EVALUATING THE EFFECT OF VARIOUS SULFHYDRIL GROUP ACTIVATORS ON EXPERIMENTALLY INDUCED CATARACT IN TEST ANIMALS

D. Kalitzin, N. Konstantinov, N. Ivanov, L. Ivanova

Cataract is a sign of the occurrence of aging processes and atherosclerosis in the lens of the eye. On the other hand, data are available pointing to changes in the cysteine content of free sulfhydril groups of lenticular proteins during cataractogenesis (8, 9, 10, 11, 13). Recently, special attention has been focused on the role played by sulfhydril groups in the process of aging (1, 4, 12) and atherosclerosis development.

I. A. Myasnikova and A. L. Myasnikov (7, 6) proved that ascorbic acid exerts an inhibitory effect on the development of experimental atherosclerosis. A similar effect has been demonstrated under the effect of zinc ions too (2).

Proceeding from the above data, we set out to investigate the changes in sulfhydril groups of animal lenses with experimentally induced cataract, following treatment with vitamin C and biotic zinc doses (3).

Material and methods

The experiments were conducted on 68 male white rats, weighing from 130 to 170 grams, divided up in the following groups: I — control animals — 21; II — fed ordinary laboratory diet mixed up with 50 per cent glucose — 19; III — fed ordinary laboratory diet, mixed up with 50 per cent glucose, ascorbic acid and small doses zinc sulfate — 28 animals.

The rats of group II and III were subjected to a 50 per cent glucose diet for a thirty day period. The ration of the animals in group III was supplemented by 50 mg ascorbic acid and 0.22 mg zinc sulfate per rat during the last ten days. After sacrifice of the animals the lenses were promptly removed, measured in analytical balance, and homogenized with 2.5 ml distilled water. Following centrifugation for 10 min at 3000 rpm, from the supernatant were decanted 0.25 milliliters, and then diluted with 4.75 ml water. From the solution thus obtained 0.5 ml were pipetted, and mixed with 2 ml 0.2 molar solution of ammonium citrate and 0.2 ml molar solution of ammonium each, and the sulfhydril groups were demonstrated through amperometric titration with $10^{-4}$ molar solution of silver nitrate (5).

A turning platinum electrode was used for amperometric titration. Measurements and uninterrupted registration of the results were done by means of a polarographic apparatus set LP-60. A $10^{-4}$ molar solution of cysteine was employed as a standard reference electrode.
Results and discussion

The end results of the experiments described are presented in Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Controls</th>
<th>Fed 50% glucose</th>
<th>Fed 50% glucose, ascorbic acid+zinc sulfate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Lens weight in mg SH groups relative to 1 ml 10^-4 cysteine</td>
<td>60.85±0.78</td>
<td>85.89±1.79</td>
<td>92.52±1.22</td>
</tr>
<tr>
<td></td>
<td>130.68±6.67</td>
<td>142.36±6.21</td>
<td>167.41±7.14</td>
</tr>
</tbody>
</table>

Kinoschita (9) claims that the 50 per cent glucose diet accounts for a 30 to 50 per cent hydration of the lens, which is a sign of a precataract condition. On the other hand, I. A. Myasnikova and A. L. Myasnikov (7, 6) state that ascorbic acid exerts an inhibitory effect on the development of experimental atherosclerosis in rabbits fed cholesterol. The cited authors succeeded in demonstrating that the continuous administration of high doses ascorbic acid in humans decreases the elevated hypercholesterolemia and the high content of protein-lipid complexes in the blood.

A similar effect is achieved under the influence of zinc ions. According to experimental results published by a number of authors, during intravenous zinc introduction against the background of cholesterol atherosclerosis, the hypercholesterolemia is promptly reduced with ensuing protein metabolism normalization. Under the influence of zinc an inhibition of atherosclerotic changes is observed (2).

The statistical elaboration of our results leads to the following inferences:

1. Since in our experimental setup the precataract condition was induced, no statistically reliable changes were discovered upon comparison of the sulphydryl groups in lenses from animals fed glucose diet (group II) with those in the control animals (group I). Explanation of the latter fact may be sought for in the absence of sclerotic alterations in the lens, linked to the modification of the sulphydryl groups. For the presence of a precataract condition in our animals we judge from the enhanced hydration of the lens by 43.33 per cent.

2. The changes in sulphydryl groups in the animals of group III (fed glucose, ascorbic acid and zinc sulfate) display a statistically reliable increase which is in accordance with the literature data concerning antisclerotic action of ascorbic acid and zinc ions (t=3.91, P<0.01).

The influence of lens cataract on sulphydryl groups was demonstrated in a different experimental setup. The investigation was carried out on lenses, extracted from suddenly dying young persons free of cataract, and from persons with cataract lenses. A statistically reliable reduction of the sulphydryl groups by 54.35 per cent (t=3.16, P<0.01) was recorded in the cataract affected lenses. The final results of these studies are submitted in Table 2.
Evaluating the effect of various sulfhydryl.

### Table 2

<table>
<thead>
<tr>
<th>Group</th>
<th>Free of cataract</th>
<th>With cataract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of investigations</td>
<td>4</td>
<td>53</td>
</tr>
<tr>
<td>Sulfhydryl groups relative to 1 ml cysteine $10^{-4}$ m</td>
<td>$112.78 \pm 16.0$</td>
<td>$51.48 \pm 4.53$</td>
</tr>
</tbody>
</table>

Regarding the clinical implication of our results, it should be stressed that they may be used in the prophylaxis against cataract by subjecting patients with incipient cataract and cataract in the family history to diets rich in ascorbic acid and zinc.

**REFERENCES**