Electrochemical Methods for Study of Influence of Selenium Nanoparticles on Antioxidant Status of Rats

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The aim of the experiment was to determine the effect of selenium nanoparticles (SeN) and selenium nanoparticles bound with glucose (SeN-GLU) on the antioxidant status of rats. The rats were fed with two defined forms of selenium nanoparticles for ten days. The first experimental group (n=6) was dosed with SeN solution (0.06 mg of Se per kg of body weight / day). The second experimental group (n=6) was dosed with SeN-GLU (0.06 mg of Se and 0.3 mg of glucose per kg of body weight / day). In both experimental groups, the antioxidant activity was decreased in rat plasma and increased in liver, when measured using the both free radicals (FR) and Ferric Reducing Antioxidant Power (FRAP) method. Electrochemical technique (differential pulse voltammetry-DPV) was applied to analyze the content of metallothionein (MT) and heavy metals. The reduced and oxidized forms of glutathione were analyzed by high performance liquid chromatography with electrochemical detection (HPLC-ED). In the analysis of whole blood, a significant increase of reduced glutathione (GSH) by 41% ($P < 0.05$) was observed in the SeN-GLU group compared with the control group. Higher levels of GSH were also observed in the SeN group by 12%, but without any statistical significance. On the other hand, a smaller increase in oxidized glutathione (GSSG) by 22% ($P < 0.05$) was observed for the SeN-GLU group and an insignificant decrease by 13% was recorded for the SeN group which implies

increased GSH/GSSG ratio and higher antioxidant activity for both SeN-GLU and SeN groups in the whole blood. In the assessing of GSH in erythrocytes, a linear increase was observed for each group. An increase by 14% in the SeN group and a significant increase by 19% ($P < 0.05$) in the SeN-GLU group of rats was recorded. The amount of GSSG was the highest in the SeN group (an increase by 21%). In the liver, decrease in both forms of glutathione was observed. MT values were significantly higher in erythrocytes, plasma and liver in the groups with addition of SeN and SeN-GLU, which again implies higher antioxidant activity. The levels of zinc and copper were not significantly changed in the plasma or in the liver. From these results, it is apparent that SeN and SeN-GLU may be considered as an alternative source of selenium for improving of antioxidant status of the animal organism, which is characterized by high usability.

Keywords: selenium nanoparticles; antioxidant; rat; animal nutrition; selenium; supplementation

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