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# **IODINE AND HORMONAL BALANCE: THE FOUNDATION OF HEALTH FROM THE PRENATAL PERIOD THROUGH ADULTHOOD**

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Iodine is an essential trace element that the human body cannot produce on its own. Iodine deficiency is a common problem in many parts of the world, including Ukraine. This deficiency leads to thyroid dysfunction and delays in mental and physical development, especially in children. Therefore, ensuring adequate iodine intake is important for public health.

Iodine is essential for the human body to synthesize thyroid hormones (thyroxine (T4) and triiodothyronine (T3)). These hormones influence overall metabolism. In particular, they promote the production and distribution of energy in the body (accelerating the breakdown of fats, proteins, and carbohydrates to produce energy), increase heart rate and contractile force, maintain body temperature, and stimulate oxygen uptake by tissues. They are especially important during pregnancy and childhood, as they ensure normal growth and development (including mental development in children) [1].

The body requires relatively small amounts of iodine to maintain good health. Requirements vary depending on age, gender, and stage of development. The recommended daily intake for adults (18 years and older) is 150 mcg of iodine, increasing to 350 mcg per day during pregnancy and breastfeeding. The recommended daily iodine intake for children is as follows: 0-6 years: 90 mcg; 7-10

years: 120 mcg; 11-17 years: 150 mcg per day [5].

To ensure adequate iodine intake, the most practical solution is to use iodized salt. This salt tastes just like cooking salt, so it doesn't alter the flavor of food, and it's also good for your health. Seafood (fish, shellfish, and seaweed) is the richest source of iodine. It's also found in eggs, milk, and dairy products, although the amount depends on the animal's diet. In dietary supplements, iodine is often present in the form of potassium iodide or sodium iodide. Supplements containing iodine-rich seaweed are also available. A study by scientists showed that the body's absorption of potassium iodide was nearly complete (96.4%). Many multivitamin and mineral supplements contain iodine, often at a dose of 150 mcg, as do some prenatal supplements, which support the mother's thyroid hormone production to ensure the development of the child's cognitive and nervous systems. Dietary supplements containing only iodine are also available, many of which contain high doses, sometimes exceeding the upper safe limits (ULs). Many dietary supplements containing iodine are listed in the NIH (National Institutes of Health) Dietary Supplement Labeling Database. This database contains labeling information for tens of thousands of dietary supplements available on the U.S. market [2].

Iodine in food and iodized salt exists in several chemical forms, including sodium and potassium salts, inorganic iodine ( $I_2$ ), iodate, and iodide, the reduced form of iodine. Iodine is rarely found in its elemental state, but rather as a salt; for this reason, it is referred to as iodide rather than iodine. Iodide is rapidly and almost completely absorbed in the stomach and duodenum. Iodate is reduced in the digestive tract and absorbed as iodide. Once in the bloodstream, iodide is concentrated by the thyroid gland in amounts necessary for the synthesis of thyroid hormones, and most of the remainder is excreted in the urine. A healthy adult with adequate iodine intake has approximately 15-20 mg of iodine, of which 70-80% is stored in the thyroid gland [5].

Iodine deficiency has numerous adverse effects on human growth and development and is the most common preventable cause of intellectual disability worldwide. Disorders associated with iodine deficiency arise from insufficient

production of thyroid hormones, which, in turn, is secondary to inadequate iodine intake. During pregnancy and early childhood, iodine deficiency can lead to irreversible consequences [3].

Under normal conditions, the human body finely regulates thyroid hormone levels through thyroid-stimulating hormone (TSH). Typically, TSH secretion increases when iodine intake is less than approximately 100 µg/day. TSH stimulates iodine uptake by the thyroid gland and the production of thyroid hormones. However, very low iodine intake can reduce thyroid hormone production, even in the presence of elevated TSH levels. Furthermore, it is important to note that TSH levels may remain within the normal range despite low iodine intake; therefore, TSH is not a sensitive indicator of iodine deficiency [4].

If a person's iodine intake falls below approximately 10-20 µg/day, hypothyroidism develops, a condition often accompanied by endemic goiter. Goiter is usually the first clinical sign of iodine deficiency. In pregnant women, iodine deficiency of this magnitude can lead to significant neurodevelopmental disorders and fetal growth retardation, as well as spontaneous miscarriages and stillbirths. Serious chronic iodine deficiency during pregnancy causes cretinism, a condition characterized by intellectual disability, deafness and mutism, motor spasticity, growth retardation, delayed puberty, and other physical and neurological disorders [3].

In infants and children, even a mild iodine deficiency can lead to neurodevelopmental disorders, such as an IQ slightly below average. Iodine deficiency in the mother, even mild or moderate, is also associated with an increased risk of attention-deficit/hyperactivity disorder (ADHD) in children. In adults, even mild or moderate iodine deficiency can cause goiter, as well as cognitive impairment and reduced work productivity due to hypothyroidism. Chronic iodine deficiency may be associated with an increased risk of follicular thyroid cancer [4].

Iodine excess is a condition that occurs when this trace element is consumed in excessive amounts through food, medication, or environmental exposure. Iodine is essential for the synthesis of the thyroid hormones thyroxine (T4) and triiodothyronine (T3); however, an excess of iodine is just as dangerous as a

deficiency. The clinical manifestations of iodine excess are varied. The most common are palpitations, arrhythmia, excessive sweating, a sensation of heat, and weight loss associated with normal or increased appetite. Neurological symptoms include irritability, anxiety, insomnia, and hand tremors. Other symptoms characteristic of iodine poisoning include a metallic taste in the mouth, hypersalivation, a runny nose, coughing, watery eyes, and skin rashes. The mucous membranes may also be affected, manifesting as inflammation and irritation [2].

**Conclusions.** Iodine is a critically important essential trace element without which the synthesis of thyroid hormones (T3 and T4) would be impossible. Its role extends far beyond simply supporting metabolism – it is the architect of a child’s intellectual and physical development even in the womb and a key regulator of energy in adulthood. Therefore, it is important to maintain optimal iodine levels in the human body, which is essential for good health.

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