Iodine Deficiency

Description/Etiology

Iodine is an essential microelement that is found naturally in the environment, primarily in the form of iodide. It is required for the synthesis of the thyroid hormones thyroxine (T4) and triiodothyronine (T3), which are necessary for proper development of the nervous system (especially during the fetal period and the first 3 years of life), physical growth and sexual development, and metabolism and energy regulation.

Iodine deficiency results in insufficient production of thyroid hormones, an enlarged thyroid gland (i.e., goiter), and hypothyroidism. Iodine deficiency in an infant or young child can lead to neonatal hypothyroidism, a condition marked by severe stunting of physical and mental development. If the deficiency occurs during the prenatal period, the condition is called congenital hypothyroidism. Research shows that children born to mothers who are iodine deficient are more likely to experience lower verbal and reading scores at 8 to 9 years of age (Leung et al., 2014).

In most regions of the world where iodine is supplemented as iodized table salt and through iodization of water supply, the prevalence of iodine deficiency has declined. However, in areas where the soil is low in iodine and supplementation programs have not been implemented, the prevalence of iodine deficiency is still high. Other dietary sources of iodine include seafood (e.g., cod, bass, haddock, and perch) and kelp. Dairy products, eggs, and produce grown in iodine-rich soil can also be good food sources of iodine, but the quantity of iodine in these sources is difficult to measure.

Iodine deficiency may be suspected based on clinical presentation (see Signs and Symptoms/ Clinical Presentation, below) and patient history. Treatment of iodine deficiency involves long-term dietary iodine supplementation and management of complications.

Facts and Figures

An estimated 29% of the world’s population across 130 countries lives in iodine-deficient environments, and according to WHO approximately 285 million children of school age have iodine deficiency. Iodine deficiency is responsible for the most common, preventable form of congenital hypothyroidism (i.e., hypothyroidism due to maternal iodine deficiency during pregnancy). Congenital hypothyroidism is endemic in some regions of the world, affecting up to 10% of the population in severely iodine-deficient regions (e.g., parts of India, Indonesia, and China). Mild to moderate iodine deficiency has been reported in Australia, New Zealand, Sweden, continental Europe, the Republic of Ireland, the United Kingdom, and the United States. Only about 15% of pregnant and lactating women in the United States take vitamin and mineral supplements containing adequate iodide.

The recommended daily intake of iodine for infants 0–6 months of age is 110 mcg; for infants 7–12 months of age: 130 mcg; for children 1–8 years of age: 90 mcg; for children 9–13 years of age: 120 mcg; for males and females ≥ 14 years of age: 150 mcg; for pregnant women: 220 mcg; and for lactating women: 290 mcg.

Risk Factors

Iodine deficiency occurs when intake is < 20 mcg/day over a prolonged period. Because most environmental iodine is found in and around seawater, populations located in remote, mountainous regions are at greatest risk for iodine deficiency. Other groups at risk of iodine
deficiency include women during pregnancy and the postpartum period due to the increased iodine requirements associated with fetal development and breastfeeding, infants born to pregnant women deficient in iodine, and individuals who consume a vegan diet or use sea salt rather than iodized salt.

**Signs and Symptoms/Clinical Presentation**

Maternal iodine deficiency can result in congenital hypothyroidism in the infant, with the potential for extreme hypothyroidism during fetal life, characterized by permanent brain damage and intellectual disability, deafness/mutism, growth retardation, and spasticity. Iodine deficiency in individuals of all ages can result in goiter, evidenced by visible swelling at the base of the neck, a choking sensation, difficulty swallowing, and restricted breathing. Clinical manifestations of hypothyroidism include psychomotor slowing, lethargy, depression, impaired cognitive function (e.g., deficits in attention and memory), cold intolerance, chills, fatigue, weight gain, tachycardia, hoarseness, sore mouth, thickening of the tongue, hearing loss, and brittle hair. Iodine deficiency in women of reproductive age can also result in infertility, miscarriages, stillbirths, and preterm deliveries.

**Nutritional Assessment**

› **Patient Medical History**
  • Obtain a complete medical and mental health history; assess for
    – coexisting conditions (particularly those affecting thyroid function)
    – recent history of depression or psychomotor slowing, either of which can be associated with hypothyroidism
    – Ask about onset, duration, and severity of signs and symptoms, if any, that can have a negative effect on dietary intake (e.g., vomiting, diarrhea, constipation, pain, fatigue, headaches)

› **Physical Findings of Particular Interest**
  • Goiter (possibly multinodular) is often the first physical sign of iodine deficiency
  • Dry skin, periorbital edema, and delayed reflexes indicate possible hypothyroidism

