Iodine: The Universal Nutrient

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In textbooks of medicine, endocrinology and thyroidology, the essential element iodine is mentioned only in connection with the most severe forms of deficiency of this nutrient: cretinism, iodine-deficiency induced goiter and hypothyroidism. Due to thyroid fixation, inhibitors of iodine uptake and utilization by target cells are called goitrogens, that is, substances causing thyroid enlargement, implying that iodine inhibitors only influence thyroid function. Perhaps, there is a restraining order preventing iodine inhibitors from interfering with iodine in extrathyroidal target organs. Many physicians would be surprised to learn that more than a hundred years ago, iodine was called "The Universal Medicine", and was used in several clinical conditions. Nobel Laureate Albert Szent Györgyi,1 the physician who discovered Vitamin C in 1928, commented:

"When I was a medical student, iodine in the form of KI was the universal medicine. Nobody knew what it did, but it did something and did something good. We students used to sum up the situation in this little rhyme:

If ye don't know where, what, and why
Prescribe ye then K and I.

Our medical predecessors, ...were keen observers and the universal application of iodide might have been not without foundation."

Recent research on the medical applications of this essential nutrient may prove indeed that iodine is a universal medicine, or more appropriately, a universal nutrient.2-13 Only 8 years after the discovery of iodine from seaweed by French chemist Bernard Courtois in 1811, Swiss physician J.F. Coindet who previously used successfully burnt sponge and seaweed for

simple goiter, reasoned that iodine could be the active ingredient in seaweed. In 1819, he tested tincture of iodine at 250 mg per day, an excessive amount by today's standard, in 150 goiter patients with great success. He published his results in 1820.14 Coindet was the first physician to use the newly discovered element iodine in medical practice. Since then, the collective experience of a large number of clinicians from the U.S. over the last century has resulted in the recommended daily amount of 0.1 to 0.3 ml of Lugol, containing from 12.5 to 37.5 mg elemental iodine, for iodine/iodide supplementation.5,15 The Lugol solution was developed by French physician, Jean Lugol in 1829 for treatment of infectious diseases using oral ingestion of his preparation.16 The Lugol solution contains 5 percent iodine and 10 percent potassium iodide in water. Iodine is not very soluble in water, with aqueous saturation at 0.33 gm iodine/L. The addition of potassium iodide to an aqueous solution of iodine stabilizes the iodine by forming a complex triodide I_3^- and increases the aqueous solubility of iodine in the form of a triodide complex 150 times. The range of daily intake of Lugol solution for iodine supplementation based on clinical observation of the patient's overall well being turned out to be the exact range of iodine needed for whole body sufficiency, based on an iodine/iodide loading test developed recently.5

British physicians recommended a similar range of daily intake of iodine in the form of hydrogen iodide as the ranges of iodine recommended by U.S. physicians in the form of Lugol solution. The recommended daily intake of hydriodic acid syrup was 2 to 4 ml.17 The syrup is prepared by the British apothecary from an aqueous stock solution containing 10 percent hydrogen iodide (HI), which is diluted 10 fold with syrups of different flavors. When hydrogen iodide is dissolved in water it forms hydriodic acid. The syrup would contain 1 percent hydrogen iodide equivalent. This would compute to 10 mg iodide per ml. So, the recommended daily amount of elemental iodine was from 20 to 40 mg.

The element iodine was used for the treatment of hypo- and

hyperthyroidism5 and for many other medical conditions.18 For hyperthyroidism, the daily dose ranged from 6.25 mg to 180 mg elemental iodine in the form of Lugol solution with the most common intake of 90 mg achieving success rate as high as 90 percent.5

With the availability of thyroid hormones in the 1930s, thyroidologists started using these preparations in patients with iodine deficiency and simple goiter instead of the previously used inorganic iodine/iodide preparations. The situation was aggravated by the fact that during the same period, the public was relying on iodized table salt instead of iodine/iodide preparations from apothecaries for supplementation, due to the propaganda favoring the use of iodized salt.19 The thyroidologists assumed that, with iodization of table salt, iodine deficiency became a thing of the past, because of the positive effect of iodized salt on the incidence of goiter. That was the beginning of thyroid fixation. It only requires 0.05 mg iodide per day to control goiter.5 With an estimated daily intake of 10 gm of table salt by the U.S. population and at an iodide concentration of 75 PPM, the daily intake of iodide averaged 750 µg or 0.75 mg. There are 30,000 times more chloride than iodide on a molar basis in iodized salt. Due to competition for intestinal absorption between the halides chloride and iodide, only 10 percent of iodide in iodized salt is bioavailable.6 This bioavailable amount of 75 µg or 0.075 mg iodide is 500 times less than 0.3 ml of Lugol solution previously recommended by U.S. physicians. Iodization of salt decreased markedly the prevalence of goiter because it only takes 0.05 mg per day of iodide to achieve this goal.5

