

The effect of goat coccidiosis on certain blood components

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RÉSUMÉ

Effet de la coccidiose sur certaines composantes sanguines chez la chèvre

L'étude hématologique chez les chèvres atteintes de coccidiose montre un net abaissement du taux des érythrocytes et du volume de l'hémoglobine, également suivi d'un accroissement tant de l'hématocrite que du volume corpusculaire moyen des globules rouges. Il existe une nette éosinophilie avec une augmentation importante des éosinophiles et une augmentation moins marquée des lymphocytes et des monocytes. L'étude des protéines sériques montre leur accroissement tant dans le sérum que dans sa fraction albumine qui se maintient à un niveau constant à partir du 2^e jour après l'infection jusqu'à la fin des observations.

L'analyse des composants minéraux du sérum a montré une augmentation considérable du potassium, avec abaissements sensibles des taux de sodium et de phosphore, probablement dus à la déshydratation ainsi qu'à l'incapacité de l'épithélium intestinal à absorber ces minéraux à la suite de lésions locales dues à la présence de mérozoites coccidiens.

INTRODUCTION

The vascular system and its components are not known to be directly affected in caprine coccidiosis. However, alterations in the composition of the blood and changes in the blood vessels may be induced as a result of intestinal infection which certainly has its effects on other body systems. Haematological studies were done chiefly in fowl coccidiosis and to some extent on bovine coccidiosis, but very little was known in ovine, and caprine coccidiosis. The purpose of this study is to determine the blood picture in coccidia infection in goats including such parameters as haemoglobin concentration, packed cell volume, red and white cells count and differential count.

Total serum protein and albumin content as well as mineral analysis is attempted.

MATERIAL AND METHODS

4 male goats 1-2 months old were experimentally infected with 240 000 oocysts of *Eimeria*

arloingi over three successive days at an oral dose level of 80 000 oocysts per day to each of them. Other 4 male goats were left noninfected as controls. All animals were kept in clean disinfected pens within the premises of the central Veterinary Research Laboratories at Soba, Khartoum. The infected and the noninfected animals were kept away from each other and they were fed green lucern and sorghum hay and made to drink clean tap water. Blood samples were withdrawn from the jugular veins before and after infection. Blood samples after infection were withdrawn every two days, over a period of 18 days. Whenever blood samples were taken they were divided into two. One was allowed to clot prior to serum collection while the other sample was taken in test tubes containing EDTA as anticoagulant. The latter fraction was used for the determination of haemoglobin concentration using cyanmethaemoglobin method by a haemoglobin meter (Evans Electroselectium LTD). The packed cell volume (PCV) was determined using the microhaematocrit centrifuge, while the red blood cells

TABLE I—Average haematological data of goats experimentally infected with *E. arloingi*

	Hb gm/100	PCV	MCV	MCH	RBC 10 ⁶	WBC 10 ³	Differential Leucocytic count				
							Neut.	Lymph.	Eos.	Baso.	Mono.
Average values before infection	11	23	15	7.2	15.15	5	40.1	59.2	0.5	0.1	0.6
Average experimental values in 2 days	7.8	24.1	19.8	6.4	12.15	6.48	35.8	58.5	3.0	0.1	2.6
" " " " 4 "	7.8	24.4	20.1	6.4	12.11	6.46	33	63.3	3.0	0.0	0.7
" " " " 6 "	8.1	26.5	20.1	6.1	13.15	6.53	34.2	63.3	2.0	0.0	0.5
" " " " 8 "	8.1	29.7	20.3	5.5	14.60	6.58	29.3	67.1	1.6	0.0	2.0
" " " " 10 "	8.1	28.7	23.2	6.5	12.38	6.67	29.7	66.7	2	0.0	1.6
" " " " 12 "	8.1	28.8	21.8	6.1	13.21	6.51	28.9	66.3	3.3	0.0	1
" " " " 14 "	8.1	31.67	27.9	7.1	11.35	7.67	24.6	70.3	4.1	0.0	1
" " " " 16 "	9.2	38.0	28.3	7.0	13.41	8.08	31.1	62.9	4.6	0.0	2
" " " " 18 "	9.1	38.1	28.6	6.8	13.30	8.10	31.2	59.8	6.0	1	2

and the white blood cells counts were determined using improved Neubauer haemocytometer. Differential leucocytic count was estimated by classifying 100 cells on blood smears stained by Giemsa's staining method.