› **Patient Dietary History**
  • Conduct a diet analysis by asking the patient to complete a diet history (specifically assess for adequate intake of iodized salt and other foods that contain iodine)
    – Useful tools for evaluating the patient’s dietary strengths and weaknesses include a food frequency questionnaire and a 3-day diet recall (i.e., patient recall of all foods and beverages consumed in a 3-day period) that includes 1 weekend day

› **Anthropometric Data**
  • Calculate the patient’s BMI by dividing body weight (kilograms) by height (meters squared) or by multiplying 703 by weight (pounds) and dividing by height (inches squared)
    – Extremely underweight: < 18.5; underweight: 18.5–20; normal: 20–25; overweight: 25–30; obese: > 30

› **Laboratory and Diagnostic Tests of Particular Interest to the Registered Dietitian**
  • Thyroid-stimulating hormone (TSH) level can be measured to assess thyroid function (normal: 0.4–4.0 mIU/L)
  • When other risk factors are present (e.g., living in an environmentally iodine-deficient region, being pregnant), patients with TSH levels > 2.0 mIU/L should be closely monitored for iodine deficiency
  • No test is currently available to reliably diagnose iodine deficiency, but measuring the concentration of iodine in a 24-hour urine collection can assess the adequacy of iodine intake, as the kidneys excrete 90% of ingested iodine
  • Imaging tests (e.g., CT scan) may be ordered to assess the extent of goiter

**Treatment Goals**

› **Relieve Symptoms and Promote Optimum Physiologic Status**
  • Monitor weight and vital signs and report abnormalities to the treating clinician
  • Review results of laboratory tests and diagnostic studies used to assess for or monitor complications; report nutritional status–related findings to the treating clinician as they are obtained
  • Assess for pain and other discomfort (e.g., due to mouth soreness), and adjust dietary recommendations (e.g., soft diet) accordingly
  • Review diet history information to assess dietary intake and patterns and provide detailed patient education about eating a healthy diet that includes sufficient levels of iodine and other nutrients
  • Provide thorough patient education about the purpose of the prescribed iodide supplementation and the correct daily dosage (e.g., oral supplementation of potassium iodide 150 mcg/day)

› **Provide Emotional/Psychological Support and Educate**
• Assess the anxiety level and coping ability of the patient and/or family and for knowledge deficits related to diagnosis or treatment; address any concerns expressed by the patient/family, and educate and encourage discussion about the etiology, signs, symptoms, diagnosis, and potential complications of iodine deficiency

• Request clinician referral to a
  – social worker, if appropriate, for information about community resources available to assist children with special needs and their families

**Food for Thought**

› Approximately 90% of salt consumption in industrialized countries comes from processed foods; concerns have been raised over the current push to reduce salt consumption for disease prevention, as this can reduce iodine intake

› Suboptimal iodine stores during pregnancy could increase the risk of maternal thyroid dysfunction during pregnancy, potentially inhibiting proper fetal brain development. In studies, the offspring of women who experienced low iodine status in early pregnancy have exhibited lower verbal IQ and reading scores; and, based on observational studies, mild to moderate iodine deficiency is associated with subpar cognitive and educational development in children (Bath et al., 2015)

**Red Flags**

› Using very concentrated doses (e.g., saturated potassium iodide of 35,000–50,000 mcg/drop) for iodide supplementation can result in iodine toxicity

› Prolonged intake of > 1,100 mcg of iodine/day can result in iodine-induced hyperthyroidism

› Iodine toxicity is manifested by burning in the mouth and throat, fever, GI symptoms, weak pulse, and coma

› Amiodarone, a potent antiarrhythmic agent similar in structure to T4, can cause hyperthyroidism due to its high iodine content

**What Do I Need to Tell the Patient/Patient’s Family?**

› Eat a well-rounded diet that includes good sources of iodine (e.g., iodized salt, seafood, and kelp)

› Adequate iodine intake during pregnancy is vital to the health and development of the fetus/infant

› Community assistance programs (e.g., Meals on Wheels, Supplemental Nutrition Assistance Program (SNAP), or the Special Supplemental Nutrition Program for Women, Infants, and Children [WIC]) are available for individuals who are experiencing financial difficulties

**Discharge Planning**

› Eat a calorie-appropriate diet that includes good sources of iodine (e.g., iodized salt, seafood, and kelp), lean proteins, unsaturated fats (including omega-3), complex carbohydrates (e.g., whole grains), legumes, nuts and seeds, and a variety of fruits and vegetables

› Take dietary supplements as prescribed

› Participate in regular physical activity of at least 150 minutes each week, including strength training at least 2 days each week

› Recruit the help of family and friends to assist in meal planning, grocery shopping, and food preparation

**References**


10. Leung, A. M., & Brent, G. A. (2014). Children of mothers with iodine deficiency during pregnancy are more likely to have lower verbal IQ and reading scores at 8-9 years of age. Evidence-Based Nursing, 17(3), 86. doi:10.1136/eb-2013-101585


