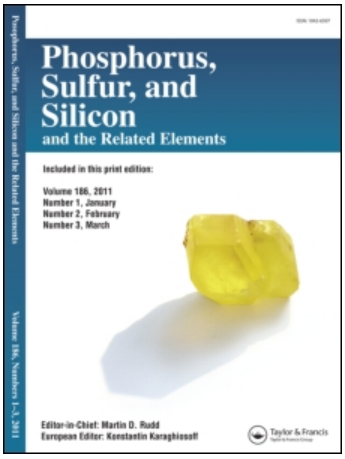


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# Renal Excretion After Peroral Administration of Tellurium to Humans

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# RENAL EXCRETION AFTER PERORAL ADMINISTRATION OF TELLURIUM TO HUMANS

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Abstract The present study was aimed to investigate the renal excretion of tellurium after oral administration in various forms to male volunteers. In a total of 12 experiments on 5 healthy subjects tellurium was given as sodium tellurate, sodium tellurite, metallic colloid, and intrinsically bound in cress. Tellurium concentrations were measured by means of graphite furnace atomic absorption spectroscopy. From the cumulated tellurium concentrations in the first four days a mean percentage intestinal absorption of 28% ± 11% was calculated. The introduction of tellurium to cress did not alter the intestinal absorption significantly. For metallic tellurium the intestinal uptake was about 15%. The renal excretion is faster after administration of the hexavalent tellurium than after ingestion of tetravalent form.



## INTRODUCTION

Tellurium ranks among the rare non-essential trace elements and there is only little known of its intestinal absorption and its metabolic behaviour in humans. Data for risk evaluations needed for occupational medicine are based on animal experiments only. It was the aim of the present study to investigate the renal excretion of tellurium after oral administration to healthy male volunteers.

## MATERIALS AND METHODS

A total of 12 experiments were performed on 5 healthy male volunteers (age: 28 - 44 years) who had given their informed consent. The tellurium was administered to the subjects on an empty stomach. In four experiments (#1-#4) on

3 volunteers 26 to 57 µg of tellurium as tellurate were administered, in one experiment (#5) 15 µg was given as tellurite, and three volunteers received 25 to 40 µg of tellurium as metal (powdered, particle diameter: about 1 µm, #6-#8). In these experiments the tellurium was swallowed in about 100 ml of table water.

In order to provide organically bound tellurium, cress was cultivated on a tellurium solution[1]. About 15 g of cress leaves, containing 18 to 55 µg intrinsically bound tellurium, were harvested and administered in experiments #9 to #12. Whereas in experiments #9 -#11 the raw cress was given, in experiment #12 a dressing of olive oil, vinegar, salt, and pepper was added.

Urine samples were collected immediately before and during the first three to four days after the ingestion. The tellurium concentrations in urine and cress were measured by means of atomic absorption spectrometry using a graphite furnace (Perkin Elmer, PE 2380, HGA 500)[2]. Prior to the measurement a preparation of the biological material was necessary. Samples with a dry weight of less than 100 mg were wet ashed with 0.7 ml of concentrated nitric acid in a pressure bomb system[3]. The obtained solution was dried and redissolved in 400 µl of 6molar HCl. The tellurium was extracted with 150 µl of isobutyl methyl ketone. Aliquots of 20 µl of the IBMK were analyzed directly by atomic absorption spectroscopy[4].

The cumulated tellurium excretion was calculated from the measured tellurium concentrations and the respective volumes of the urine samples. Assuming 1) that there is no long term storage of tellurium within the organism, 2) that renal excretion is the predominant route of excorporation (75%)[5,6,7,8] and 3) that after a certain time $t_f$ the excretion rate of tellurium is a monoexponential function of time, the fractional intestinal absorption $F_1$ can be estimated from

$$F_1 = 4/3 * Q_u(t_{inf})$$

with the cumulated excretion for time to infinity $Q_u(t_{inf})$, calculated from the time course of renal excretion according to

$$Q_u(t>t_f) = Q_u(t_f) + (Q_u(t_{inf}) - Q_u(t_f) * (1 - e^{-\ln 2 * t/t_{1/2}})$$

applying the best fit of the experimental data to this equation.