The sera collected from both infected and noninfected groups were analysed for total protein by Biuret method and albumin by Bromocresol green method. Inorganic phosphorous was determined according to Fiske and Subbarow method while calcium was determined by precipitation technique according to Trinder (1960). Sodium and potassium were determined by flame photometry.

RESULTS

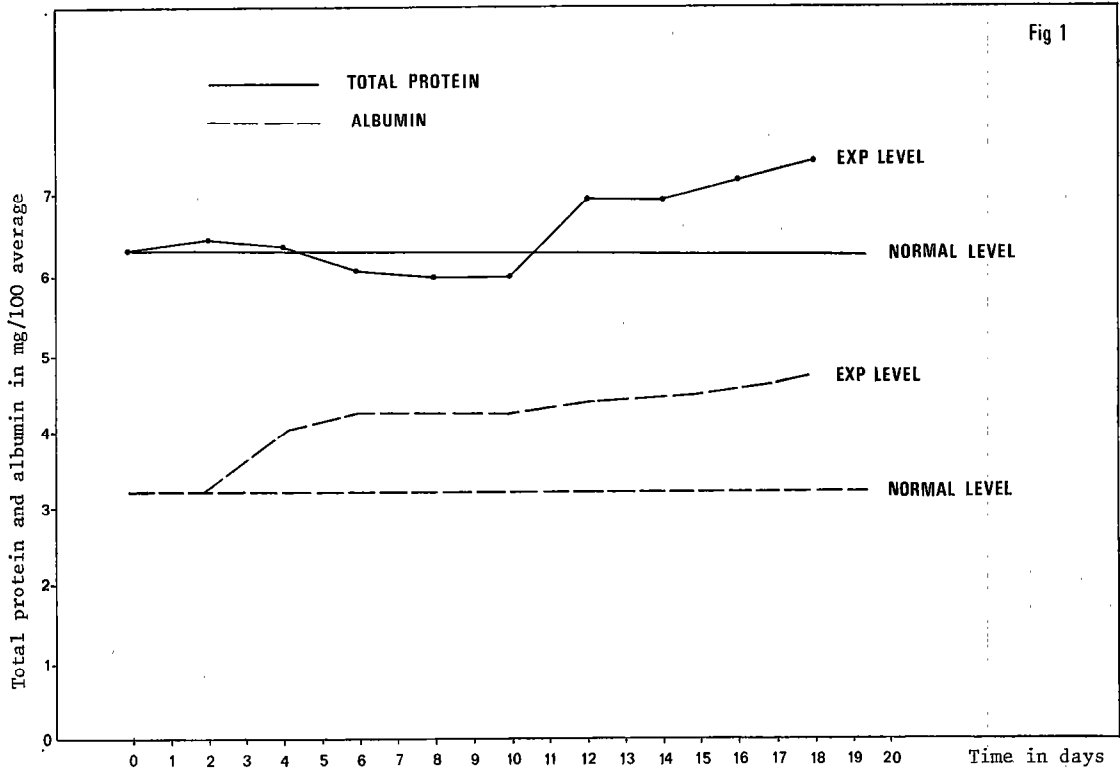
The results of the experiment are summarized in tables I and II and figures 1 and 2. The haemo-

globin content decreased from 11 gm/100 ml before infection to as low as 6 gm/100 ml in the first 4 days after the onset of symptoms with the average value of 7.8 gm/100 ml of blood. The haemoglobin content then gradually increased until it reached the average of 9.1 to 9.2 after two weeks of infection but it did not reach the normal standard. The packed cell volume (PCV), as shown in table I, gradually increased from 23 before infection to 38.1 by day 18, after infection. The red blood cell counts showed a decrease in number but their mean corpuscular volume (MCV) showed a considerable increase. The mean corpuscular haemoglobin (MCV) however showed slight low values.

