

## 1 OVERVIEW

### *What is iodine deficiency?*

Iodine is an element that is needed for the production of thyroid hormone. The body does not make iodine, so it is an essential part of your diet. Iodine is found in various foods (see *Table 1*). If you do not have enough iodine in your body, you cannot make enough thyroid hormone. Thus, iodine deficiency can lead to enlargement of the thyroid (goiter – see *Goiter* brochure), hypothyroidism (see *Hypothyroidism* brochure) and to mental retardation in infants and children whose mothers were iodine deficient during pregnancy.

Before the 1920s, iodine deficiency was common in the Great Lakes, Appalachian, and Northwestern U.S. regions and in most of Canada. Treatment of iodine deficiency by the introduction of iodized salt has virtually eliminated the “goiter belt” in these areas. However, many other parts of the world do not have enough iodine available through their diet and iodine deficiency continues to be an important public health problem globally. Approximately 40% of the world’s population remains at risk for iodine deficiency.

### ADDITIONAL PATIENT RESOURCES [WWW.THYROID.ORG](http://WWW.THYROID.ORG)

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## 1 SYMPTOMS

### What are the symptoms of iodine deficiency?

All of the symptoms of iodine deficiency are related to its effect on the thyroid:

**Goiter** – Without adequate iodine, the thyroid progressively enlarges (develops a goiter) as it tries to keep up with demand for thyroid hormone production. Worldwide, iodine deficiency is the most common cause of thyroid enlargement and goiter (see *Goiter* brochure). Within a goiter, nodules can develop. Patients with a large goiter may experience symptoms of choking, especially when lying down, and difficulty swallowing and breathing.

**Hypothyroidism** – As the body’s iodine levels fall, hypothyroidism may develop, since iodine is essential for making thyroid hormone. While this is uncommon in the United States, iodine deficiency is the most common cause of hypothyroidism worldwide (see *Hypothyroidism* brochure).

**Pregnancy-related problems** – Iodine deficiency is especially important in women who are pregnant or nursing their infants. Severe iodine deficiency in the mother has been associated with miscarriages, stillbirth, preterm delivery, and congenital abnormalities in their babies. Children of mothers with severe iodine deficiency during pregnancy can have mental retardation and problems with growth, hearing, and speech. In the most severe form, an underactive thyroid can result in cretinism (a syndrome characterized by permanent brain damage, mental retardation, deaf mutism, spasticity, and short stature), though this is not seen in the United States. Congenital hypothyroidism due to iodine deficiency is the most common preventable cause of mental retardation in the world. Even mild iodine deficiency during pregnancy, which may be present in some women in the United States, may be associated with low intelligence in children.

## 2 CAUSES

### What are the causes of iodine iodine deficiency?

Since the body does not make iodine, it relies on the diet to have enough iodine. Thus, iodine deficiency is caused but not having enough iodine in the diet. Iodine is present naturally in soil and seawater. The availability of iodine in foods differs in various regions of the world (see Table 1). Individuals in the United States can maintain adequate iodine in their diet by using iodized table salt (unless they have to

restrict the amount of salt in their diet), by eating foods high in iodine, particularly dairy products, seafood, meat, some breads, and eggs, and by taking a multivitamin containing iodine (see below). However, the amount of iodine in foods is not listed on food packaging in the U.S., and it can be difficult to identify sources of iodine in foods.

## 3 DIAGNOSIS

### How do you diagnose iodine deficiency?

Iodine deficiency is diagnosed across populations and not specifically in individuals. Since iodine is released from the body through the urine, the best way to determine iodine deficiency across a large population is to measure the amounts of iodine in urine samples. Iodine deficiency is defined as a median urinary iodine concentration less than 50 µg/L in a population (see Table 2).

In the United States, iodine status has remained generally adequate in the last 2 decades although studies have shown that urinary iodine levels dropped by about half between the early 1970s and the early 1990s. However, iodine deficiency is a major issue in other parts of the world, including parts of Europe, Africa and Asia.

## 4 TREATMENT

### How is iodine deficiency treated?

There are no tests to confirm if you have enough iodine in your body. When iodine deficiency is seen in an entire population, it is best managed by ensuring that common foods that people eat contain sufficient levels of iodine. Since even mild deficiency during pregnancy can have effects on delivery and the developing baby, all pregnant and breastfeeding women should take a multivitamin containing at least 150 µg iodine per day.

### How is iodine deficiency prevented?

As with many diseases, it is better to prevent the problem rather than have to treat it. Over the last 80 years, world-wide efforts have been made to eliminate iodine deficiency. Indeed, elimination of iodine deficiency has been a major goal of the World Health Organization. Iodized salt has been the mainstay of treatment for iodine deficiency worldwide, including in the United States. Injections of iodized oil are occasionally used in regions of the world where widespread iodized salt use is not possible. Iodination of water supplies also has been effective in some places.

**Table 1. Common Sources of Dietary Iodine**

Breads	Iodized table salt
Cheese	Saltwater fish
Cow's milk	Seaweed (including kelp, dulce, nori)
Eggs	Shellfish
Frozen yogurt	Soy milk
Ice cream	Soy sauce
Iodine-containing multivitamins	Yogurt

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## TREATMENT CONTINUED

*United States Recommendations* - The Institute of Medicine has set the Recommended Dietary Allowance (RDA) for iodine in adult men and women at 150 µg per day. Individuals who add table salt to their food regularly should use iodized salt. One teaspoon of iodized salt contains approximately 400 µg iodine. Most iodine-containing multivitamins have at least 150 µg iodine, but only about half of the types of multivitamins in the U.S. contain iodine.

The RDA is 220 µg iodine per day for pregnant women and 290 µg iodine per day for breastfeeding women. Because the effects of iodine deficiency are most severe in pregnant women and their babies, the American Thyroid Association has recommended that all pregnant and breastfeeding women in the U.S. and Canada take a prenatal multivitamin containing 150 µg iodine per day.

## Are there problems with taking too much iodine?

Taking too much iodine can also cause problems. This is especially true in individuals that already have thyroid problems, such as nodules, hyperthyroidism and autoimmune thyroid disease. Administration of large amounts of iodine through medications (ie Amiodarone), radiology procedures (iodinated intravenous dye) and dietary excess (Dulse, kelp) can cause or worsen hyperthyroidism and hypothyroidism.

In addition, individuals who move from an iodine-deficient region (for example, parts of Europe) to a region with adequate iodine intake (for example, the United States) may also develop thyroid problems since their thyroids have become very good at taking up and using small amounts of iodine. In particular, these patients may develop iodine-induced hyperthyroidism (see *Hyperthyroidism* brochure).

**Table 2. Median Population Urinary Iodine Values and Iodine Nutrition**

MEDIAN URINARY IODINE CONCENTRATION (µG/L)	CORRESPONDING IODINE INTAKE (µG/DAY)	IODINE NUTRITION
<20 .....	<30 .....	Severe deficiency
20-49 .....	30-74 .....	Moderate deficiency
50-99 .....	175-149 .....	Mild deficiency
100-199 .....	150-299 .....	Optimal
200-299 .....	300-449 .....	More than adequate
>299 .....	>449 .....	Possible excess

[From WHO, UNICEF and ICCIDD 2001 Assessment of the Iodine Deficiency Disorders and monitoring their elimination. A guide for programme managers. WHO publ., Geneva. WHO/NHD/01.1]

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