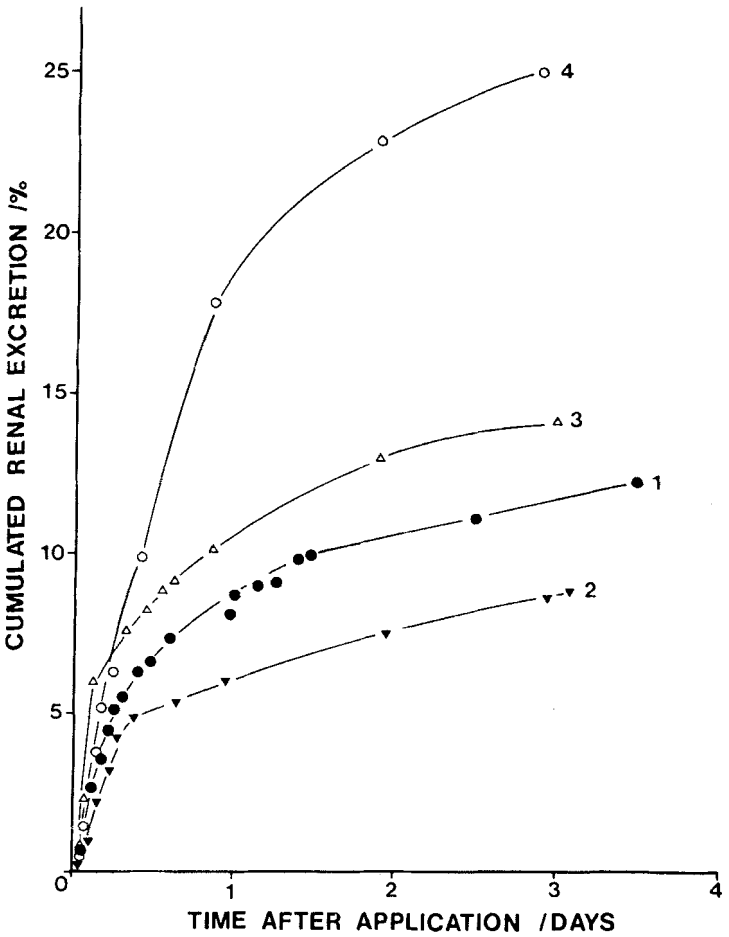


FIGURE 1 Cumulated renal excretion after oral administration of sodium tellurate

## RESULTS AND DISCUSSION

The cumulated excretion for all experiments is shown in figures 1 - 4. Fractional intestinal absorption from tellurate (#1 - #4) was calculated to be 28% ± 11%. For metallic tellurium (#6 - #8) the absorbed fraction amounted to 16% ± 3%. After the ingestion of tellurium bound to

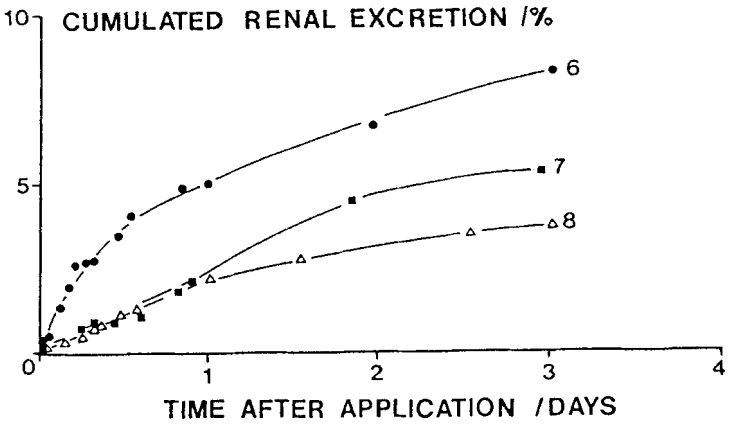


FIGURE 2 Cumulated renal excretion after oral administration of metallic tellurium

cress a delayed excretion of tellurium was observed as compared to tellurate. This indicated the retarded absorption of tellurium in the organic matter. Intestinal absorption was not significantly lowered (26% ± 10%), however in the particular study, with the dressing intestinal uptake was about only 10%. In contrast to these experiments no bending down of the cumulated excretion could be observed after the ingestion of tetravalent tellurium until the 4th day after administration. Therefore, it was not useful to calculate intestinal absorption from these figures. Since the excretion of tellurite is slower than that of tellurate, the retention may be longer for tellurites than for tellurates. This can explain the higher toxicity of the tetravalent tellurium compounds found in animal experiments.

