EFFECT OF SULFUR COMPOUNDS AND URANIUM ON THE DISTRIBUTION OF Se IN MICE STUDIED BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS

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The incorporation of Se into some mice organs after injections of seleno-cystamine [(Se-Cta)₂] in the presence of glutathione, cysteine, methionine, cysteamine, 6-mercaptopurine, 2-mercaptopurine and UO₂⁺ has been studied. Variations in the Zn, Rb, Co, Fe and Hg contents were determined in all examined organs after intraperitoneal injections with the above compounds. Instrumental neutron activation analysis was applied as the analytical method. It was found that injected compounds affect the Se-distribution in the organs examined. Single applied intraperitoneal injection of (Se-Cta)₂ or UO₂⁺ lead to variations in the Zn, Rb, Co, Fe and Hg contents in mice organs.

Introduction

The chronic selenosis caused by various organic forms of Se, such as seleno-cystine [(CySe)₂], selenodiglutathione [(GS)₂ Se] or seleno-methionine (Se-Met), can presumably be at least partially explained by their eventual catabolism to selenite.¹⁻³ Organic Se-compounds, are rapidly metabolised via selenohydryl intermediates.³⁻⁶ In view of the early works⁵,⁷ it is well known that selenohydryl groups (like selenite) are highly effective in reactions with monothiols and dithiols, apart from their high affinity for metals.⁵ The reactions with thiols or dithiols lead to Se-products which have differential toxic effects on cells in vitro.²,⁴ Indeed, a strong inhibition of protein synthesis of 3T 3-f cells has been observed by (GS)₂ Se in vitro.⁴ The authors suggest that (GS)₂ Se acts by inserting a Se atom between two thiol groups of the protein.²,⁴ More recently, studies indicated that the incorporation of Se into some organs of high animals is greatly affected by the presence of thiol compounds.⁶,⁸⁻¹⁰ Furthermore, the incorporation efficiency of Se into organs depends upon both the chemical form of sulfydryl and selenium compounds.⁸,¹⁰ Considering the above mentioned facts we found it reasonable to study the incorporation efficiency of Se [as selenocystamine (Se-Cta)₂] in some organs of mice as dependent upon the chemical form of i.p. injected sulfur compounds.
Moreover, the efficiency of Se incorporation into mice organs after injection of (Se–Cta)\(_2\) and thiols was compared with the efficiency of Se incorporation after injection of thiols and other Se compounds. It was the purpose of this study to examine whether uranyl ion (as an oxidant of thiol groups) affects the incorporation yield of Se (as (Se–Cta)\(_2\)) in some organs of mice. Changes in the content of Zn, Co, Fe, Rb and Hg were determined after i.p. injection of (Se–Cta)\(_2\) and uranyl ions (UO\(_2^+\)). Instrumental neutron activation analysis was applied as the analytical method due to the advantages of sensitivity and a chemically non-destructive procedure.

**Experimental**

Seleno-cystamine (Se–Cta)\(_2\) and 2-mercapto-purine (2-MP) were purchased from Sigma. Cysteine (CySH), methionine (Met), cysteamine (Cta) and U\(_2\)(CH\(_3\)COO)\(_2\) \(\cdot\) 2H\(_2\)O were obtained from Merck A. G., glutathione (GSH) was obtained from Reanal. The other chemicals: RbCl, Co(NO\(_3\))\(_2\) \(\cdot\) 6H\(_2\)O, Zn(NO\(_3\))\(_2\) \(\cdot\) 6H\(_2\)O, FeSO\(_4\) \(\cdot\) 7H\(_2\)O and Hg(NO\(_3\))\(_2\) \(\cdot\) H\(_2\)O (used for preparation of standards only) and 6-mercapto-purine (6-MP) were purchased from Fluka AG, Buchs SG. Water was carefully purified by means of four distillations.

Eighty four healthy SAS/4 mice (males, aged 3 months, body weight 32 \(\pm\) 3 g) were taken for the examination. The animals were housed in metabolic cages with free access to water and standard food (Murigram, Bacutil) which contained the essential trace elements Se, Hg, Co, Fe, Zn and Rb at concentrations of 0.27, 0.8, 0.323, 175, 107 and 31 ppm, respectively. The mice were divided into twenty eight groups (three mice per group) and then i.p. injected with 100 \(\mu\)l of an aqueous solution of the appropriate compounds. In all treatments with (Se–Cta)\(_2\) solution mice were dosed with 0.08 \(\mu\)mol per mouse. In the treatments with GSH, CySH, Cta, Met and 6-MP mice were injected with a dose of 1.4 \(\mu\)mol per animal. Group dosed with 2-MP was i. p. injected with 100 \(\mu\)l of a saturated aqueous solution of 2-MP (at 298 K). In all experiments mice were killed 2.5 (groups A), 24 (groups B) and 48 hours (groups C) after injections with the above mentioned compounds (alone or together):

<table>
<thead>
<tr>
<th>Groups I</th>
<th>Groups IIA, IIB and IIC</th>
<th>Groups IIIA, IIIB and IIIC</th>
<th>Groups IVA, IVB and IVC</th>
<th>Groups VA, VB and VC</th>
<th>Groups VIA, VIB and VIC</th>
<th>Groups VIIA, VIIB and VIIC</th>
<th>Groups VIII, VIIIIB and VIIIIC</th>
<th>Groups IXA, IXB and IXC</th>
<th>Groups XA, XB and XC</th>
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</thead>
<tbody>
<tr>
<td>control group;</td>
<td>(Se–Cta)(_2);</td>
<td>UO(_2^+);</td>
<td>(Se–Cta)(_2) and UO(_2^+);</td>
<td>(Se–Cta)(_2) and GSH;</td>
<td>(Se–Cta)(_2) and CySH;</td>
<td>(Se–Cta)(_2) and Cta;</td>
<td>(Se–Cta)(_2) and Met;</td>
<td>(Se–Cta)(_2) and 2-MP;</td>
<td>(Se–Cta)(_2) and 6-MP.</td>
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