A single intraperitoneal injection of partially purified ginseng extract after X-irradiation of 650-675 R significantly increased the 30-day survival ratio in mice.

Death of mice occurring 10 to 20 days after whole-body exposure to ionizing radiation is primarily produced by the damages of blood-forming tissues, and is called bone marrow death. Recently, stimulating action of ginseng (roots of Panax ginseng C. A. Meyer) on rat bone marrow and other tissues have been investigated. Oral administration of a ginseng extract resulted in an increase of the number of mitotic cells both in myeloid and erythroid cells. Intraperitoneal injection of the extract also increased the rate of syntheses of serum albumin and gamma-globulin as well as DNA, RNA, protein and lipid syntheses in bone-marrow cells. Several saponins such as ginsenoside-Rb2, Rc, and Rg1, are though to be the active components of the ginseng extract.

Here we studied the restorative effect of the ginseng extract in mice given an acute dose of X-irradiation, expecting that it might protect the irradiated mice from death by increasing mitosis of the surviving bone-marrow cells.

The ginseng extract was prepared by the following procedures: (i) extraction of powdered ginseng with 0.05 M Tris-HCl buffer (pH 7.6) by stirring for 24 hrs at 4°, (ii) centrifugation of the filtrate, (iii) dialysis of the concentrated (1/4 by volume) supernatant, (iv) ammonium sulfate (70%) precipitation, (v) dialysis, and (vi) lyophilization. This preparation corresponds to fraction 3 of the purification procedure of ginseng saponin described by Oura et al.

Inbred male NIH-Swiss mice, 8 weeks old, weighing 29±2 g, were whole body irradiated with X-rays using a therapeutic X-ray generator (200 kV, 20 mA, 0.3 mm Cu+0.5 mm Al filter, 50 R/min). Within 5 min the mice were intraperitoneally injected...
with the ginseng extract dissolved in 0.2 ml of physiological saline. Mice injected without the extract were served as the control.

Table 1

<table>
<thead>
<tr>
<th>No.</th>
<th>Date of exposure</th>
<th>Dose (R)</th>
<th>Ginseng extract injected (mg)</th>
<th>30-day survival (%)</th>
<th>p b</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept. 18</td>
<td>650</td>
<td>1.0</td>
<td>33(15) a</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>2</td>
<td>Oct. 8</td>
<td>675</td>
<td>4.0</td>
<td>27(30)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3</td>
<td>Dec. 3</td>
<td>675</td>
<td>4.0</td>
<td>32(25)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

 a Number of animals.
 b Chi-square test. Yates' correction was applied.

The survival of mice in the three experiments carried out from September 1975 to January 1976 is shown in Table 1. Injection of either 1 mg of the extract after exposure to 650 R or 4 mg after 675 R diminished the incidence of death of the animals within 30 days after irradiation. Time-survival relation in the experiments 2 and 3 (cumulated) is illustrated in Fig. 1. Protective effect of the extract appeared 10 to 19 days after exposure, that is, at the time of bone marrow death.

It has been mentioned by Russian investigators that ginseng extract may improve survival of irradiated animals, although the increase in survival was rather slight.59

Fig. 1. Survival of mice exposed to 675 R of X-rays. A, saline-injected control; B, ginseng extract (4 mg per animal) injected within 5 min after exposure. Data of experiments 2 and 3 are cumulated.
This was followed by another report that rats given ginseng survived twice longer than control under continuous X-irradiation. We are not able to discuss our data further in relation to those investigations since detailed informations about these reports are not available to us.

The mechanism of the restoration with ginseng should be related to the activation of the blood-forming tissues. We are now investigating blood, spleen, and thymus of mice to which the ginseng extract was given after irradiation. The result will be reported elsewhere.

REFERENCES


