

BLOOD GLUCOSE, PLASMA OSMOLARITY AND UREA AND CREATININE CLEARANCE IN RABBITS ARTIFICIALLY INFECTED WITH INTESTINAL COCCIDIA

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*Two groups of ten coprologically oocyst free rabbits were infected with 2×10^5 or 4×10^5 coccidia oocysts composed of *Eimeria flavescens* (7%), *E. matsubayashi* (9%), *E. magna* (12%), *E. neoleporis* (19%), *E. perforans* (21%) and *E. media* (32%). A third group served as the control. Only three infected animals developed full-blown disease with diarrhoea. The others suffered from a subclinical form of the disease. Shortly before and then on days 4 and 10 after infection, blood glucose levels were determined, and plasma osmolality and urea and creatinine clearance were calculated. Throughout the observation period a decline in blood glucose levels and plasma osmolality was observed. In parallel, a pronounced elevation of urea and creatinine clearance was found.*

Key words: rabbits, coccidiosis, blood glucose, plasma osmolality, urea and creatinine clearance

INTRODUCTION

Hepatic and intestinal coccidiosis are caused by several species of intestinal coccidia (Levin and Ivens, 1972; Catchpole and Norton, 1979) and it is difficult to find a coccidia free rabbit colony (Catchpole and Norton, 1979; Šerkov et al., 1986; Hoop et al., 1993; Polozowski, 1993). Most investigations of rabbit coccidiosis have focused on the morphology of oocysts, clinical symptoms, pathologic changes, diagnosis, treatment and prophylaxis of disease. A few authors dealt with alterations in biochemical parameters in the blood of rabbits with coccidiosis (Coudert et al., 1978; Peeters et al., 1984; Šerkov et al., 1986; Coudert et al., 1993; Fukata et al., 1995). The aim of this study was to determine the influence of intestinal coccidia infection of rabbits upon blood glucose (BG), plasma osmolality i. e. osmotic pressure of plasma (OPP), and urea (UC) and creatinine clearance (CC).

MATERIALS AND MEMTHODS

Male rabbits (Large Chinchilla breed), 52 days old and 1200 - 1300 g in weight were used in the study. Prior to artificial infection, the coprologic examination was consistently negative in all selected rabbits. In order to identify and isolate intestinal coccidia oocysts, standard coprological methods were employed (Levine and Ivens 1972, Coudert et al. 1993, Tambur et al. 1995, Tambur et al. 1998). Oocysts of the following intestinal coccidia were used as the infectious material: *Eimeria flavescens*, *E. matsubayashi*, *E. magna*, *E. neoleporis*, *E. perforans* and *E. media*.

Rabbits were divided into three groups of 10 animals. The first group served as a control (C) - noninfected rabbits. Rabbits of the second (A) and third (B) groups were infected with 2×10^5 and 4×10^5 sporulated oocysts, respectively, by direct instillation through a tube into the empty stomach. Immediately before infection, then on day 4 and 10 following infection with the coccidia oocysts, blood samples were drawn and glucose levels measured by glucose oxidase test (ASTRA-8, Beckman). Plasma osmolality was calculated on the basis of sodium, urea and glucose concentrations. Urea and creatinine clearances were calculated taking into account body weight, quantity of the 24-hour urine sample and plasma and urinary levels of urea and creatinine.

The results obtained were analyzed on a PC IBM compatible computer (software program STATGRAPH ver. 4.2) by bidirectional variance analysis (Student's t-test for small samples).

RESULTS

Only three artificially infected animals (one from group A and two from B) developed a complete clinical presentation of coccidiosis with diarrhoea, whereas others displayed milder signs of the disease such as polydipsia, bristling hair and moderate weight loss.

Blood glucose levels. A decline in blood glucose was consistently found during the whole observation period in both groups of infected rabbits (Figure 1). In group A, a significant decrease in blood glucose was observed on day 4 and the most pronounced fall was on day 10. After a moderate decline on day 4, there was significant drop on day 10 in the group of animals which received the higher dose of infectious agents. All over the course of intestinal coccidiosis, the intergroup difference in blood glucose levels was significant.

Plasma osmolality. In both groups of infected rabbits a decrease in plasma osmolality was noted throughout the observed period. The decrease was more apparent in rabbits infected with the lower dose of sporulated intestinal coccidia oocysts (Figure 2). In both groups a maximal and significant decline in osmolality was registered on day 10. Intergroup statistically significant variability was found on days 4 and 10 after infection.

Urea clearance. A progressive and significant increase in urea clearance was found in both groups of infected rabbits (Figure 3). It was more pronounced

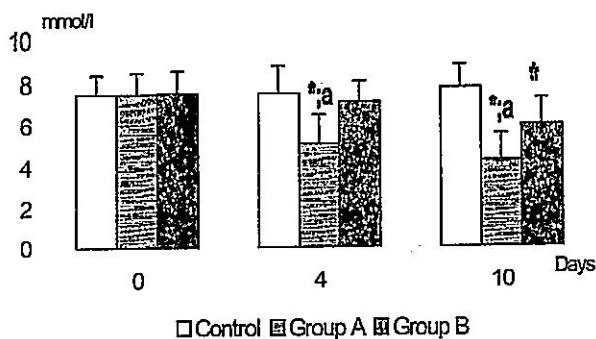


Figure 1. Blood glucose level in rabbits infected with intestinal coccidia (* $p < 0.05$ difference between control and group A and B; ^a $p < 0.05$ intergroup difference).