The white cells count of the blood increased progressively from the average 5 000 cells/ml before infection to as high as 10 000 cells/ml with the average of 8 100 cell/ml of blood. The differential leucocytic count showed a great

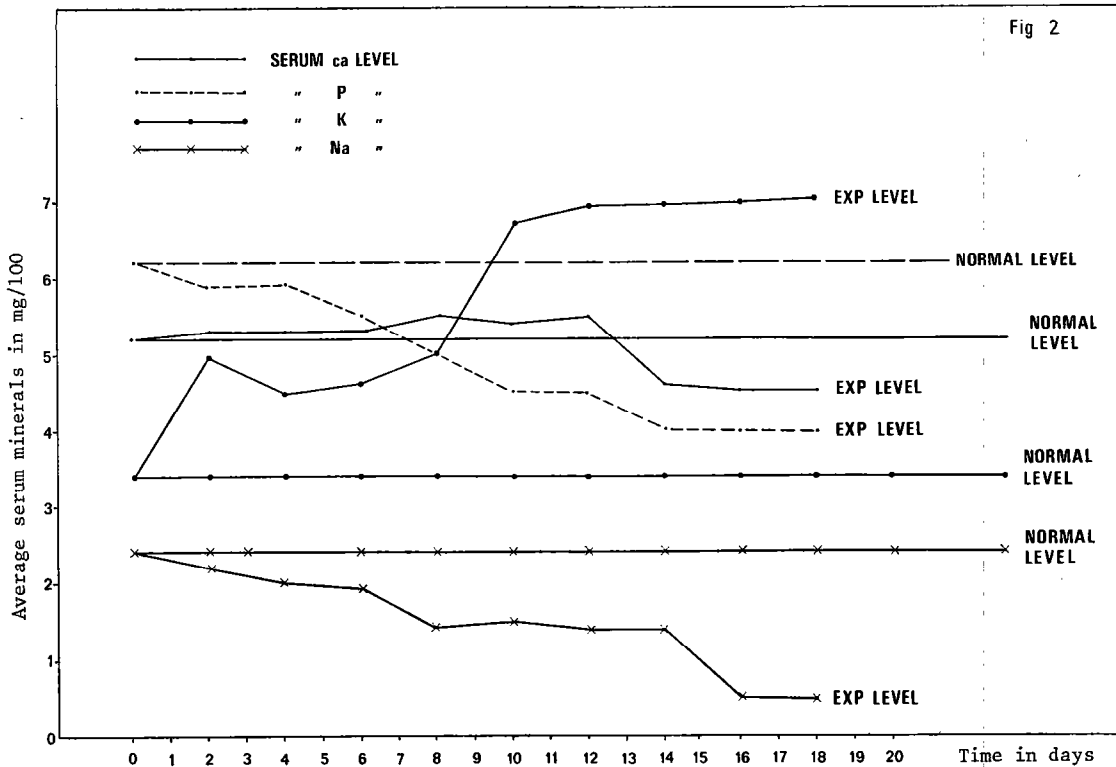
TABLE II—Serum protein and mineral analysis in goats experimentally infected with *E. arloingi*

	Total protein	Albumin mg/100	Ca mg/100	P mg/100	Na mg/100	K mg/100
Average values before infection	6.28	3.18	5.2	6.2	143.7	3.98
Average experimental values in 2 days	6.53	3.23	5.3	5.8	141.7	4.90
" " " " 4 "	6.40	4.05	5.3	5.8	140.2	4.50
" " " " 6 "	6.12	4.16	5.3	5.5	138.5	4.65
" " " " 8 "	6.10	4.16	5.5	5.0	134.5	4.94
" " " " 10 "	6.03	4.16	5.4	4.5	135.3	6.72
" " " " 12 "	7.00	4.32	5.5	4.5	134.5	6.83
" " " " 14 "	7.01	4.32	4.6	4.0	134.0	6.82
" " " " 16 "	7.17	4.45	4.5	4.0	125.0	6.90
" " " " 18 "	7.20	4.59	4.5	4.0	125.0	6.95



increase in the eosinophilic fraction and a moderate increase in lymphocytes and monocytes. The neutrophilic values were kept below

the normal standard throughout the course of infection. The basophilic count remained within the normal standard.



The serum total protein and albumin analysis as shown in table II and figure 1 showed an increase in both the total protein content of the serum and in its albumin fraction. The total protein content showed a slight increase in the first 4 days of infection, then decreased below the normal standard up to day 10 of the infection and then it started to increase. The albumin fraction, however, kept on rising from day 2 of infection till the end of the experiment.

