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THE INFLUENCE OF INTESTINAL COCCIDIA INFECTION OF RABBITS UPON PLASMA AND URINE ELECTROLYTE CONCENTRATIONS

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Two groups of rabbits, with 10 animals each, were artificially infected with varying doses of sporulated intestinal coccidia oocysts. The first group was infected with $2x10^5$, whereas the second received $4x10^5$ infectious oocysts. The infectious material consisted of several rabbit intestinal coccidia oocyst species: Eimeria flavescens, Eimeria matsubayashi, Eimeria magna, Eimeria neoleporis, Eimeria perforans and Eimeria media. A third group of 10 rabbits served as the control. Following the artificial infection, in most animals a subclinical form of the disease was induced with weight loss, bristling hair and polydipsia while only 3 animals developed full-blown with diarrhoea.

Immediately before and then on days 4, 7, and 10 after the infection, levels of the following electrolytes were determined in blood: sodium, potassium, chloride and calcium. Additionally, the concentration of sodium, potassium and chloride was measured in urine samples. A decrease in plasma sodium, potassium and chloride concentrations was observed with a concomitant rise in the levels of these electrolytes in urine. Plasma calcium concentrations varied, both rising and dropping in the course of the disease. The changes in concentration of the measured electrolytes in blood and urine did not correlate with the size of the inoculum of sporulated coccidia oocysts.

Key words: coccidiosis, rabbit, electrolyte, blood, urine.

INTRODUCTION

A major limiting factor in optimal production in the rabbit breeding industry is the incidence of various parasitic diseases, particularly coccidiosis. Rabbit coccidiosis manifests itself as a hepatic or intestinal form, and represents one of the most frequent rabbit parasitoses, inflicting considerable losses to the modern rabbit breeding industry (Catchpole and Norton 1979, Hoop et al. 1993, Polozowski 1993). It is an important health and economic problem due to

treatment costs and the lower rate of food conversion in diseased rabbits. Studies of rabbit coccidiosis have been limited to the morphology of coccidia oocysts (Levin and Ivens 1972, Catchpole and Norton 1979). Few authors have published works describing alterations in biochemical parameters in blood and urine.

A significant decrease in sodium, potassium and chloride concentrations in plasma of rabbits with coccidiosis was observed by Licois et al. 1978. Following artificial infection with sporulated oocysts of *E. intestinalis,* a decline in plasma sodium, chloride and potassium concentration was registered (Peeters et al. 1984). Changes in magnesium and inorganic phosphate levels induced by coccidiosis were described by Šerkov et al. (1986).

Diarrhoea elicitedby coccidiosis in rabbits resulted in alterations in electrolyte concentrations in the intestinal secretions (Na^+ and K^+) and hypokaliemia (Licois and Mongin 1980). Namely, sodium was reabsorbed in the colon in preference to potassium.

On day 10 after infection of rabbits with oocysts of *E. intestinalis* and *E. pelerdyi,* a decrease in sodium and potassium concentrations in urine was noted (Licois et al. 1978).

The immunological aspect of rabbit coccidiosis has recently been investigated by many authors (Coudert et al. 1993, Licois et al. 1995).

This study was aimed at determining the plasma concentrations of sodium, potassium, calcium and chloride in rabbits artificially infected with sporulated intestinal coccidia oocysts. Additionaly we measured levels of sodium, potassium and chloride in 24-hour urine samples of infected rabbits.

MATERIALS AND METHODS

Male rabbits (Big Chinchilla race) aged 52 days and weighing 1200 - 1300 g were used in the study. Prior to artificial infection, coprologic examination was consistently negative in all selected rabbits.

