

EFFECT OF EXPERIMENTAL FASCIOSIS AND DIETHYLNITROSAMINE INTOXICATION ON TRACE ELEMENTS CONTENT IN RAT LIVER

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ABSTRACT

The aim of the work was to be investigated the trace elements content in rat liver after the effect of chronic fasciolosis and diethylnitrosamine (DENA) intoxication. The Mo, Rb, Br and Cu contents were near to the controls or slightly increased. The highly increased quantity of Cu and low values of Zn, Fe and Co were established. The obtained results pointed that the combined action of *Fasciola hepatica* and DENA led to a specific mineral imbalance in the liver, which might take place in the pathogenesis of the interaction between experimental fasciolosis and chemical intoxication.

Key words: Experimental helminthosis, chemical intoxication, liver, trace elements.

Introduction

The pathogenesis of the interaction between *Fasciola hepatica*-infection and diethylnitrosamine (DENA) treatment is not well clarified yet (Tsocheva, 1986). Fasciolosis and DENA initiated hepatocarcinoma are wide spread and very dangerous for humans (Kutikhin et al., 2013). The target organ of the both pathogenic factors is the liver. It is known that mineral imbalance corresponds to the structural changes of the tissue and to the biochemical disturbances of the cells, so the investigation of the changes in trace element content may reveal some of the mechanisms of this interaction.

The aim of the present study is to investigate the trace elements content in the rat liver tissue after the combined effect of chronic *F. hepatica* infection and DENA intoxication.

Material and Methods

The experiment was carried out on 24 male albino Wistar rats, 30 days old, divided in 4 groups: Group I - healthy animals – 6; Group II – *F. hepatica* infected animals – 6; Group III – DENA treated animals – 6; Group IV – *F. hepatica* infected and DENA treated animals – 6.

The rats were infected per os on the 1st day of the experiment with 15 metacercariae of *F. hepatica*. DENA was injected intraperitoneally 4 times at 7-day intervals at a dose of 100 mg/ kg body weight from the 6th week p. i. The animals were sacrificed on the 10th week of the experiment.

The experiment was conducted in compliance with the requirements of the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Specific Purposes and the current Bulgarian laws and regulations.

The trace elements content in the liver tissue was determined by a non-destructive method of neutron activation analysis (Gabrashanska & Damyanova, 1987). The contents of zinc (Zn), iron (Fe), copper (Cu), cobalt (Co), molybdenum (Mo), chrome (Cr), selenium (Se), rubidium (Rb) and bromine (Br) were determined in the rat liver tissue. The results were statistically processed after variation analysis and Student's t-test.

Results and Discussion

The results are presented in figures 1, 2 and 3.

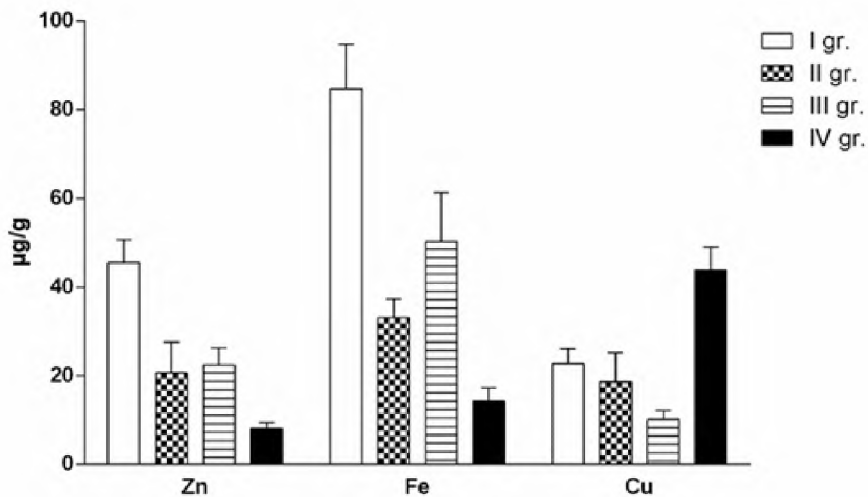


Figure 1: Content of Zn, Fe and Cu in rat liver after *F. hepatica* after *F. hepatica* infection and DENA treatment.

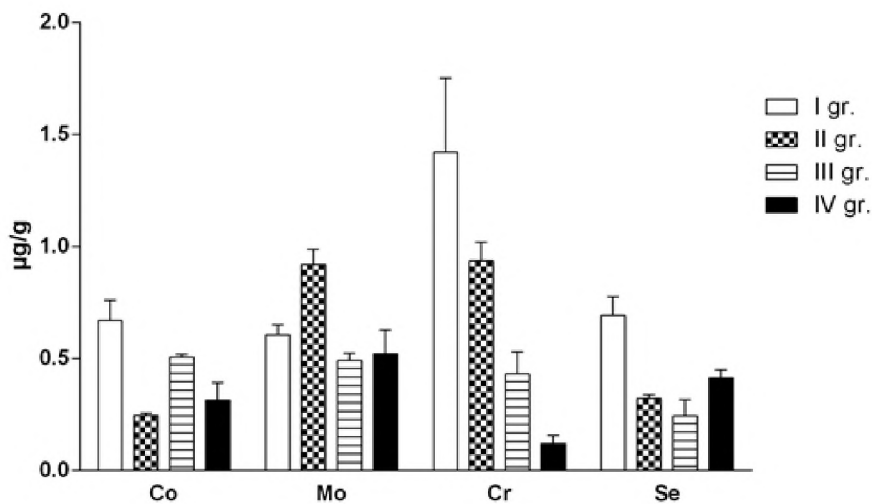


Figure 2: Content of Co, Mo, Cr and Se in rat liver after *F. hepatica* after *F. hepatica* infection and DENA treatment.