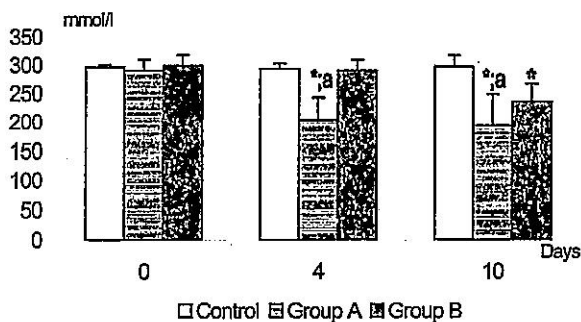


Figure 2. Plasma osmolarity in rabbits infected with intestinal coccidia (* $p < 0.05$ difference between control and group A and B; ^a $p < 0.05$ intergroup difference).

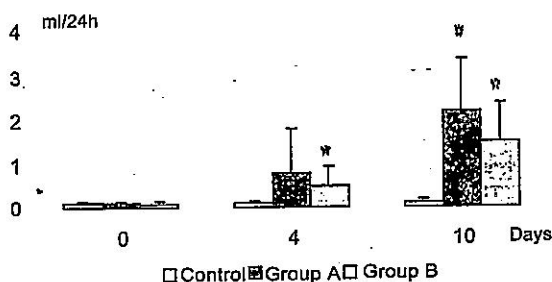


Figure 3. Urea clearance in rabbits infected with Intestinal coccidia (* $p < 0.05$ difference between control and group A and B).

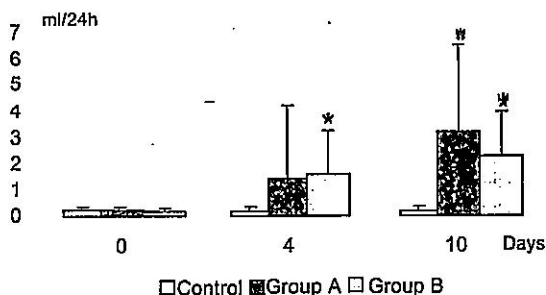


Figure 4. Creatinine clearance in rabbits infected with intestinal coccidia (* $p < 0.05$ difference between control and group A and B).

in the group of animals infected with the lower dose of infectious material, but intergroup differences in urea clearance were not significant.

Creatinine clearance. During the whole period a continued and significant increase in creatinine clearance was found (Figure 4). The differences between groups A and B were not significant.

DISCUSSION

The decrease in blood glucose in rabbits with coccidiosis occurs probably as a result of a decrease in absorption capacity together with possible leakage into the intestinal lumen. This for the most part contributes to the decline in blood glucose levels in rabbits with intestinal coccidiosis. However, it should be kept in mind that the glycolytic process in the liver might be affected to some degree as well. Our results are in accordance with those reported by other authors (Peeters et al. 1984., Coudert et al. 1993) who showed that glucose absorption is decreased in infected rabbits. Similar results were reported in poultry Chow et al. (1972) and Ruff and Wilkins (1980).

The disorder of the hydroelectrolyte balance in the infected animals resulting in a decline in plasma osmolarity may be explained by the widespread malfunction of the intestinal mucosa accompanying coccidiosis. Our results are similar to the data of Coudert et al. (1993) who registered decreased Na and glucose concentrations and a greatly increased urea concentration in plasma in coccidial infected rabbits.

A maximal rise in urea clearance was observed on day 10 after infection in group A. Coudert et al. (1978) and Peeters et al. (1984) found an increased urea concentration in the plasma of infected rabbits, but Licois et al. (1978) registered that urea clearance was not significantly changed in the coccidial infected group.

The increase in urea and creatinine clearance as well as their urinary levels in rabbits with coccidiosis suggests excess protein mobilization in order

to compensate for the deficit in nutrients resulting from malabsorption in the small intestine. In a short period of time, the infected animals lose a significant amount of body weight. However, the kidney functions as the main excretory organ for the end products of protein metabolism, which is well illustrated by our findings of clearance changes in rabbits with coccidiosis.

Intestinal coccidia oocysts damage the small and large intestine mucosa, particularly the absorptive surface, i. e. the epithelium of small intestine villi. As a result, the basic food components formed by the action of hydrolytic digestive enzymes cannot be absorbed. Additionally, a significant amount of proteins, glucose and electrolytes passes through the damaged intestinal mucosa back into the lumen. These together lead to a fall in blood glucose levels and plasma osmolality in rabbits with coccidiosis. In an attempt to eliminate the excess of products of protein metabolism, the kidney excretes large amounts of urea and creatinine so that their clearance is significantly elevated.

It is interesting that the lower dose of oocysts produced stronger changes of biochemical parameters but for an explanation of this finding further investigations are necessary.

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KONCENTRACIJA GLUKOZE, OSMOLARITET PLAZME I KLIRENS UREJE I KREATININA U KUNIĆA VEŠTAČKI INFICIRANIH INTESTINALNIM KOKCIDIJAMA

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SADRŽAJ

Kod dve grupe kunića izazvali smo kokcidiozu oocistama različitih vrsta crevnih kokcidija (*Eimeria flavescens*, *Eimeria matsubayashii*, *Eimeria magna*, *Eimeria neoleporis*, *Eimeria perforans* i *Eimeria media*). Prva grupa kunića je bila kontrolna (neinficirani). Drugu grupu smo inficirali sa 2×10^5 , a treću sa 4×10^5 infektivnih oocista. Kunići su oboleli od subkliničke kokcidioze. Neposredno pre infekcije, zatim četvrtog i desetog dana, određivali smo koncentraciju glukoze, osmolaritet plazme i izračunavali klirens ureje i kreatinina. U svim ispitivanim terminima zabeležen je pad koncentracije glukoze i vrednosti osmolariteta. Nasuprot smanjenju osmolariteta zabeležen je porast vrednosti klirensa ureje i kreatinina.