The stool specimens were prepared for examination by the flotation method using a saturated solution of coccidia oocysts was induced by incubating the stool specimens with added 2% solution of potassium bichromate at 27^{0}C for 5 days. The samples were observed under a light microscope (immersion, magnification 12 x 40). Coccidial oocysts were identified according to the following morphological criteria: length, width, shape, color, wall width, and the presence of oocyst residual bodies. After the stool samples had beeen incubated in a thermostat at 27^{0}C for 5 days, they were mixed with distilled water, centrifuged at 1500 rpm for 5 min, and the supernatant was discarded. The resulting pellet contained concentrated intestinal coccidia oocysts. The oocysts were counted in the McMaster chamber. The infectious dose of the oocysts was determined on the basis of the number of oocysts in 1 ml of the pellet. Oocysts of the following intestinal coccidia were used as the infectious material: *Eimeria flavescens* (7%), *Eimeria matsubayashii* (9%), *Eimeria magna* (21%), *Eimeria neoleporis* (19%), *Eimeria perforans* (21%) and *Eimeria media* (32%).

After an adaptation period of 10 days, rabbits were transfered to metabolic cages and divided into three groups of 10 animals each. The first group served as a control (0) - noninfected rabbits. Rabbits of the second and third groups were infected by direct instillation of oocysts through a tube into the empty stomach. Rabbits of the second group (A) were infected with $2x10^5$, whereas rabbits of the third group (B) received $4x10^5$ infectious cocysts. Immediately before the infection, then on the fourth, seventh, and tenth day following the infection with intestinal coccidia oocysts, blood samples were drawn and 24-hour urine specimens were collected and electrolyte concentrations measured there in, using the ASTRA-8device (Beckman). The obtained results were analyzed bidirectional variance analysis (Studentis t-test for small samples). Means were considered to be significantlly different $p<0.05$.

RESULTS

On day 10, coprological examination confirmed the presence of intestinal coccidia oocysts in the stools of all the infected rabbits. Sporulated intestinal coccidia oocysts artificially introduced into rabbits were not pathogenic enough to produce a complete clinical presentation of coccidiosis. Most infected rabbits displayed milder signs of coccidiosis such as polydipsia, bristling hair and moderate weight loss. Only three animals developed a complete clinical presentation of coccidiosis - diarrhoea, bristling hair, polydipsia, and weight loss.

Plasma sodium concentration in rabbits with coccidiosis. The concentration of plasma sodium fell in both groups of infected rabbits (Figure 1). The decrease in sodium levels on days 4 and 10 after the infection was more pronounced in the group of animals infected with the lower dose of the infectious material, whereas on day 7 a more apparent decrease was noted in the group infected with the higher dose of sporulated oocysts. Plasma sodium levels significantly declined on days 4 and 7 after infection in group A rabbits and on day 10 in rabbits in group B. A. significant intergroup variability in sodium concentration was noted at all observation periods.

Plasma potassium concentrations in rabbits with coccidiosis. At all time points, a lower plasma potassium levels were found in both groups of rabbits infected with intestinal coccidia oocysts (Figure 2). The fall in potassium concentrations in rabbits receiving the lower dose of infectious material was significant on days 4 and 10 after infection and then it was more pronounced than in rabbits in group B. The decline in plasma potassium levels was statistically significant in group B at all time points studied. The decline in potassium concentration in this group was greatest on day 4, but it was more pronounced on day 7 in comparison to rabbits in group A. Statistically significant intergroup variability in potassium concentrations was observed on days 4, 7 and 10 following infection.

