét. Pays trop.*, 1985, 38 (1) : 11-15.

Este estudio trata de las modificaciones hematológicas observadas en las cabras durante enfermedades con virus PPR tanto naturales como experimentales. Los resultados obtenidos muestran que el virus produce una leucopenia caracterizada por una linfopenia, una eosinopenia y

una monocitosis. El nivel de la linfopenia parecía dependiente de la gravedad de la enfermedad clínica. Los autores sugieren que la linfopenia y la eosinopenia están acaso consecutivas a una destrucción masiva de los linfocitos y a procesos degenerativos de la medula osea debidos tanto al virus como a los efectos del increcimiento en la sangre de

la tasa de los glucocorticoides, aumentación bajo la mediación de la adrenalina y relacionada al stress de la diarrea.

Palabras claves: Cabra - Peste de los pequeños rumiantes - Virus - Infección natural - Infección experimental - Modificaciones de la sangre - Nigeria.

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