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RELATIVE HUMAN BIOAVAILABILITY OF SODIUM SELENITE AND HIGH SELENIUM YEAST

Background

The relative bioavailability of different forms of Selenium can be determined by either short-term or long-term experiments. In short-term experiments, the area under the blood concentration time curve is a measure of absorption of the selenium. Urine excretion indicates how rapidly the absorbed selenium is removed from the body.

The present study is designed to test the relative bioavailability of sodium selenite and a high selenium yeast using a short term experiment.

Protocol

Seven normal subjects - 4 males and 3 females, aged 18-30 volunteered with informed consent. They collected a 24 hour blank urine sample before the study. Each subject appeared 2 hours after eating breakfast. The selenium (300 µg) of selenite or yeast was drunk in 100 ml of a 10% glucose solution. First one form was given, then 5 days later the other form was ingested. Capillary blood samples were taken at 0, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 and 4.0 hours. A 24 hour urine sample was collected following selenium ingestion.

Selenium was measured following 500° overnight ashing of blood or urine with magnesium nitrate ashing acid. The samples were reconstituted nitric acid and the selenium measured by the AOAC method.

The average blood concentration before testing (0 hour) was 42.4 ± 23.0 for the sodium selenite and 46.3 ± 27.4 ng/ml for the yeast. There was no significant difference between these baseline values. A plot of the average selenium concentration vs. time for each of the two forms is shown in the following figure. As can be seen, the selenite peaks at an earlier time (1 hour) compared to the yeast (1.5 hours). After 4 hours the yeast group was back to baseline and the selenite group was below baseline. The area under each subject's curve was measured by planimeter and the results are given in Table 1. All seven subjects experienced a greater area for the yeast than the selenite. The yeast produced a 22% greater area, $p < 0.001$.

The changes in blood selenium from the baseline (0 hour) for each subject was determined, and the average results shown in Table 2. The selenite group had a significantly greater concentration after 1 hour than the yeast. However, the yeast group had a significantly greater concentration after 2, 2.5 and 4 hours than the selenite.

The urine data are shown in Table 3. Six out of the seven subjects had a greater excretion of selenium after ingestion of the selenite as compared with the yeast. The selenite produced over a two-fold greater selenium excretion, $p < 0.01$. This result, coupled with the blood data, indicates that the selenium in the yeast is returned for a longer period of time in the tissues. This conclusion is confirmed by our long term rat supplementation study which showed over a two fold greater liver concentration

following yeast supplementation as compared with selenite.

In summary, the yeast was more highly absorbed, peaked at a later time and remained in the blood for a longer period of time than the selenite. These results are in agreement with our long term animal supplementation study in which we found a greater blood selenium concentration after feeding rats yeast as compared with selenite. The urine results also corroborated the blood in that the yeast selenium was less excreted, i.e.. more retained than the selenite.

Table 1: Areas under the Blood Concentration Time Curves (Arbitrary Units).

Subject	Supplement	
	Selenite	Yeast
1	560	639
2	518	695
3	533	767
4	639	770
5	480	577
6	643	726
7	698	801
Mean \pm S.D.	582 \pm 79.3	711 \pm 79.9*

* p < 0.001

Table 2: Changes in Average Blood Concentration (ng/ml) from Baseline

Supplement	Time (hours)							
	1	1.5	2.0	2.5	3.0	3.5	4.0	
Selenite	112* (37.9)	95.0 (41.9)	59.1 (24.5)	24.1 (11.9)	12.6 (11.5)	1.1 (8.4)	-3.2 (9.2)	
Yeast	73.7 (31.0)	135 (40.3)	110** (49.0)	56.4* (36.1)	24.1 (15.4)	3.8 (8.6)	4.9* (4.8)	

* Significantly greater p < 0.05

** Significantly greater p < 0.01

Table 3: Net 24 hour Urine Excretion of Selenium.

Subject	Micrograms Selenium/24 hour	
	Selenite Blank	Yeast Blank
1	38.2	47.1
2	88.2	59.6
3	52.1	0.2
4	21.7	21.8
5	47.0	3.3
6	53.6	6.4
7	57.1	15.2
Mean \pm S.D.	51.1 \pm 20.3	21.9 \pm 22.9

Average Blood Selenium vs. Time