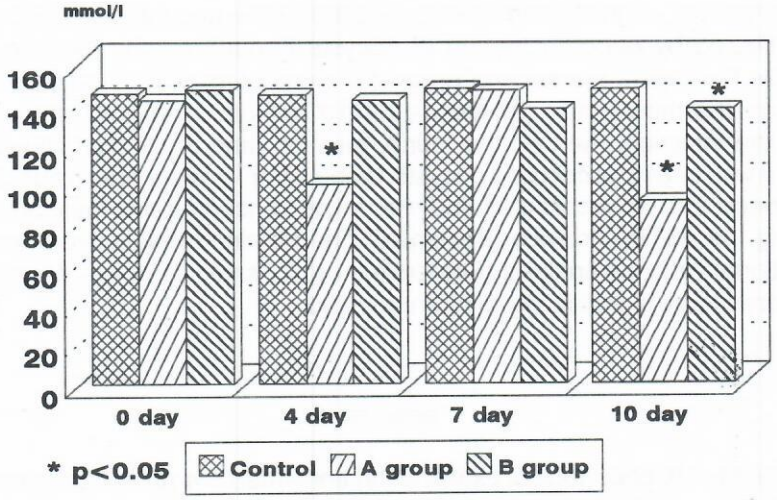

Figure 1. A comparative depiction of plasma sodium levels in rabbits infected with intestinal coccidia.

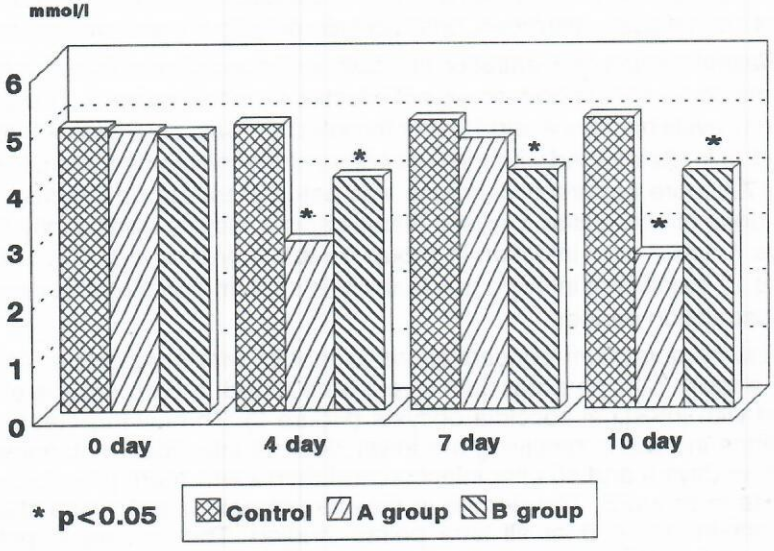

Figure 2. A comparative depiction of plasma potassium levels in rabbits infected with intestinal coccidia.

Plasma chloride concentrations in rabbts with coccidiosis. At all time points, a lower plasma chloride levels were found in both groups of rabbits infected with intestinal coccidia oocysts (Figure 3). In rabbits infected with the lower dose of infectious material, a marked decrease was noted on day 4, then a slight increase on day 7 followed by a significant decrease on day 10 after infection. Similar dynamics of chloride concentration changes were found in the plasma of group B rabbits. On days 4 and 10 after infection there was a significant intergroup difference in chloride concentrations.

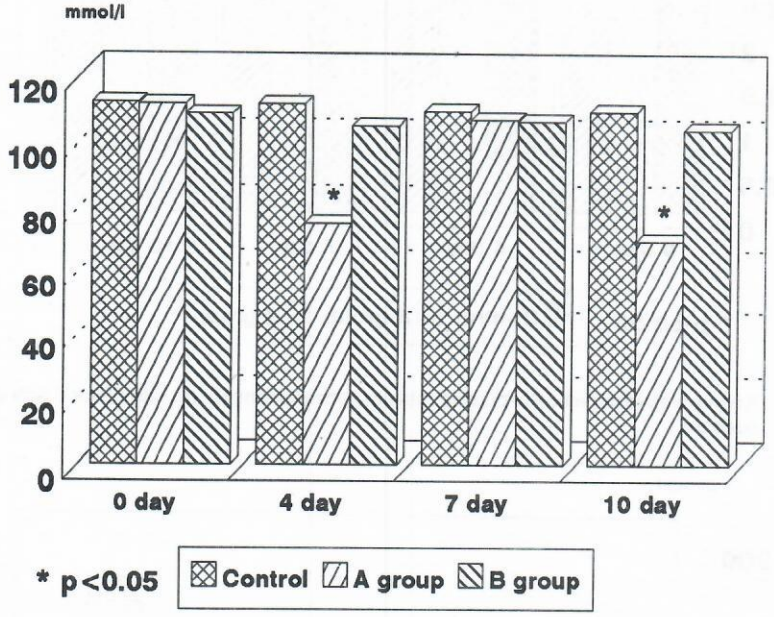

Figure 3. A comparative depiction of plasma chloride levels in rabbits infected with intestinal coccidia.