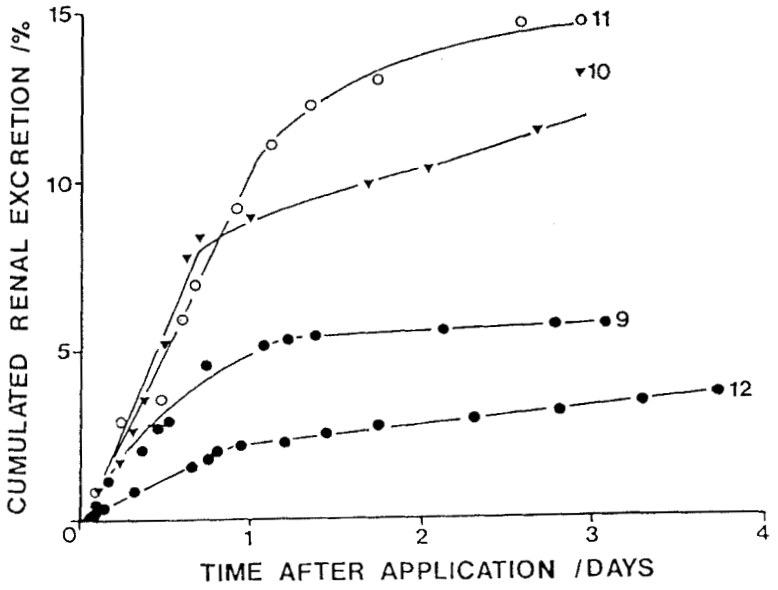


FIGURE 3 Cumulated excretion after oral administration of tellurium intrinsically bound to cress

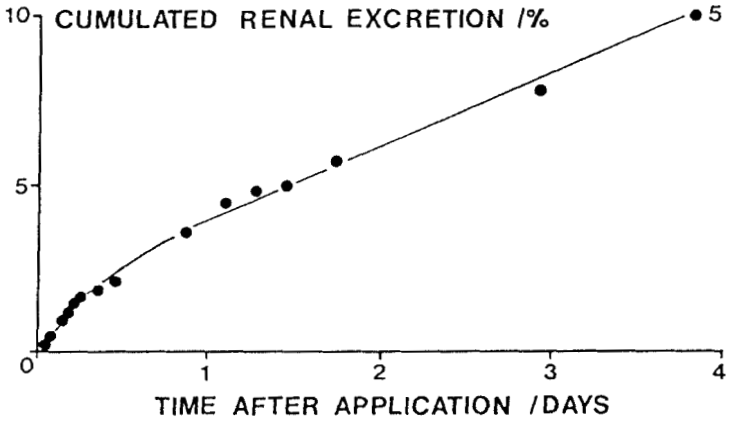


FIGURE 4 Cumulated excretion after oral administration of sodium tellurite

REFERENCES

1. T. Kron, Ch. Hansen, and E. Werner, in Current trends in trace element research, edited by G. Chazot (Smith Gordon, London, 1989) pp. 86-88.
2. H.W Sinemus, M. Melcher, and B. Welz, At. Spectroscopy, 2, 81 (1981).
3. L. Kotz, G. Kaiser, P. Tschöpel, and G. Tölg, Z. Anal. Chem., 260, 207 (1972)
4. T. Kron, Ch. Hansen, and E. Werner, in CAS 5. Colloqium Atomspektrometrische Spurenanalytik, edited by B. Welz, (Perkin-Elmer GmbH, Überlingen, 1989)
5. J.G. Hollins, Health Phys., 17, 497 (1969).
6. I.Y. Moskalev, Med. Radiol., 5, 54 (1960).
7. V. Slouka, Sb. Ved. Pr. VDLDU Hradci Kralove, 47, 3, (1970).
8. P.L. Wright, M.C. Bell, Am. J. Physiol., 210, 6 (1966)