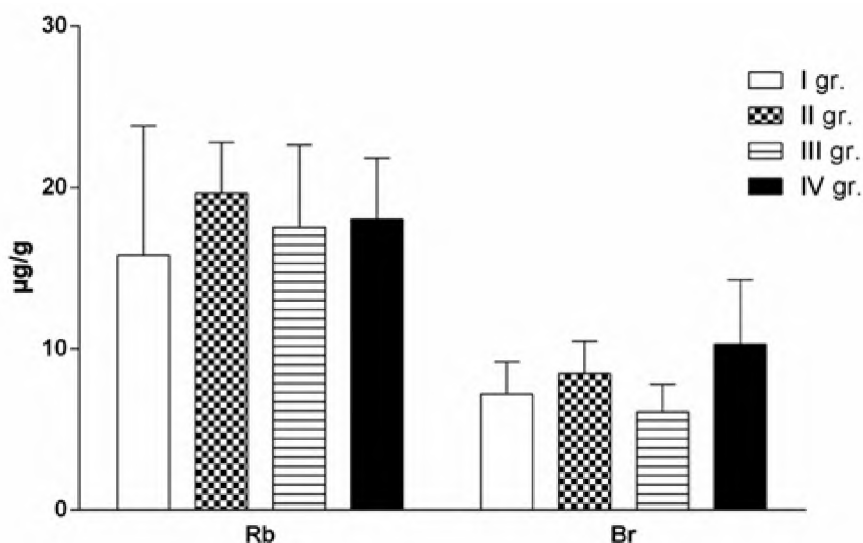


Figure 3: Content of Rb and Br in rat liver after *F. hepatica* after *F. hepatica* infection and DENA treatment.

The values of the quantitatively established trace elements in the normal liver tissue (Group I) are used as controls.

The study of the trace element status in the liver of *F. hepatica* infected rats (Group II) shows a significant decrease of Zn, Se, Co and Fe content compared to the control ($P < 0.001$) and slide decreased values for Cu and Cr ($P > 0.1$) (Fig. 1 and Fig. 2). The content of Rb and Br is near the control (Fig. 3) and the content of Mo is increased ($P < 0.001$) (Fig. 2).

The study of the trace elements spectrum in the liver of DENA-injected animals (Group III) shows a deficit of Zn, Cr, Se, and Cu compared to the control ($P < 0.001$). The Co and Mo contents are slightly reduced and the content of Rb and Br is similar to that of the controls (Fig. 1 and Fig. 2).

The study of the trace elements content in the rat liver after combined treatment with *F. hepatica* and DENA (Group IV) shows increased levels of Rb ($P < 0.01$) and Cu ($P < 0.1$) (Fig. 1 and Fig. 3). A decrease in the contents of Fe, Cr, Co and Zn ($P < 0.001$) is reported. The contents of Mo, Se and Br are similar to that of the controls (Fig. 1 and Fig. 2).

Our results for the trace element status in the liver of *F. hepatica* infected rats (Group II) support the literature data (Gabrashanska & Damyanova, 1987; Gajewska et al., 2005). The function and biochemical regulation of the liver cells are altered from the direct and indirect action of *F. hepatica* causing hepatitis, fibrosis, cirrhosis in the liver tissue. The decreased levels of Zn, Co, Mo, Cu, etc. depend of the intensity and stage of the parasitic infection (Gabrashanska et al., 2008; Breshahen & Tanumihardjos, 2014).

A decrease in the content of all studied liver trace elements is strongly expressed in the DENA-treated animals (Group III). It is possible due to the direct toxic effect of DENA. Other authors report a decreased level of Se in children with malignant tumors (Shabanov, 1981). Se-supplementation reduces oxidative stress in DENA-induced carcinoma in rats (Mohamed et al., 2011).

There are no literature data available for changes in the trace elements content in animals subjected to combined treatment with *F. hepatica* and DENA.

Our present study shows that the combined effect of the two pathogenic factors (Group IV) statistically changes but does not aggravate the status of the liver trace elements content. The Mo, Rb, Br and Cu contents are near to the control or slightly increased. The highly increased quantity of the liver Cu in this group may be discussed as a possible mechanism by which the inhibition of the DENA-induced liver carcinogenesis at the background of the chronic fasciolosis is realized, which has been established earlier (Tsocheva, 1986).

The low values of Zn, Fe and Co in this group show a disturbance of the oxidant-antioxidant processes in the liver cells and the increased permeability of the cell membranes (Evans & Halliwell, 2001). These data correlate with the structural changes in the hepatocytes in Group IV which have been established earlier (Tsocheva et al., 1988).

Our previous data show a stronger decrease of some liver drug metabolism parameters (heme, cyt b5, cyt. P450, etc.) After combined effect of chronic fasciolosis and DENA intoxication compared to the cases of their independent action (Tsocheva et al., 1992). These results correlate with the present data about the lowest Fe content in the rat liver in Group IV.

Conclusions

The results we obtained point that the combined effect of chronic fasciolosis and DENA intoxication leads to a specific mineral imbalance, which may take place in the pathogenesis of the fasciolosis and chemical carcinogenesis interaction.

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