Plasma calcium concentrations in rabbits with coccidiosis. Oscillations in plasma calcium concentrations were seen in both groups of infected rabbits (Figure 4). In group A rabbits the concentration of calcium decreased on day 4, increased on day 7, and maximally declined on day 10 after infection which was statistically significant.

In group B rabbits a decrease in calcium concentrations was noted on day 4 whereas on days 7 and 10 plasma calcium levels returned to the normal range. On days 7 and 10 after infection an intergroup variability in plasma calcium levels was found.

Urinary sodium concentration in rabbits with coccidiosis. An even increase in urinary sodium concentration was found during all time points studied in both groups of infected rabbits (Figure 5). The highest increase was observed on day

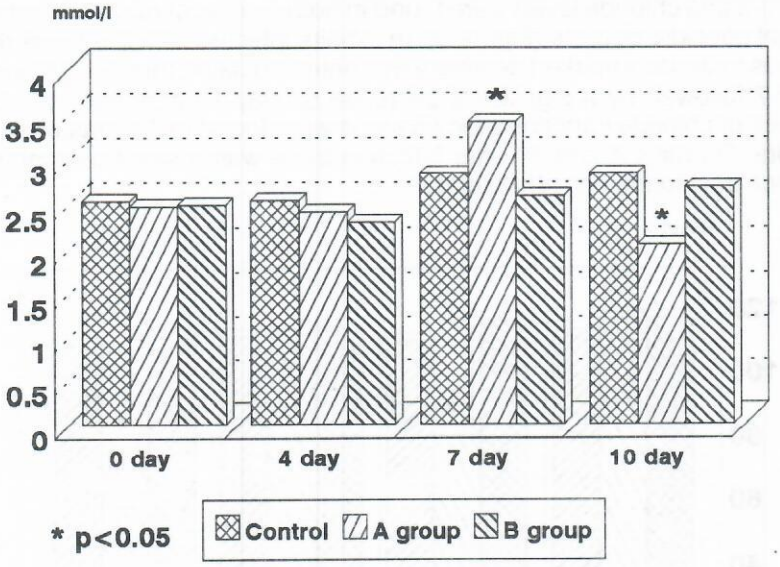

Figure 4. A comparative depiction of plasma calcium concentrations in rabbits infected with intestinal coccidia.

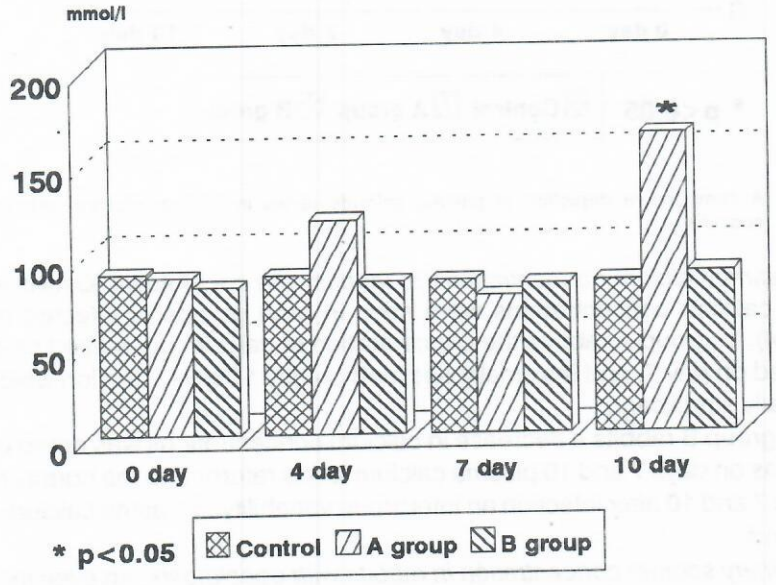

Figure 5. A comparative depiction of urinary sodium levels in rabbits infected with intestinal coccidia.