Most physicians by the 1950s neglected the rest of the human body, in terms of sufficiency for iodine, and forgot that their predecessors were using amounts of iodine/iodide 2 orders of magnitude greater than the amounts present in the average daily consumption of table salt. This was mainly due to iodophobic publications appearing in the late 1940s and also due to the erroneous assumption that absence of goiter means iodine sufficiency. Published studies on the safe and effective use of Lugol

solution in hypo- and hyperthyroidism mysteriously disappeared during the 1940s, concurrent with the appearance of iodophobic publications. The promotion of thyroid extracts and thyroid hormones as an alternative to Lugol solution in the management of iodine deficiency induced goiter and hypothyroidism; and of goitrogens and radioiodide as an alternative to Lugol solution in the management of hyperthyroidism with both alternatives well synchronized with the iodophobic publications. It was a brilliant move and it worked wonderfully. By the 1970s, following the iodophobic publication of Wolf20, physicians concluded that one must avoid inorganic non-radioactive iodine "like leprosy," unless it was incorporated into the toxic organic iodine-containing drugs. Then, iodine could be tolerated because iodine could be blamed for the toxicity of these drugs.

Against this background, a 1993 publication by Ghent et al21 reported the beneficial effects of 5 mg iodine ingested daily for approximately one year in 1,368 patients with Fibrocystic Disease of the Breast (FDB). I became aware of Ghent's publication in 1997. Ghent's study did not confirm Wolff's prediction that daily iodine intake of 2000 ug (2 mg) was "excessive and potentially harmful." Based on academic credentials and reputation, the opinion of thyroidologist Wolff from the National Institute of Health would prevail over the findings of Ghent et al. However, being interested in facts only, not in preconceived opinions of famous thyroidologists, I initiated an extensive search of the literature on iodine in medicine 7 years ago, combined with some original clinical research.7

The literature search revealed that 60 million mainland Japanese consume a daily average of 13.8 mg of elemental iodine, and they are one of the healthiest nations based on overall well being and cancer statistics.7 Japanese women do not stop consuming iodine-rich foods during pregnancy, and Japanese fetuses are exposed to maternal peripheral levels of iodide at concentrations of 10-5M to 10-6M. Either the Japanese are mutants capable of surviving on toxic levels of iodine or we have been

grossly deceived. The human body needs at least 100 times the RDA, which was established very recently in 1980 and confirmed in 1989!!

After overcoming the delusion that inorganic non-radioactive forms of iodine are toxic, and becoming aware that the inorganic non-radioactive forms of iodine were extremely safe (and were used extensively by U.S. physicians for many medical conditions), I initiated the Iodine Project. It is very exciting to learn that the team at Complementary Prescriptions has decided to join the Iodine Project. Welcome!

Administration of iodine in liquid solution is not very accurate, may stain clothing, has an unpleasant taste and causes gastric irritation. We decided to use a precisely quantified tablet form of Lugol. To prevent gastric irritation, the iodine/iodide preparation was absorbed into a colloidal silica excipient; and to eliminate the unpleasant taste of iodine, the tablets were coated with a thin film of pharmaceutical glaze.2

To confirm the safety of the Lugol tablets, pilot studies were performed with tablets of Lugol containing from 1 mg to 12.5 mg of elemental iodine. Following the pilot studies, ten female subjects, 7 with breast symptomatology, were studied for 3 months at 12.5 mg per day. Pre and post-supplementation evaluation of blood chemistry, hematology, thyroid function tests and ultrasonometry of the thyroid gland were performed. The results obtained in these female subjects using a tablet form of Lugol solution (Iodoral®) at 12.5 mg per day for 3 months confirmed Ghent's observations and the safety of the Lugol tablets. The data were published in the Original Internist in 2002.2

The bioavailability of a Lugol tablet (Iodoral®) containing 12.5 mg elemental iodine was evaluated by measuring 24 hr urine levels of iodide together with the minerals, trace elements and toxic metals before and after administration of this preparation. The results obtained following iodine supplementation revealed that in some subjects, the urine levels of mercury, lead and cadmium increased by several fold after just one day of

supplementation. For aluminum, this increased excretion was not observed usually until after one month or more on the iodine supplementation. Since this observation was made on a limited number of assays, it needs to be confirmed using a well designed protocol in a large number of patients.

