

Iodine in Health and disease

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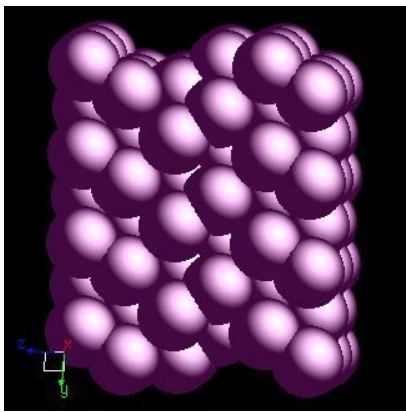
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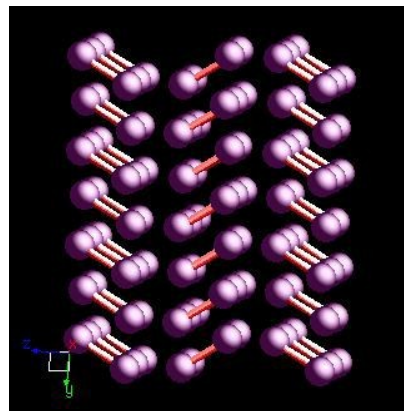
Historical perspective

Iodine was accidentally discovered in burnt seaweed by B. Courtois in 1811, and was first isolated by Fyfe in 1819. In 1896, E. Baumann discovered that the thyroid gland, when compared with the other tissues, was very rich in iodine. In 1917, Drs Marine and O. P. Kimball conclusively proved the value of iodine both in preventing and curing simple goiter. Iodine is grayish-black in color. When heated, it yields corrosive fumes of a rich violet color. Iodine, also referred to as iodide, and is a trace mineral necessary for thyroid gland function and development.

Microscopic representation of iodine



Atomic structure of Iodine



Natural source

The oceans are the most important source of natural iodine in the air, water, and soil. Iodine in the oceans enters the air from sea spray or as iodine gases. Once in the air, iodine can combine with water or with particles in the air and can enter the soil and surface water, or land on vegetation when these particles fall to the ground or when it rains. Iodine can remain in soil for a long time because it combines with organic material in the soil. Plants that grow in the soil can also take it up. Cows or other animals that eat these plants will take up the iodine in the plants. Iodine is also in cow and goat milk. Iodine is in some bread because it is added to flour to condition bread dough for baking.

Iodine that enters surface water can reenter the air as iodine gases. Iodine can enter the air when coal or fuel oil is burned for energy; however, the amount of iodine that enters the air from these activities is very small compared to the amount that comes from the oceans. Iodine is in ocean fish, shellfish, and certain plants that grow in the ocean (kelp).

Most of the iodine that enters our body comes from the food that we eat. A smaller amount comes from the water that we drink. Iodine that leaves our body each day is usually replaced by the iodine that we eat and drink, so the amount of iodine in our body is just enough to keep us healthy. Lobster, milk, mushrooms, nutritional yeast, oysters, canned salmon, salted nuts and seeds, saltwater fish (cod, haddock, and herring), sea salt, seaweed, shrimp and table salt are rich sources of iodine.

Use of iodine

Iodine has many uses. Iodine is necessary to form thyroid hormones, which regulate the body's metabolism. It also promotes normal cell function, keeps skin hair and nails healthy and is important for overall growth and development. It is used as a disinfectant for cleaning surfaces and storage containers. Iodine is also used in skin soaps and bandages, and for purifying water. Iodine is used in medicines. Iodine is added to food, such as table salt, to ensure that all people have enough iodine in their bodies to form essential thyroid hormones. Iodine is put into animal feeds for the same reason. Iodine also helps to eliminate toxins throughout the body, and helps the body to use both calcium and silicone. Iodine is used in the chemical industry for making inks and coloring agents, chemicals used in photography, and in making batteries, fuels, and lubricants.

Radioactive iodine is used in the treatment of hyperthyroidism. But there is no proven hazard to patient or the family if given appropriate dose and all the precautions are taken. Amiodarone is a drug that is used for treating and preventing heart rhythm problems and since it contains iodine, it can interfere with thyroid function.

Iodine deficiency and Iodization

IDD (Iodine Deficiency Disorders) affects over 740 million people, 13% of the world's population; 30% of the remainder are at risk. IDD preys upon poor, pregnant women and preschool children, posing serious public health problems in 130 developing countries. Until recently iodine Deficiency was the world's most prevalent yet easily preventable cause of brain damage. Today we are on the verge of eliminating it – an achievement that will be hailed as a major public health triumph. In our country Sub Himalayan belt is the area where there is maximum iodine deficiency. With the advent of iodized salt, meeting the daily iodine requirement became nearly effortless and inexpensive in the industrialized regions. As developing nations are able to make the shift to iodized salt, their rates of iodine deficiency and the diseases associated with it have also begun to decline. The excessive consumption of certain foods like cabbage, cauliflower, and radish can cause iodine deficiency. These foods contain a substance that reacts with the iodine present in the food and makes it unsuitable for absorption.

