



**INE** | INSTITUTE OF  
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ENDOCRINOLOGY

## Micronutrients: Strontium

Dr. Ritamarie Loscalzo

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### Strontium General Info

- ✓ Silvery metal, non-radioactive element
- ✓ About 99% of the strontium in the human body is concentrated in the bones
- ✓ Radioactive strontium-89 is given intravenously for prostate cancer and advanced bone cancer
- ✓ Strontium chloride is the most common form of strontium found in dietary supplements
- ✓ Body contains 320 to 400 mg of strontium



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# INE: Micronutrients - Minerals: Strontium

## Strontium Uses/Functions

- ✓ Strontium chloride hexahydrate is added to toothpaste to reduce pain in sensitive teeth
- ✓ Strontium ranelate can increase bone formation and prevent bone loss when used in postmenopausal women with osteoporosis
- ✓ A radioactive form of strontium may kill some cancer cells
- ✓ Might boost the formation of collagen and cartilage in joints
- ✓ Fewer dental caries (cavities) in some population groups who drink public water that contains relatively high levels of strontium



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## Strontium Safety

- ✓ Strontium is **LIKELY SAFE** when taken by mouth in amounts found in food; the typical diet includes 0.5 to 1.5 mg/day of strontium
- ✓ The prescription form of strontium, known as strontium-89 chloride, is also **LIKELY SAFE** when given intravenously (by IV) under the supervision of a healthcare provider
- ✓ Toothpastes (Sensodyne-SC) that contain strontium are also **LIKELY SAFE** and have received safety approval from the U.S. Food and Drug Administration (FDA)
- ✓ Taking another prescription form of strontium known as strontium ranelate by mouth for up to 56 months is **POSSIBLY SAFE**; strontium ranelate might cause side effects such as stomach pain, diarrhea, and headache in some people
- ✓ Taking very high doses of strontium by mouth is **POSSIBLY UNSAFE**; High doses of strontium might damage the bones



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## Strontium Precautions & Warnings

- ✓ **Paget's disease (a bone disease):** The bones of people with Paget's disease seem to take up more strontium than normal
- ✓ **Kidney problems:** Strontium is eliminated by the kidneys and can build up in people with poor kidney function
- ✓ **Blood clotting disorders:** Strontium ranelate is associated with a small increased risk of blood clots



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### Strontium Precautions & Warnings: Pregnancy

- ✓ **Pregnancy and breast-feeding:**  
Strontium is **LIKELY SAFE** during pregnancy and breast-feeding when taken by mouth in food amounts or when used in toothpaste (Sensodyne-SC)
- ✓ Strontium-89 is **LIKELY UNSAFE** during pregnancy and breast-feeding; it's a radioactive material that might harm the fetus; may also pass into breast milk and could harm a nursing infant



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### Strontium and Bone Strength

- ✓ Strontium increases bone density and both trabecular and cortical strength, making bones denser and thicker, but they lack ductility and tensile strength
- ✓ Tensile strength is the ability of a material to resist stretching and pulling and is different from compressive strength
- ✓ Compressive strength is the ability to resist compression or crushing
- ✓ Bone compressive strength is always much greater than tensile strength; tensile strength must therefore be of primary concern



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### Strontium Mayo Clinic Study

- ✓ 22 individuals with severe (and painful) osteoporosis
- ✓ Part of the group took 1,700 milligrams of strontium daily
- ✓ Another group took the same amount of strontium with estrogen and testosterone
- ✓ In the "hormones plus strontium" group, 9 of 10 people experienced marked improvement of their symptoms, and the other one had moderate improvement
- ✓ In the strontium-only group, 18 of 22 had marked improvement, and the other four had moderate improvement



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### Strontium Osteoporosis Research

In a three-year, randomized, double-blind, placebo controlled study using 680 milligrams of strontium daily, women suffering from osteoporosis had a **41 percent reduction in vertebral fractures** compared with placebo. The overall vertebrae density in the strontium group increased by 11.4 percent compared to a 1.3 percent *decrease* in the placebo group.

