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Silicon

DESCRIPTION

Silicon is a non-metallic element with atomic number 14 and symbol Si. In the periodic table, it is in the same group as carbon and is carbon's closest relative. Silicon is, next to oxygen, the most abundant element in the earth's crust and is found in plants, animals and in most living organisms.

Silicon is not currently considered an essential nutrient for humans. Silicon deficiency states have been reported in chicks and rats, and silicon is an essential nutrient for some plants. Chicks fed silicon-deficient diets are found to have abnormalities in their skulls and long bones. Abnormalities include poorly formed joints, defective endochondral growth and defective articular cartilage. Bone and cartilage abnormalities have also been found in rats fed silicon-deficient diets. In these animals, silicon appears to be involved in collagen and glycosaminoglycan formation. Silicon may play such a role in other animals, including humans, but this has not yet been established. Silicon has also been reported to inhibit experimental atheromas induced by an atheromatous diet in rabbits.

Daily dietary intake of silicon in the United States ranges from approximately 20 to 50 milligrams. The richest sources of silicon are cereal products and unrefined grains of high fiber content. Significant amounts of silicon in the diet occur in the form of silicon dioxide (silica), which is poorly absorbed. Animal foods are low in silicon.

Magnesium trisilicate is frequently used as an antacid, either alone or in combination products. In the stomach, magnesium trisilicate is converted to silicon dioxide and magnesium chloride.

ACTIONS AND PHARMACOLOGY

ACTIONS

The actions of supplemental silicon are not known.

PHARMACOKINETICS

Little is known about the pharmacokinetics of supplemental and dietary silicon in humans. There is great variability in the absorption of the various forms of silicon in the diet. Most forms of dietary silicon are poorly absorbed. Most of the silicon food additives are hardly absorbed at all. Silicon dioxide or silica is more poorly absorbed than orthosilicic acid, which is formed by the hydration of silicon dioxide. The mechanisms of silicon absorption are unknown. Silicon is not bound in plasma, where it is believed to exist almost entirely as monomeric silicic acid. Most of the silicon in the body is found in connective tissues, such as in bone, tendons, the trachea, the aorta, skin, hair and nails. Absorbed silicon is mainly excreted in the urine.

INDICATIONS AND USAGE

There is, at present, insufficient evidence to support any indication for the use of supplemental silicon. A very preliminary animal study suggests that it might have some positive impact in atherosclerosis. There is very preliminary evidence suggesting that silicon supplementation might play a positive role in bone health.

RESEARCH SUMMARY

It has been hypothesized that lack of silicon may play a role in the etiology of atherosclerosis. Intravenous administration of silicon inhibited experimental atheromas in an animal model, making atheromatous plaques fewer in number and the lipid deposits more superficial. This research was conducted many years ago and needs follow-up.

Silicon deficiency has been associated with bone defects in various animals. Silicon supplementation has inhibited bone mass loss in ovariectomized rats. Little is known about the role of dietary silicon in bone health in humans. It has been reported, however, that dietary silicon correlated positively and significantly with bone mineral density at all hip sites in men and premenopausal (but not postmenopausal) women in a cross-sectional, population-based study involving 2,847 participants (Framingham Offspring cohort). This previously unrecognized association is being further explored in continuing research.

CONTRAINDICATIONS, PRECAUTIONS, ADVERSE REACTIONS

CONTRAINDICATIONS

Known hypersensitivity to a silicon-containing product.

PRECAUTIONS

There are reports of high doses of silicon intake, usually in the form of the antacid magnesium trisilicate, causing siliceous renal calculi. Those who form renal calculi should be cautious about the use of supplemental silicon.

ADVERSE REACTIONS

High doses of silicon have been reported to form siliceous renal calculi.

INTERACTIONS

Silicon may inhibit aluminum absorption.

OVERDOSAGE

No reports of overdosage.

DOSAGE AND ADMINISTRATION

There is not sufficient data to set dietary reference intakes (DRIs), including tolerable upper intake levels (UL), for silicon.

Silicon is available in multivitamin preparations, usually in the form of silicon dioxide or magnesium trisilicate, typically at doses of about 2 milligrams. Supplemental silicon is also available as orthosilicic acid. The stems of the herb horsetail (*Equisetum arvense*) are rich in silicon dioxide. *Equisetum* is also used as a homeopathic remedy. Silicon may be found in colloidal or liquid minerals.

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Sodium Alginates and other Phyco-Polysaccharides

DESCRIPTION

The algal plants or seaweeds are classified into four principal groups: the green algae or *Chlorophyceae*, the blue-green algae or *Cyanophyceae*, the brown algae or *Phaeophyceae*, and the red algae or *Rhodophyceae*. The study of algae is called phycology. The brown and red algae are important commercially because of their polysaccharide content. These phyco-polysaccharides have broad applications in foods, pharmaceuticals and cosmetics, and as nutritional supplements. Agar and carrageenan are extracted from various types of red seaweeds, and algin is derived from brown seaweeds.

Agar is comprised of two major polysaccharides, neutral agarose and charged agaropectin. Both of these polysaccharides are composed of linear chains of alternating beta-D-galactose and 3,6-anhydro-alpha-L-galactose residues. These polysaccharides are resistant to digestion by intestinal digestive enzymes. Agar is also known as agar-agar. Agar is marketed in flakes and powder form and is commonly used to replace gelatin in various recipes. Agar is sometimes used to promote bowel regularity.

Carrageenans are polysaccharides also derived from certain red seaweeds. They are polysulfated, straight-chain galactans comprised of residues of D-galactose and 3,6-anhydro-D-galactose. The principal carrageenans are called kappa-carrageenan, lambda-carrageenan and iota carrageenan. Carrageenans are also resistant to digestion by intestinal digestive enzymes. Carrageenans have been reported to lower cholesterol levels in animals and also to have antiviral activity against some membrane-containing viruses in culture.

Algin is a polysaccharide derived from the brown seaweeds or *Phaeophyceae*. Algin is present in these organisms as a mixed salt (sodium, potassium, calcium, magnesium) of alginic acid. Alginic acid is a high molecular polymer comprised of two types of uronic acid residues, beta-D-mannuronic acid and its C₅ epimer alpha-L-guluronic acid. The uronic acids are simple monosaccharides in which the primary hydroxyl group at C₆ has been oxidized to the corresponding carboxylic acid. For example, D-mannuronic acid is derived from D-mannose.