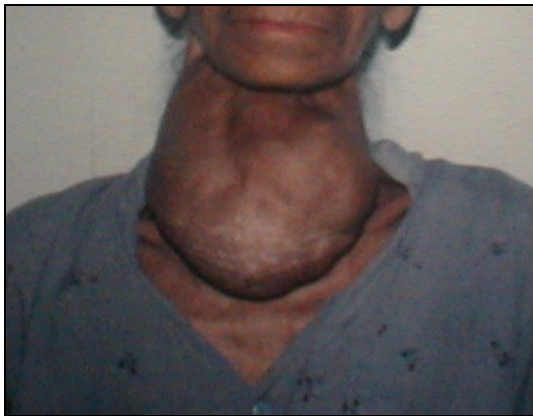
Thyroid and Iodine

Dietary iodine is absorbed from the gastro-intestinal tract into the blood. The amount of iodine present in the body of an adult is estimated to be about 25 milligrams. Most of it is concentrated in the thyroid gland, where it is stored in the form of thyroglobulin, a complex of protein and iodine. About 30 percent is removed by the thyroid gland for the synthesis of the thyroid hormone, thyroxine, and the rest is excreted by the kidneys.

These hormones play a major role in regulating processes involved in growth and development of the body, and influence the maturation of the reproductive system. Because of its influence on the thyroid's activities, iodine is also important in the basic metabolic processes and levels in the body. It helps to regulate efficient burning of calories and preventing excess calories from being stored as more fat than the body needs. It has a role in maintaining the energy level of the body and in helping the skin, teeth, nails and hair to be strong and healthy.

The thyroid gland of a child or infant is smaller than that of an adult; a child's thyroid gland will receive a higher radiation dose than an adult. Children are more sensitive to the harmful toxic effects of iodine and radioactive iodine than adults because their thyroid glands are still growing and the thyroid gland tissues are more easily harmed by radioactive iodine, and because children need a healthy thyroid gland for normal growth.

Goiter (Enlarged thyroid gland)



Brain development and Iodine

Babies and children need iodine to form thyroid hormones, which are important for growth and health. If infants and children do not have enough iodine in their bodies, their thyroid glands will not produce enough thyroid hormone and they will not grow normally. If they have too much iodine in their bodies, they may develop an enlarged thyroid gland (goiter), which may not produce enough thyroid hormone for normal growth. We also need just the right amount of iodine from our mothers before we are born. Serious iodine deficiency during pregnancy may result in stillbirths, abortions and congenital abnormalities such as cretinism, a grave, irreversible form of mental retardation that affects people living in iodine-deficient areas.

A deficiency in iodine can negatively affect the body and mind's functioning in many ways, some of which are more serious than others. The mind symptoms of iodine deficiency range from feelings of frustration and anxiety to depression. According to the World Health Organization, iodine deficiency is among the leading causes of mental retardation internationally. Physical symptoms of hypothyroidism due to iodine deficiency include dry, scaly skin, constipation, fatigue, unusual weight gain, goiters, impaired thyroid operation, decreased fertility, increased rate of stillbirth, and growth abnormalities ranging in severity.

Daily requirement

The following are the recommended daily allowances for iodine:

- Infants- 40 - 50 micrograms
- Children
 - One to three years - 70 micrograms
 - Four to six years - 90 micrograms
 - Seven to 10 years - 120 micrograms
 - 11+ years - 150 micrograms
- Pregnant women - 175 micrograms
- Lactating women - 200 micrograms
- Adult men & women - 100 - 200 micrograms

Because iodine cannot be stored for long times in the body, tiny amounts must be consumed regularly, but food grown in iodine poor soil will not provide sufficient dietary iodine. Most people, however, are able to meet their iodine requirements by eating seafood, seaweed, iodized salts and plants grown in iodine-rich soil. A spectacularly simple, universally effective, wildly attractive and incredibly cheap technical weapon is IODIZED SALT.

Where salt iodization has been in place for over five years, improvement in iodine status has been overwhelming. Over the last decade, the number of countries with salt iodization programs doubled, rising from 46 to 93. As a result, today:

- 68% of the 5 billion people living in countries with IDD
- have access to iodized salt;
- The global rates of goiter, mental retardation and cretinism
- are falling fast.

Danger of over-iodization

Toxicity is only caused from excess iodine supplements, not food sources. Irregular heartbeat, confusion, breathing difficulties, swollen neck and black stools may result. Radioactive iodine also forms naturally from chemical reactions high in the atmosphere. Most radioactive forms of iodine change very quickly (seconds to days) to stable elements that are not radioactive. Small amount of radioactive iodine can also enter the

air from nuclear power plants, which form radioiodine from uranium and plutonium. Larger amounts of radioactive iodine have been released to the air from accidents at nuclear power plants and from explosions of nuclear bombs. People are almost never exposed to radioactive iodine, unless they work in a place where radioactive iodine is used or if their doctors give them radioactive iodine. Radioactive iodine is used in certain medical tests and treatments. You might have these tests if your doctor needs to look for problems in your thyroid gland or if your doctor needs to treat you for a problem with your thyroid gland.

Commonly available preparations

Potassium iodide solution (collosol liquid- 8mg/ml), used for inhibition of thyroid hormone release in situations of thyroid crisis, pre operative preparation of hyperthyroid patients and rarely for prevention of radioactive iodine uptake by thyroid.

Povidone iodine (Betadine, Microshield, Wokadine etc), used as antiseptic & disinfectant, mainly for contaminated wounds and preoperative preparation of skin and mucous membrane as well as for disinfection of equipments.

Conclusion

Iodine is a trace element, which is sufficiently available in marine products, iodized salt, drinking water, and atmospheric air. It is very essential for formation of thyroid hormones, brain development and regulating normal metabolism of body. Iodine is also used as disinfectant, antiseptic and the radioactive form of iodine is used in treating hyper functioning of thyroid. As with any other substance, iodine in excess also has many adverse effects on the body.

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