

Questioning US Iodine and Fluoride Intake-Focus on Thyroid Cancer Treatment

Xu Chen

University of the Rockies and the College of St. Scholastica, USA

*Corresponding author

Xu Chen, University of the Rockies and the College of St. Scholastica. USA.
E-mail: xuchen3296@gmail.com.

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Abstract

Thyroid nodules are very common among adults. One of the major reasons for this problem is iodine deficiency. Iodine is an important essential element for human body. It is not just for thyroid hormone synthesis, it is an anti-oxidant for the whole body. Currently, US iodine intake is questionable due to many reasons. Fast foods and processed foods are part of it. To make it worse, fluoride, a very toxic element to thyroid, is in municipal water to prevent tooth decay. This paper will be about a literature review in what to eat and how to cook to take in enough iodine to keep up thyroid health.

Introduction

During the past 40 years, thyroid nodule/cancer rates went up [1]. Although there were evidences showing that the increased thyroid cancer rate was because of the modern detection technology, a real increase does exist. Despite of the sensitive detection and early diagnosis, the mortality of thyroid cancer increased, which indicated the increase of thyroid cancer incidence [1]. Among both men and women, follicular thyroid cancer rate increased [2]. Among women, all the tumor sizes increased; and women got more aggressive tumors in addition to small and localized tumors [2].

Current non-surgical treatments for thyroid nodules include non-invasive methods and minimal invasive methods. Minimum invasive procedures include;

1. Percutaneous ethanol injection therapy
2. ultrasound-guided laser or radiofrequency ablation,
3. Microwave ablation and
4. high-intensity focused ultrasound.

A non-invasive method is to use levothyroxine to suppress the nodule [3]. The suppression treatment does not work in all patients [4]. Currently, levothyroxine are not proved to be effective. Therefore, doctors usually do not recommend this treatment [5]. The minimal invasive procedures do work in shrinking benign nodules, but can be costly. Proficient doctors may perform the procedures well in large medical centers [3]. If by improving thyroid health through everyday activities such as diet, exercise, and improving mental status, patients can help shrinking benign thyroid nodules or keep thyroid cancer in remission, patients can avoid suffering or the financial cost of invasive procedures.

Iodine in the human body works more than as a component in thyroid hormone; it is also an anti-oxidant [6]. Different forms of iodine might have different functions [7]. Excess iodine can kill malignant mammary cells [8]. Iodine is also important in detoxification of

thyroid. For instance, Perchlorate is a naturally occurring inorganic anion, which is usually used as a part of solid rocket fuel, explosives, and pyrotechnics. High intakes of perchlorate can competitively inhibit iodine intake and hurt the thyroid. In the research carried out by the researchers examined how perchlorate affected thyroid function in infants [9]. The result showed that although breast fed infants took in high level of perchlorate, the perchlorate did not damage thyroid due to high levels of iodine [9].

Iodine deficiency is the major cause of goiter [10]. The iodine deficiency problem is a long-existing problem, because soil and water from all over the world is iodine deficient. The determination of iodine deficiency is mainly geological, not social or economic [10]. Iodine deficiency causes thyroid cancer in animal experiments; while iodine supplement decreases thyroid cancer rate. Not only does iodine work on thyroid, it also works on other tissues. High iodine intake can lower breast cancer and prostate cancer rates [6]. Therefore, it is important to have an optimum iodine intake standard, because it is about both women's and men's health. The current US standard of iodine upper limit is reasonable only for people who have previous thyroid diseases [11].

Asian people have fewer incidences of benign or cancerous breast and prostate diseases because of their high iodine intake [6]. Among these Asian groups, the iodine intake is 25 times higher than that of western countries. Among all forms of iodine, molecular iodine (I₂) is the one that decreases the size and growth of benign and cancerous neoplasias [6]. Aceves proposed that iodine intake should be 3 mg/day of I₂ for those breast and prostate pathologies. Thyroid cancer treatment should be more than a local treatment. It is supposed to be a whole body thing, because thyroid has closer connections to the whole body than other organs do [12]. Iodine, thyroxine, and iodothyronine all show antioxidant properties, and have antioxidant functions for all living things, from the ancient algae to vertebral animals [13]. Iodine enters cells through the form of iodide; and is

in the diet of all marine and terrestrial organisms [13]. If iodine is an important antioxidant in single celled organisms, while human body has many single cells, iodine can be one of the most important antioxidants in the whole body.