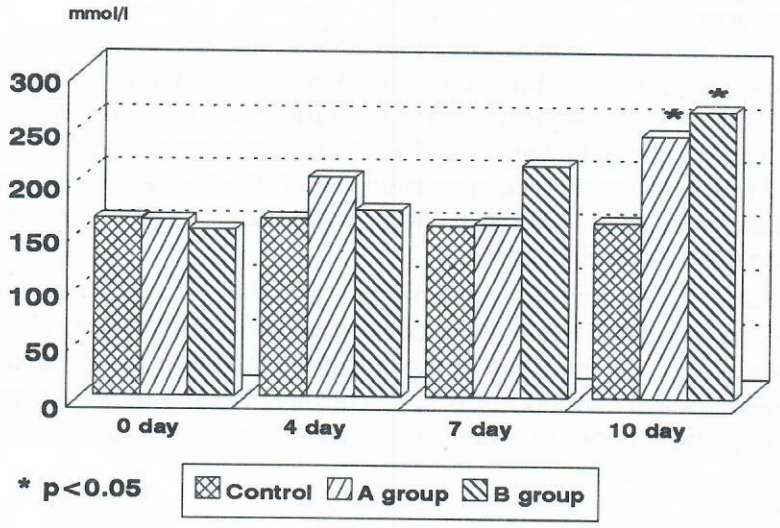

Figure 6. A comparative depiction of urinary potassium concentrations in rabbits infected with intestinal coccidia.

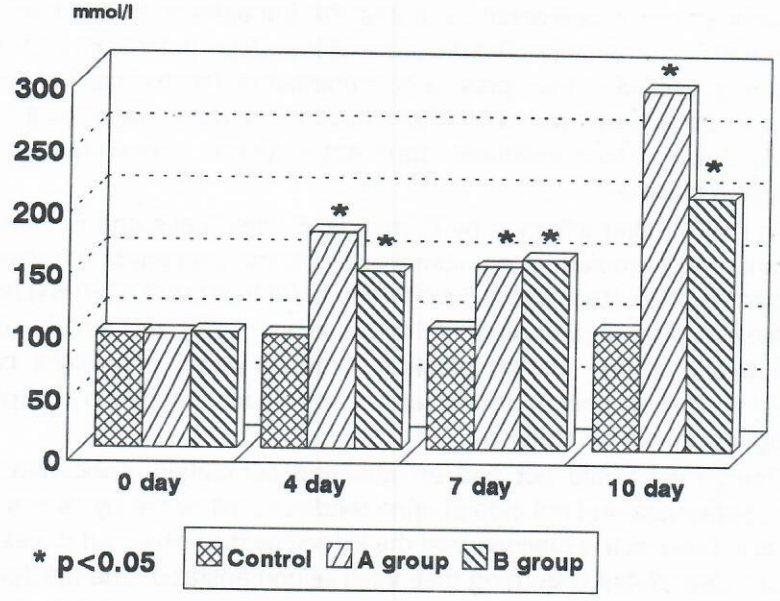

Figure 7. A comparative depiction of urinary chloride concentrations in rabbits infected with intestinal coccidia.

10 after infection in rabbits receiving the lower dose of infectious oocysts. At the same time point a significant intergroup variability in urinary sodium concentrations was found.