The mineral analysis of the serum showed a considerable increase in the potassium content with a corresponding decrease in sodium. Table II and figure 1. The serum calcium level slightly increased at the beginning of infection until day 12 when it began to decrease below the normal standard. The serum phosphorous, on the other hand, began to decrease from the second day of infection and kept on progressively decreasing considerably.

DISCUSSION

Coccidiosis is a disease which is generally believed to arise from an imbalance in the host-parasite relationship. In this context, it is logical to direct the studies towards the site of reaction against coccidiosis i.e. the intestines. It is believed that gastroenterology might provide a profitable area for future veterinary studies in the field of coccidiosis. In view of many workers including LONG (4) since coccidiosis causes intestinal injuries it interferes with food consumption and therefore with other systems of the body. FITZGERALD (3) studying the effect of bovine coccidiosis on certain blood components in calves reported marked changes in haemoglobin, PCV and erythrocyte values. He attributed these changes to blood loss due to severe intestinal bleeding. The same author, FITZGERALD (1967) reported a considerable increase in serum potassium and a decrease in serum sodium. He assumes that cellular anoxia associated with moribund condition caused the alteration in serum electrolytes. In this work, the red blood cells are reduced in number but the MCV values are increased. The haemoglobin concentration is reduced and so does the MCH while the PCV is increased. These findings indicate a macrocytic hypochromic form of anaemia due to loss of blood as a result of intes-

tinal bleeding. FITZGERALD and MANSFIELD (3) found no significant difference in PCV haemoglobin content in calves. CHAPMAN (1974) reported haemoconcentration as a result of plasma loss in lambs infected with coccidiosis.

In the present work, the leucocytic count is increased and the differential count showed marked eosinophilia and a moderate increase in the lymphocytic fraction with a decrease in the neutrophils.

The total serum protein showed an increase after 10 days of infection while serum albumin content kept on increasing starting from second day of infection. This finding is in contrast to what CHAPMAN (1974) reported in coccidiosis in lambs where there were no significant rise in total serum protein while serum albumin showed significant decline. The author attributed the decline in serum albumin to the decrease in circulating blood volume in addition to the damage of the intestinal epithelium. In the present work, the hyperalbuminemia is probably due to the profuse dehydration which lead to high concentration of albumin in the blood stream as a result of increased plasma volume.

Analysis of the mineral contents of the serum showed a decrease in calcium, phosphorous and sodium contents. Potassium content, however, increased considerably. The decrease in mineral content is probably due to dehydration which lead to depletion of these elements from the blood. It may also be due to the inability of the intestinal epithelium to absorb mineral elements from the food as a result of the intestinal injury by coccidial merozoites. The explanation of potassium increase in the serum may be due to the fact that when cells are damaged and their permeability is increased, the intracellular potassium may leak and diffuse into the plasma thereby increasing its contents.

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SUMMARY

Haematological studies in goats coccidiosis showed decrease in erythrocytes count and haemoglobin content. It is also followed by an increase in the MCV and PCV values. The differential counts revealed eosinophilia and moderate increase in the lymphocytic fraction. Analysis of serum proteins showed an increase in the total serum content and serum albumin. Serum calcium, phosphorous and sodium decreased while potassium level in the serum increased.

RESUMEN

El efecto de la coccidiosis sobre algunos componentes de la sangre en las cabras

El estudio hematológico en cabras atacadas por la coccidiosis muestra una baja notable de la proporción de los eritrocitos y del volumen de la hemoglobina, seguida también por un aumento tanto del hematocrito como del volumen corpuscular medio de los globulos rojos. Existe una neta eosinofilia con un aumento importante de los eosinofilos y un aumento menos acentuado de los linfocitos y de los monocitos.

El estudio de las proteínas séricas muestra su aumento en el suero y en su fracción albúmina que se mantiene a un nivel constante desde el segundo día después de la infección hasta el fin de las observaciones.

El análisis de los compuestos minerales del suero mostró un aumento considerable del potasio, con disminuciones notables de las proporciones de sodio y de fósforo, probablemente causadas por la deshidratación así como por la incapacidad del epitelio intestinal para absorber dichos minerales a causa de lesiones locales provocadas por la presencia de merozoitos coccidianos.

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