Based on data available in the medical literature, urinary iodide levels are considered the best index of iodine intake.3 The initial results of the bioavailability study suggested that the Lugol tablets were not well absorbed since only 20 to 30 percent of the administered amount was recovered in the 24 hr. urine collection of 5 subjects tested.3 Just in case medical textbooks were wrong, and the explanation for the low recovery of iodide is body retention of iodine/iodide, the supplementation was continued for one month and then urine iodide levels were measured again in the 24 hr. urine collection. Medical textbooks were wrong. The subjects excreted a mean of 50 percent of the amount ingested, with one subject excreting 96 percent of the ingested amount.

The implication of such an observation was that an iodine/iodide-loading test could be developed to assess not just thyroid sufficiency for iodine, but requirement of the whole human body for that essential element. However, instead of a one-month loading test, further studies were performed to shorten this test to a single ingestion of the preparation. Another group of 6 subjects, (3 males and 3 females) were evaluated with 24 hr urinary iodide levels after ingesting one, two and three tablets of the same preparation. The mean percent excretions were: 1 Tab = 22; 2 Tab = 23 and 3 Tab = 25. In a third group of 6 subjects, urine iodide levels were evaluated following 4 tablets of the same preparation. The mean percent excretion was 39. (Fig. 1) For the loading test, a single ingestion of 4 tablets was chosen.5 This dose resulted in the highest mean percent iodide excreted with the widest interindividual variations. Because of the improved overall well being reported by the subjects who achieved 90 percent or more iodide excreted, sufficiency was arbitrarily set as 90

percent .

Whole body sufficiency for iodine correlated well with overall well being, and some subjects could tell when they achieved sufficiency even before knowing the results of the test. Iodine sufficiency was associated with a sense of overall well being, lifting of “brain fog,” feeling warmer in cold environments, increased energy, needing less sleep, achieving more in less time, experiencing regular bowel movements and improved skin complexion. Several clinical conditions where whole body iodine deficiency may play an important role are listed in Table I.

The iodine/iodide loading test is based on the concept that the normally functioning human body has a mechanism to retain ingested iodine until whole body sufficiency for iodine is achieved. During orthoiodosupplementation, a negative feedback mechanism is triggered that progressively adjusts the excretion of iodine to balance the intake. As the body iodine content increases, the percent of the iodine load retained decreases with a concomitant increase in the amount of iodide excreted in the 24 hr urine collection. When whole body sufficiency for iodine is achieved, the absorbed iodine/iodide is quantitatively excreted as iodide in the urine.5-7

After 3 months of supplementation with 50 mg iodine/iodide per day, most non-obese subjects not exposed to excess goitrogens achieved whole body iodine sufficiency, arbitrarily defined as 90 percent or more of the iodine load excreted in the 24 hr urine collections.5,6 Adult subjects retained approximately 1.5 gm of iodine when they reach sufficiency.6

In patients with a normal gastrointestinal absorption of iodine but with a very defective iodine retention system, the absorbed iodine is quantitatively excreted in the urine with little or no retention. In these rare cases, the loading test will suggest whole body iodine sufficiency (90 percent or more excreted) but the serum inorganic iodide levels 24 hrs after the iodine load will remain low (less than 0.13 mg/L).7 The inefficient

iodine retention mechanism could be due to either a defective cellular iodine transport system or due to blockage of this iodine cellular transport by iodine inhibitors that compete with iodide for the halide binding site of the symporter system and for iodine utilization. In one such case8, oral administration of Vitamin C sustained release at 3 gm per day improved significantly the defective cellular transport system for iodine (See Fig. 2 & 3).

The side effects reported with the use of inorganic non-radioactive iodine are:

- acne-like skin lesions in certain areas of your body
- headache in the frontal sinus
- unpleasant brassy taste
- increased salivation and sneezing

Based on the experience of clinicians with several thousands of patients on Iodoral®, with daily amounts ranging from 6.25 to 50 mg for up to 3 years, the incidence of the above side effects has been estimated at 1 percent.12,13 Orthoiodosupplementation induces a detoxification reaction in some patients with high bromide levels7,8, including increased body odor and cloudy urine. The body odor lasts one to two weeks, but the cloudy urine may last several months before clearing up. It is of interest to note that the pre- iodine loading urine samples in these cases were clear, but following orthoiodosupplementation, the urine samples became very cloudy with an unpleasant odor and a thick sedimentation upon standing. Although these cases were associated with high bromide excretion (greater than 200 mg per 24 hr), it is not clear if the presence of this halogen in the urine sample was the cause of the odor and cloudiness.

