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These studies may not conform to peer review standards, Therefore, the results are not conclusive.

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# 53

## Comparison of the Toxicity of Inorganic and Natural Selenium

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### INTRODUCTION

The concentration of selenium in animal tissues is dependent on the chemical form as well as the quantity of selenium in the food. rfhis fact was discovered very early in selenium research when Smith (1) showed l\lat the retention of toxic levels of organic selenium in tqe form of grain was much greater than the retentiun of inorganic selenium in tllc form of selenite. rrhe differences in human and animal tissue accumulation of organic (native or naturally occurring) and inorganic selenium have also been obser\ed at nuuoitionallevels uf intake and reviewed by Shamberger (2). Corroborative results from our laborato- ry reported at this meeting have shown that rats have higher selenium levels in blood and liver when fed selenium yeast as compared with selenite.

Since selenium is not only a necessary element, but also toxic, there is concern that selenium may accumulate in the tissues of humans and animals fed selenium supplements, especially in the form of organic selenium. 'fhe present study was undertaken to examine this problem.

### EXPEltIMEN'r AL

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Table 1. Comparison of the Toxicities of Two Forms of Selenium Given Orally to Rats. Each group was then given orally

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TABLE 1. Comparison of the Toxicities of Two Forms of Selenium Given Orally to Rats

**Form 01** selenium

- Sodium selenite
- Sodium selenate
- Selenium yeast
- Selenium yeast ..
- Selenium yeast

Selenium dose  
(119)

80 320 640  
640 3200 6400

Selenium dose  
(mg/kg)

1.60 6.40 12.80  
10.67 47.10 94.12

. Deaths (%)

20 30 50  
0 40 100

by giving an aqueous solution of selenium in either of two forms: sodium selenite or yeast Selenium Yeast (1000 mg/kg selenium/g). The yeast is a protein hydrolysate consisting primarily of peptides and amino acids. The animals were observed for a period of 2 weeks after dosing, and the number of deaths were noted.

**RESULTS AND DISCUSSION**

The toxicity of the two forms of selenium is compared in Table 1. From these data, the LD50 can be calculated by plotting the dose (mg/kg) vs percentage of mortality on a probit plot. The results of this plot are shown in Table 20

The value for the LD50 for sodium selenite, 12.7 mg/kg, is similar to that reported in a registry of toxic substances (3), which is 7 mg/kg. The yeast has a toxicity of 3703 mg/kg, which is near that of selenourea, 50 mg/kg (3). This latter comparability is to be expected, since the selenium in the yeast is probably in an organic form, replacing sulfur in amino acids.

Our data indicate that organic selenium in the form of yeast is less toxic than inorganic selenium in the form of sodium selenite. This seems to contradict long-term studies of selenium fed at nutritional levels in which organic selenium is more absorbed and retained than

TABLE 2. Calculation of LD<sub>50</sub> for Two Forms of Selenium Given Orally to Rats

Form of selenium

Correlation coefficient

5:1. Toxicity of INORGANIC AND NATURAL S-

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selenite. The answer to this paradox may lie in the recent work of Levander *et al.* (4), who found that inorganic selenium was much more rapidly absorbed than yeast selenium in a long-term human study. Thus, the lower toxicity of the yeast selenium may be due in part to its slower absorption relative to selenite. Another explanation is that yeast selenium may be more slowly converted than selenite to a toxic form.

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Sodium selenite Selenium yeast

1266 37.33

0.9989 09676