Iodine is an important element through out evolutionary history. Inorganic iodide is a strong antioxidant. Iodine is not just for thyroid, but for many other organs such as mammary glands, salivary glands, ovary, and nervous, arterial, and skeletal systems [13]. In breast tissues, iodine can kill malignant mammary cells [8]. In mice, shortage of iodine can cause kidney failure [15]. Actually, thyroid only contains 1/30th of total body iodine [13]. Oxidants form during the thyroid hormone synthesis procedure, which are harmful to thyroid cells and may lead to thyroid cancer [7]. In 2015, Karbownik-Lewińska, et al, proved that different forms of iodine, potassium iodide (KI) or potassium iodate (KIO) both can help protect nDNA and mtDNA in thyroid cells from oxidants. KI works better than KIO [7].

Excess iodine caused hyperthyroid does happen, but is a rare phenomenon called Jod-Basedow effect. Excessive iodine only causes thyrotoxicosis in patients with underlying thyroid diseases [15]. Some literature state that excess iodine intake might increase thyroid oxidative stress [16]. However, iodine is a type of anti-oxidant and may compensate for oxidative stress [6]. Normal thyroids have a protecting function to prevent excessive iodine from entering thyroid cells. When iodine level is high, a healthy thyroid automatically stops pumping iodine into thyroid cells [17]. All those study are saying that excessive iodine might not be bad for the thyroid.

Sometimes, excess molecular iodine does not necessarily cause hypothyroidism. When some new born babies go hypothyroidism, doctors found out that the hypothyroidism connects to iodine usage. Among these hypothyroid babies, the medical workers used antiseptics containing iodine to disinfect the umbilicalcord [18]. Mild iodine excess can cause hypothyroidism and the related neurological functioning [19]. On the other hand, some researchers argued that excessive potassium iodide does not cause hypothyroidism [17]. When a pig used high iodine diet, it significantly increased the storage of iodine in its body without synthesizing excessive thyroid hormones [19]. This is to say, whether excess iodine intake is harmful to a human body is questionable.

It is currently not very clear how much iodine intake is enough. Although iodine intake differs from person to person and food to food, Japanese, which contains a lot of iodine in their diet, consumes approximately 1-3mg of iodine everyday [20]. Japanese national daily iodine intake standard is 130mcg to 2200mcg [21]. In US, the lower limit of iodine intake standard is 150mcg per day [22]. Compared to Japanese iodine intake, the US standard seems has brought about some iodine deficiency. However, there is evidence saying that US standard is somewhat reasonable for certain group of people. For children or people with previous thyroid problems, excessive iodine can both lead to hyper- and hypo-thyroidism [11]. The iodine-triggered thyroiditis is especially obvious among people with recurring thyroid diseases, elderly, fetuses, and neonates [11].

Seaweed contains the most iodine. For a one-gram serving, it contains 16 to 2984 mcg of iodine, which is about 11%-1989% DV. The second is cod, which contains 99 mcg of iodine per three-

ounce serving. Next are plain yogurt, iodized salt, milk, fish sticks, and bread [22]. Meat and Poultry are not generally good sources of iodine, but it depends on what the meat-producing animals have eaten. If the meat-producing animals take in a big amount of iodine, the iodine content of the meat will be high [23]. Iodine content in vegetables and cereals are consistent with the soil from which they grow from. Vegetables and cereal are not good sources of iodine if they are from iodine deficient soil [23].

All foods are not created equal! Iodine content in marine fish is higher than that of in freshwater fish, and egg yolk contains more iodine than a whole egg does [23]. Eggs contain more iodine than the meat from the chicken that laid the eggs. Chickens fed by iodine supplement have a high level of iodine content in their eggs are about 144–1304 µg/kg, while their meat iodine content stays low as about 14 µg/kg [24]. Therefore, when seafood is not available, iodine fortified eggs can be a good source of iodine. Although milk can be a source of iodine, the concentration of iodine in milk varies because of many factors. The concentration of iodine in cow milk has a linear co-relation with the iodine content in the feed. Iodine content in cow milk is not largely higher than that of in other tissues [25].