Increased fluid intake and a complete nutritional program emphasizing magnesium instead of calcium minimize these side effects. Administration of magnesium in daily amounts up to 1200 mg eliminated the body odor but not the cloudy urine. Scrubbing the skin with a vegetable brush while

bathing is recommended in those cases. Occasionally, the released bromide from storage sites induced decreased thyroid function, bromide being a potent goitrogen.5,8 If the loading test provokes high urine bromide levels, it is best to start the patient on a low dose of iodine (1/2 to 1 tablet Iodoral®) and progressively increase the daily intake for optimal response to bring serum and urine bromide levels below 10 mg/L and 10 mg per 24 hr respectively. In some patients, it may take up to 2 years. Bromide is ubiquitous in our homes and environment. Bromine-containing fire retardants are in our carpets, our clothes, even children's clothes! The question: Is this due to collective stupidity or a well planned conspiracy?

Since chloride increases renal clearance of bromide8, a trial of chloride load (6-10 gm per day) would decrease the time required for bromide detoxification. Use unprocessed sea salt instead of processed iodized table salt. If serum and urine bromide levels are not available, it is best to start with a daily amount of one tablet of Iodoral® and increasing the amount to two tablets after one week, three tablets after two weeks and four tablets after three weeks. A complete nutritional program emphasizing magnesium is recommended. Use clinical observation of the patient's response and overall well being to titrate the iodine supplementation like our medical predecessors who did not have access to serum thyroid hormone levels and procedures for assessing whole body sufficiency for iodine.

Summary of findings

Based on a review of the literature, and recent clinical research studies2-13, the concept of orthoiodosupplementation can be summarized as follows:

1. The nutrient iodine is essential for every cell of the human body requiring peripheral concentrations of inorganic iodide ranging from 10-6M to 10-5M.

2. In non-obese subjects without a defecting cellular transport system for iodine, these concentrations can be achieved with daily intake of 12.5 mg to 50 mg elemental iodine. The adult body retains approximately 1.5 gm iodine at sufficiency. At such time, the ingested iodine is quantitatively excreted in the urine as iodide.

3. The thyroid gland is the most efficient organ of the human body, capable of concentrating iodide by 2 orders of magnitude to reach 10-6M iodide required for the synthesis of thyroid hormones when peripheral levels of inorganic iodide are in the 10-8M range.

4. Goiter and cretinism are evidence of extremely severe iodine deficiency, because the smallest intake of iodine that would prevent these conditions, that is 0.05 mg per day, is 1000 times less than the optimal intake of 50 mg elemental iodine.

5. The thyroid gland has a protective mechanism, limiting the uptake of peripheral iodide to a maximum of 0.6 mg per day when 50 mg or more elemental iodine are ingested. This amount therefore would serve as a preventive measure against radioactive fallout.

6. An intake of 50 mg elemental iodine per day would achieve peripheral concentration of iodide at 10-5M, which is the concentration of iodide markedly enhancing the singlet triplet radiationless transition. Singlet oxygen causes oxidative damage to DNA and macromolecules, predisposing to the carcinogenic effects of these reactive oxygen species.5 This effect would decrease DNA damage, with an anticarcinogenic effect.

7. Preliminary data so far suggest that orthoiodosupplementation results in detoxification of the body from the toxic metals aluminum, cadmium, lead and mercury.

8. Orthoiodosupplementation increases urinary excretion of fluoride and

bromide, decreasing the iodine-inhibiting effects of these halides.

9. Most patients on a daily intake ranging from 12.5 mg to 50 mg elemental iodine reported higher energy levels and greater mental clarity with 50 mg (4 tablets Iodoral), daily. The amount of iodine used in patients with Fibrocystic Disease of the Breast by Ghent et al20 is 0.1 mg/Kg BW per day, 10 times below the optimal daily intake of 50 mg. In our experience, patients with this clinical condition responded faster and more completely when ingesting 50 mg iodine/iodide per day.

10. For best results, orthoiodosupplementation should be part of a complete nutritional program, emphasizing magnesium instead of calcium.

11. A beneficial effect of orthoiodosupplementation was observed in the clinical conditions listed in Table I.5,7,12,13

12. The iodine/iodide loading test and serum inorganic iodide levels are reliable means of assessing whole body sufficiency for elemental iodine for quantifying the bioavailability of the forms of iodine ingested and for assessing cellular uptake and utilization of iodine by target cells.

13. Orthoiodosupplementation may be the safest, simplest, most effective and least expensive way to solve the healthcare crisis crippling our nation.

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