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(';'r.\.. E. I~.. AII:I\";I,v. W. 'I.. ;lnd"Miller. M.)[Ii3. L"liliz;ltion of different forms of dietary sl!lenium. .I. Allim. Sl:i. *:Jfi. 2Hr)-2!I~.*
(;i~,;el.Nielsen, G. I !li9. Upt:lke ;lnd trun!;lol:al iun uf selenium-75 in *Zen 1111'_\".'1.* Tel:h. Rep. Ser.-I.A.i'~.A. *2:15,* 427-4.1(i.
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These studies may not conform to peer 'eview standards, Therefore, the results are not conclusive.

53

Comparison of the Toxicity of Inorganic and Natural Selenium

J. A. ViI/SOil P. Bose

INTltODUCTION

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\1at the retention of toxic levels of organic selenium in tqe form of grain was much greater than the retentiun of inorganic selenium in tl1e 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.

EXPEltlMEN'r AL

'..

I\lale \veanlillg SlJrague-Da\\'II:!Y r:'lts \\'uru di\'ideJ into six groups uf 10 with an average \\'eight of 50 g. Each group was then given or311)'

J. A. **VINSON ,\NI) I'.** II()~I~

TABLE 1. Comparison ollhe Toxicilies of Two Forms 01 Selenium Given Orally 10 Rals

Form 01 selenium

Sodium selenite
Sodium selenile Sodium s~lenile
Selenium yeast
Selenium yeilsl ..
Selenium yeast

Selenium dose
(119)

80 320 *64(J*
640 3200 6400

Selenium dose
(mg/kg)

1.60 6.40 *12.80*
10.67 47.10 94.12

. Deaths (~o)

20 30 50
0 40 100

by ga\ragc an aqueous solution of selenium in either of two forms: sodiu111 selenite or ~r()w Company lligh Selenium Yei.lst (1000 ~!(seleniunl/g). 'fhe yeast is a protein hydrolysate consisting primarily ul' peptides i.lnd amino acids. The animals were observed for a period of 2 weeks after dosing, and the number of deaths were noted.

RESUL T5 AND DISCUSSION

The toxicity of the two forms of selenium is compared in 'fable 1. From these data, the LDso 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 \'alue for the LD511 for sodium selenite, 12.7 mg/kg, is similar to that repol'ted 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 se- lenourea, 50 mg/kg (3). This latter comparability is to be expected, since the selenium in the yeast is probably in an organic form, replac- ing 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. 'fhis 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_{50} for Two Forms of Selenium Given Orally to Rats

Form of selenium

Correlalioll coefficient

5:1. **ToXICrry** 01" **INORGANIC AND NATUR,\L S~**

51.~

selenite. The ans\ver to this paradox may lie in the recent work **of** Levander *et ai.* (4), who found that inorganic selenium was much more rapidly absorbed than yeast selenium in a long-term human stud)'. Thus, the lower toxicity of tI1e selenium yeast may be due in part **to** its
slower absorption relative to selenite. Another explanation is that tilt.' selenium yeast may be more slowly converted than selenite to a toxi, form.

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Sodium selenite Selenium yeast

1266 37.33

0.9989 09676