Addressing Iodine Deficiency: Strategies and Solutions

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Annotation:*This article summarizes the conclusions and recommendations of a technical consultation on the prevention and control of iodine deficiency, particularly in vulnerable populations such as pregnant and lactating women and young children. It emphasizes the importance of ensuring adequate iodine intake during critical periods of development to prevent adverse health outcomes. The recommendations include promoting iodized salt consumption, implementing universal salt iodization programs, and monitoring iodine status through regular surveillance.*

Keywords: *Iodine deficiency, iodized salt, supplementation programs, fortification, public health interventions, goiter, cretinism*

Iodine occurs naturally as iodide and iodate in igneous rocks and soils. However, iodine could be mobilized from superficial layers of ground, and stones such as iodide and iodate are highly soluble in the aqueous phase. Thus, they drain from rainwater into surface waters, seas, and oceans, eventually becoming available for animal and human consumption. Free elemental iodine also sublimates in the atmosphere directly from soils and rocks, because of its high volatility. When rainfalls occur, iodine precipitates on the land surface and drains into the ground and rocks, and can then be assimilated by plants.

Vegetables do not provide an adequate dietary iodine supply, and vegans are exposed to iodine deficiency even in iodine-sufficient areas. Meat, milk, eggs, fish, and other animal-derived foods are the most important dietary sources of iodine in human nutrition. The estimated mean concentration of iodine in animal tissues other than the thyroid (i.e., skeletal muscle) is approximately 0.1 mg/kg. However, the iodine content in animal tissues depends on the iodine supplementation of background animal feed. Seafood and saltwater fish are the most relevant iodine sources, as marine fauna and flora accumulate large amounts of soluble iodine from seawaters. Fresh and farmed fish, as compared to seawater foods, contain less iodine. Thus, fish from rivers or lakes usually have a lower content of this element. Iodine intake varies according to geographical areas, but also among individuals in a specific geographic region, and, indeed, individual consumption differs daily. Iodine intake largely depends on age too. In Germany, milk and dairy products provide around 35% of the daily requirement of iodine. The other two-thirds are supplied by meat and meat products, bread and cereals, and fish. In Denmark, milk provides more than 30% of daily iodine intake, and a similar percentage has been reported in Swiss children. In Dutch schoolchildren, seafood is a negligible source of iodine, as it is consumed only about once a month. Thanks to alimentary policies allowing the addition of iodine to foods, processed foods containing significantly higher levels of iodine have been available in the last few decades and have been used to provide iodine prophylaxis to counteract, in nationally based programs, the clinical consequences of iodine deficiency. The iodization of salt for human food consumption is the worldwide strategy recommended for this purpose.

Iodine may enter the body through chronic consumption or exposure to certain medications, such as amiodarone, povidone–iodine, iodine-based radiocontrast media, and multivitamin preparations. For example, 200 mg of amiodarone (the mean daily dose of maintenance treatment) contains 75 mg of iodine, exceeding five-hundred-fold the recommended daily requirement of the element. Iodine-based radiocontrast media contain grams of iodine.

Daily iodine intake ranges from less than ten micrograms in extreme iodine deficiency areas to several hundred milligrams in patients taking iodine-containing medications. Generally, 150 μg of iodine is the recommended daily intake for adults and the elderly. In pregnant or lactating women, the iodine requirement increases to at least 200–250 μg daily. The iodine requirement per kilogram of body weight is higher in newborns and children than in adults, corresponding to an absolute iodine intake requirement of 70–120 μg in children and 40 μg in newborns. These recommendations consider the daily thyroid hormone turnover in healthy individuals, with a mean iodine intake associated with the lowest values of TSH in the normal range, the smallest thyroid volume, and the lowest incidence of transient hypothyroidism in neonatal screening, and the mean requirement of levothyroxine to restore euthyroidism in patients with thyroid agenesis or following thyroidectomy.

Thyroid hormones play a central role in regulating several functions in the human body, and a sufficient iodine intake is essential to maintain thyroid homeostasis. Iodine deficiency is an epidemiological issue not only in low- or middle-income countries. Even in high-income countries, where iodine fortification has gained general acceptance and diffusion, and that have experienced a significant improvement in IDD epidemiology over time, dietary habits such as a vegan diet, low consumption of iodine-rich foods, and the lack or discontinuation of measures to monitor iodine intake in a population-based manner (e.g., screening of iodine exposure) could be responsible for subclinical iodine deficiency and other IDDs. The iodization of salt for human consumption remains the recommended strategy for adequate iodine exposure. Despite some concerns related to high iodine exposure risks (hyperthyroidism, thyroid autoimmunity, and a relative increase in the risk of papillary thyroid cancer), the benefits outweigh the risks. Specific recommendations and strategies to implement iodine intake (as a supplement) are needed for categories of people in whom iodized salt alone appears insufficient to provide adequate requirements.

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