Cooking affects food iodine content too. Among steaming, stir-frying, and boiling, boiling takes the most iodine out of the food, from 6-91% [23]. In cooking kelp, boiling loses 83% of the iodine, but 90% of the iodine remains in both kelp and soup [23]. In the study carried out by the researchers investigated a goiter endemic area. In this population, turmeric use is anti-goitrogenesis [26]. To overcome goitrogens, patients should add turmeric, spices and green chilies in their cooking recipes, which are typical of some Indian cuisine [26]. Again, iodized salt is not the only solution.

Currently, American drinking water contains fluoride, which is to protect people's teeth [27]. However, the water fluoridation is detrimental to thyroid health [28]. Withdraw of fluoride can cause thyrotoxicosis and the first sign of thyrotoxicosis is usually psychosis [29]. Moreover, the medical field overstated the health benefit in bone formation of fluoride [27].

Fluoride exposure is a contributing factor in hypothyroidism. In some thyroid patients, even if their iodine intake is adequate, they have hypothyroidism. One of the underneath reasons can be fluoride. Hosur, Puranik, Vanaki, and Puranik did a research about the relationship of children dental fluorosis and thyroid disturbance. When a child takes in more fluoride than other children, this child's thyroid function declines [29]. Fluoride is bad for thyroid health [28]. In the research about how fluoride affects thyroid, Peckham et al compared the hypothyroid prevalence between a wholly fluoridated area and a non-fluoridated area. The results showed that the highly fluoridated area has almost two times of incidence of hypothyroidism as non-fluoridated area [28]. Fluoride can induce thyroid cell death. Despite of the common view that iodine has the anti-fluoride function, the addition of excess iodine may make the fluoride toxicity worse [30].

Although Fluoride had the reputation of improving bone health, the overrated effect might have brought some harm to human bones. A study carried out by Ghanizadeh, Babaei, Naghii, Mofid, Torkaman, &Hedayati showed that the combination of boron and fluoride intake significantly improved bone mechanical properties and bone metabolic hormones [27]. However, the researchers found

out that without calcium, fluoride exacerbate osteoporosis. Chronic exposure to fluoride increases the chances of fracture and exacerbates osteoporosis in sheep [27]. The result of this research calls for investigation of bone fracture cases in areas with fluoridated water. Fluoride might also connect to bone cancer [31]. Fluoride might have a connection with osteosarcoma. In animal experiments, fluoride causes osteosarcoma among rats. Whether this is a truth among human is still controversial. Because osteosarcoma is a very rare disease, it is hard to carry out a practical case-control research [32]. Reasonably, fluoride can stimulate growth plate in children of certain age and cause overgrowth and eventually form cancer [33].

Methods

This research is a literature review, which is a qualitative research. Research methods usually fall into two types of paradigms: Interpretive and Positivist. In interpretive paradigms, the researcher figures out participants' perceptions [34]. Interpretive paradigms rule that the world is multiple and relative and this multiple reality depend on other system for meanings. The research from these paradigms is social construction Instead of objective determination [35]. Positivist paradigms are exactly the opposite from interpretive paradigms. It approaches a research problem by looking for regularities and causal relationship [35]. The basic idea of positivist paradigms is objective. It looks at the causal relationships among quantitative data. It is mostly used in quantitative research [34]. This qualitative research is more of interpretive paradigm than positivism, because the focus is based on other literatures, not objective data such as calorie intakes, counting percentage of nutrients, or measuring pain and fatigue in a scale.

Result

Currently, American iodine intake is not enough. Iodine as an antioxidant is not just for thyroid, it is for the whole body. For rich people it is easy to access iodine rich foods such as salmon, sushi, or chicken breast from iodine rich area; but poor people cannot afford those things. If eggs have much higher level of iodine than chicken meat, eggs should be a good source of iodine intake. While kelp is a good source of iodine, it is not very tasty. If after boiling in water, 90% of the iodine is in the soup and the food in soup, kelp soup should be a good source of iodine. Spice is also a necessity in cooking. Turmeric is good for treating goiter. Moreover American fluoride intake is not right. Fluoride actually hurts thyroid and with fluoride toxicity, excessive amount of iodine will get the condition worse. Currently US government adds fluoride to municipal water claiming it is in a safe range. However, data are showing that people's thyroid functions do go down with the fluoride usage.

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