*Strontium Ranelate Reduces the Risk of Nonvertebral Fractures in Postmenopausal Women with Osteoporosis: Treatment of Peripheral Osteoporosis (TROPOS) Study. J Clin Endocrinol Metab. 2005 May; 90(5):2816-22. Epub 2005 Feb 22.*



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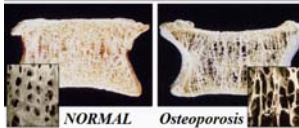
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### Strontium Osteoporosis Research

✓ 353 women who had already experienced at least one osteoporosis-related vertebral fracture took varying levels of strontium ranelate or a placebo. In the group who took 680 milligrams of strontium daily, there was a **3% increase in lumbar bone mineral density per year**, significantly greater than placebo. At the end of the second year of the study, there was a significant decrease in fractures in the strontium group compared to placebo.



**NORMAL** **Osteoporosis**

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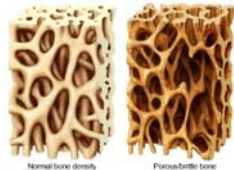
### Strontium Osteoporosis Research

✓ 2002 randomized, double-blind, placebo-controlled trial

✓ 160 post-menopausal females who did not have osteoporosis were asked to take a placebo or varying amounts of strontium daily

✓ Compared to the placebo group, women who took 340 milligrams strontium a day had a **significant increase in bone mineral density in two years' time**

✓ All groups also took 500 milligrams of calcium daily, but no hormones or vitamin D



**Normal bone density** **Porous bone**

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## INE: Micronutrients - Minerals: Strontium

### Adverse Effects of Strontium

- ✓ Nausea
- ✓ Skin irritation
- ✓ Blood clots
- ✓ Fainting
- ✓ Strontium competes with calcium absorption
- ✓ Strontium causes the outer cortical bone to become thicker, actually reducing tensile strength; this increases the risk of fractures
- ✓ Strontium is denser than calcium; it is difficult to assess actual bone improvement in a DEXA scan



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### Strontium Supplementation

**Prevention: 200-400 mg per day**

- ✓ Strontium citrate
- ✓ Strontium lactate
- ✓ Strontium carbonate
- ✓ Strontium gluconate
- ✓ Strontium ranelate: a prescription drug where the ranelate molecule is a patentable synthetic chemical
- ✓ Strontium chloride
- ✓ Strontium sulfate



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### Food Sources of Strontium

- |                          |                   |
|--------------------------|-------------------|
| ✓ Unrefined whole grains | ✓ Beans           |
| ✓ Seafood                | ✓ Celery          |
| ✓ Spinach                | ✓ Root vegetables |
| ✓ Lettuce                | ✓ Spices          |
| ✓ Carrots                | ✓ Leafy greens    |
| ✓ Peas                   |                   |



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### Strontium Resources: 1



- ✓ Greenwood, Norman N.; Earnshaw, Alan (1997). Chemistry of the Elements (2nd ed.). Butterworth-Heinemann. p. 112. ISBN 0-08-037941-9.
- ✓ <http://www.drRitamarie.com/go/StrontiumDemystified>
- ✓ Boivin, Deloffre, Perrat, et al.. Strontium distribution and interactions with bone mineral in monkey iliac bone after strontium salt administration" Journal of Bone and Mineral Research. 11:1302-1311. 1996.
- ✓ Jiang, Arlot, Genant, et al.. "Histomorphometric and  $\mu$ CT analysis of bone biopsies from postmenopausal osteoporotic women treated with strontium ranelate." Journal of Bone and Mineral Research.Feb; 23 (2): 215-22. 2008
- ✓ Picking a bone with contemporary osteoporosis management: Nutrient strategies to enhance skeletal integrity. Clinical Nutrition (Epub ahead of print, 2006 October 12).



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### Strontium Resources: 2



- ✓ The effects of strontium ranelate on the risk of vertebral fracture in women with postmenopausal osteoporosis." New England Journal of Medicine 350 (2004): 459 - 68.
- ✓ Strontium ranelate reduces the risk of nonvertebral fractures in postmenopausal women with osteoporosis: Treatment of Peripheral Osteoporosis (TROPOS) study. Journal of Clinical Endocrinology and Metabolism 90 (2005):2816 - 22.
- ✓ Strontium in Finnish foods. International Journal for Vitamin and Nutrition Research 52 (1982): 342 - 50.
- ✓ Gaby AR. Preventing and Reversing Osteoporosis. Rocklin, CA: Prima Publishing, 1994, 85-92 [review].
- ✓ Strontium ranelate: a dual mode of action rebalancing bone turnover in favour of bone formation. Curr Opin Rheumatol. 2006 Jun;18 Suppl 1:S11-5.



<http://www.drRitamarie.com/go/StrontiumEfficacySafety>

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