Uninary potassium concentrations in rabbits with coccidiosis. An increase in urinary potassium concentration, more marked in group B, was detected in the diseased rabbits at all time points (Figure 6). The increase was progressive in the group infected with the higher dose of sporulated oocysts whereas in group A on day 7 urinary potassium concentration was similar to the control group. A maximal and significant increase in urinary potassium levels was noted in both groups on day 10 following infection.

Urinary chloride concentrations in rabbits with coccicdiosis. A rise in urinary chloride concentrations was found in both groups of infected rabbits (Figure 7). The rise was more pronounced in the group infected with the lower dose of sporulated intestinal coccidia oocysts. The observed increases were significant and followed the changes in urinary sodium and potassium concentrations.

DISCUSSION

A central role in the pathogenesis of the intestinal from of rabbit coccidiosis is played by the impaired intestinal mucosa. The observed disturbance in electrolytes in our experiments ilustrates the impairment of mechanisms of reabsorption and elimination. The disturbance in sodium, potassium and chloride resulted in a decline in their plasma concentrations. Plasma calcium levels in rabbits with coccidiosis varied but these oscillations were insignificant. (except group A) Apparently, coccidiosis does not influence concentrations of the electrolyte in plasma.

On day 10 after infection by *E. magna, E. intestinalis* and *E. pellerdyi,* a significant drop in sodium, potassiumm and chloride concentrations was noted in the plasma of infected rabbits (Licois et al. 1978) Peeters et al. (1984) reported a decrease in plasma potassium (7.31%), sodium (3,2%) and chloride (3.64%) concentrations on day 10 after infection of rabbits with *E. intestinalis* cocysts. Šerkov et al. (1986) described statistically insignificant changes in phosphourus and magnesium concentrations.

Though we could not find an absolute correlation, concentrations of sodium, potassium and chloride in urine tended to follow the dynamics of their changes in plasma. It is obvious that the kidney by the enhanced diuresis does not spare electrolytes disturbing their internal homeostasis. The mechanism is not completely clear but it may be hypothesized that a coccidial product acts directly upon the renal tissue. On the other hand, it is possible that these changes

represent part of a more general homeostatic disorder occuring in the course of intestinal coccidiosis.

Licois et al. (1978) found a decrease in urinary sodium and potassium concentrations in rabbits infected with *E. intestinalis and E. peellerdyi.* Our results are not consistent with theirs because we demonstrated an increase in urinary concentrations of these electrolytes. The subclinical form of intestinal coccidiosis induced by different species of sporulated coccidia cocysts (mixed infection) resulted in changes of concentration of some electrolytes in plasma and urine. We have demonstrated a decline in plasma sodium, potassium and chloride concentrations in diseased rabbits accomparied by an increase of their levels in urine. Our results indicate that the subclinical form of intestinal coccidiosis does not significantly influence plasma concentrations of calcium in the infected animals, except in group infected with $2x10^5$ oocysts..

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UTICAJ INFEKCIJE CREVNIM KOKCIDIJAMA KUNIĆA NA KONCENTRACIJU ELEKTROLITA U PLAZMI I URINU

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SADRŽAJ

Kod dve grupe po 10 kunića izazvali smo eksperimentalnu kokcidiozu inokulacijom različitog broja i više vrsta sporulisanih oocista. Prva grupa je inficirana sa 2×10^5, a druga sa 4×10^5 infektivnih oocista. Kunići su oboleli od subkliničkog oblika kokcidioze. Pored lezija sluzokože creva i izražavanja nekih kliničkih simptoma karakterističnih za ovu bolest, došlo je i do promene koncentracije nekih elektrolita u plazmi i urinu. Tako smo registrovali smanjenje koncentracije natrijuma, kalijuma i hlora u plazmi kokcidioznih kunića, uz istovremeno povećanje koncentracije ovih elektrolita u urinu. Subklinički oblik crevne kokcidioze nije u značajnoj meri uticao na koncengraciju kalcijuma u plazmi, izuzev u grupi A 7. i 10. dana.