SHORT COMMUNICATION

Distribution of $^{31}$Silicon-Labeled Silicic Acid in the Rat

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ABSTRACT

Carrier-free $^{31}$Silicon ($^{31}$Si) prepared by neutron activation, was injected in the form of $^{31}$Si-labeled silicic acid into five albino male rats, and the organ and tissue distribution of labeled silicic acid was determined at sacrifice after 30 min. The kidney was found to contain 0.85% of the injected dose (ID) per gram of tissue; skin had 0.3% ID/G; testes 0.29; bone 0.26; liver 0.22; and brain 0.13. When expressed as % ID/organ, voluntary muscle had 14.6%; skin 10.8; bone 3.4; liver 1.6; kidneys 1.5; testes 0.8, and brain 0.2. These results indicate the need for further research into silicon metabolism in kidney, skin, bone, and brain.

Index Entries: $^{31}$Silicon-labeled silicic acid, distribution of in rat; silicon metabolism; tissue distribution; silicic acid; $^{31}$silicon.

INTRODUCTION

Little is known about the metabolism of silicon (Si) in the rat; it has been found to be an essential element (1) present in liver mitochondria (2). In experimental disease states, Si is present in renal calcifications (3)

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and in increased amounts in the brain of dialysis patients. Work on the understanding of Si has been hampered by the difficulties of measuring this trace element in biological fluids, principally because of important matrix effects, but this has been largely solved by use of electrothermal atomic absorption techniques with ultrafiltrates of diluted plasma and the use of high dilutions of urine (4). Studies have also been hampered by the lack of availability of a suitable radioisotope. This has been solved by the preparation by two of us (ZA and AK) of the radioisotope $^{31}\text{Si}$ as a pure carrier-free tracer. This isotope has enabled us to determine the organ distribution of intravenously injected $^{31}\text{Si(OH)}_4$.

**METHODS**

$^{31}\text{Si}$ was prepared by us from ammonium phosphate by neutron bombardment in the atomic research reactor of the University of Tel Aviv. The isotope was separated from phosphate ($^{31}\text{P}$ and $^{32}\text{P}$) by column chromatography and was 97% pure. The isotope was converted to silicic acid at pH 7.4 (Alfassy and Kushelevsky, to be published). Five male rats of the Weitzman Institute strain, weighing 212.8 ± 3.5 g (mean ± SD) were deprived of food for 16 h and of fluids for 9 h prior to the experiment. The five rats were each given an intracardiac injection, $2 \times 10^6$ cpm of $^{31}\text{Si}$, as silicic acid, with pH adjusted to 7.4. After 30 min, the animals were killed by exsanguination by intracardiac aspiration of blood by syringe under ether anesthesia. The following organs were then rapidly dissected out and weighed on a torsion balance: heart, liver, kidneys, brain, testes, right femur, spleen, and quadriceps femoris muscle and a portion of the abdominal wall skin. Aliquots of 0.5 g of each organ was dissolved in 0.5 mL concentrated nitric acid, then an aliquot was added to Instagel® combined emulsifier/fluor and counted in a liquid scintillation counter. Correction for quenching was obtained by use of added internal $^{31}\text{Si}$ standards. Results were expressed as % injected dose/g wet weight of tissue and as % injected dose/organ. In the case of kidneys and testes, the results were expressed as % injected dose/2 organs. The weight of organs, such as skin, muscle, and bone, was derived from previously published data (5). Results were expressed as mean ± SD.

**RESULTS**

The percentages of injected $^{31}\text{Si}$, expressed, both per gram of the various organs and per organ are given in Table 1.

**Percentage of Injected $^{31}\text{Si}$/$G$ of Tissue**

Kidney was the organ with the highest $^{31}\text{Si(OH)}_4$ concentration, followed by muscle, skin, testes, bone and liver, heart, and spleen; brain