Biochemistry & Physiology: Open Access

ISSN: 2168-9652

Samarasinghe, Biochem Physiol 2023, 12:6

Review Article Open Access

# Iodine induced Toxicity

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**Abstract**

Iodine is an essential micronutrient needed for synthesizing and producing thyroid hormones, which is important for regulating metabolism and growth. Iodine-induced toxicity is commonly known as iodism. Can occur when iodine intake is high. Various symptoms, including thyroid dysfunction, hypersalivation, fever, and gastrointestinal distress, can determine it. Chronic iodine toxicity may result in goitre, hypothyroidism, or even thyroid cancer. The most common causes of high iodine consumption are using iodine-rich foods, supplements, and medications. The use of iodine cleaners, contrast mediums used in medical images, and occupational exposure are among additional sources.

## Introduction

Iodine is a crucial trace element required for the formation of thyroid hormones. Iodine-induced toxicity, often known as iodine poisoning, can occur if high iodine intake . Large doses of iodine-containing compounds, such as iodine supplements, iodine-rich meals, or iodine-containing disinfectants, can cause acute iodine poisoning. Abdominal pain, nausea, vomiting, diarrhea, fever, burning in the throat and mouth, metallic taste in mouth, and dehydration are some symptoms of acute iodine poisoning.

Long-term iodine overconsumption can also result in chronic iodine toxicity, which can cause thyroid malfunction and other health issues.It is essential to consume iodine in appropriate amounts, as both iodine deficiency and iodine excess can negatively impact one's health [1]. For people, the recommended iodine consumption is between 90 to 290 micrograms per day, depending on various factors like age, gender, and health status. It is best to consult a professional to determine the appropriate intake of iodine.

## Causes and risk factors of iodine toxicity

Iodine toxicity occurs when there is an excessive intake of iodine, which can lead to harmful effects on the thyroid gland and other organs. Here are some common causes and risk factors of iodine toxicity:

**Iodine supplements**: Iodine toxicity risk is increased by high iodine supplement doses. Sometimes supplements could have thousands of times higher iodine levels than advised.

**Medications**: Some drugs, such as amiodarone, can have high iodine concentrations and cause iodine toxicity. Amiodarone can cause transient alterations in thyroid function tests, as well as overt hypothyroidism or hyperthyroidism.

**Contrast dyes**: Iodine-containing contrast dyes used in medical imaging examinations like CT scans and X-rays raise the risk of iodine toxicity.

**Diet**: Eating an iodine-rich diet, such as a lot of seaweed or shellfish, can raise iodine poisoning chances.

**Genetics**: Iodine toxicity risk can be increased by specific genetic mutations. For example, mutations in the N.I.S. gene can lead to an overactive thyroid gland and increased iodine intake, raising the risk of poisoning.

**Pre-existing thyroid disorders**: People with thyroid disorders like hyperthyroidism or autoimmune thyroid disease may be more likely to have iodine toxicity.

**Gender and age**: Due to increased iodine requirements, women, especially those who are pregnant or nursing, may be more at risk of iodine toxicity. Infants and elderly individuals can also be at increased risk of toxicity due to lower tolerance levels.

It is important to remember that iodine is to be consumed in accordance with the recommended daily allowance for healthy thyroid function. Iodine toxicity and its severe effects can result from excessive consumption [2]. It is always advisable to speak with a healthcare professional before beginning any new supplements or making any dietary changes.

## Diagnosis and laboratory tests for iodine-induced toxicity-

Iodine-induced poisoning can be difficult to diagnose because the symptoms might be vague and change depending on how severe the illness is. Iodine-induced toxicity can, however, be diagnosed with the aid of laboratory tests. The following are some frequent laboratory tests for iodine-induced toxicity: Iodine levels in the urine can be measured as a valuable test for determining whether someone was exposed to too much iodine. A person who has a high urine iodine level has likely absorbed more iodine than their body can utilize, which could result in iodine-induced toxicity.

Levels of serum hormones that regulate the thyroid, such as T3 and T4, can be used to diagnose thyroid dysfunction brought on by iodine-induced poisoning. Reduced levels of the hormone thyroid may be present in chronic iodine toxicity instances because of thyroid gland destruction. Due to the release of thyroid hormones that have been stored, there may be excessive quantities of thyroid hormones in acute cases. Levels of calcium, magnesium and sodium in the serum can become unbalanced due to iodine-induced toxicity, which can impact

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**Received:** 01-Nov-2023, Manuscript No. bcp-23-109950; **Editor assigned:** 03-Nov-2023, PreQC No.bcp-23-109950 (PQ); **Reviewed:** 17-Nov-2023, QC No. bcp-23-109950; **Revised:** 22-Nov-2023, Manuscript No. bcp-23-109950 (R); **Published:** 30-Nov-2023, DOI: 10.4172/2168-9652.1000432

**Citation:** Samarasinghe K (2023) Iodine induced Toxicity. Biochem Physiol 12: 432.

how well the body functions [3]. Analyzing these electrolyte levels in the blood can aid in the diagnosis and treatment of iodine-induced toxicity. Measurement of tests for liver function, such as alanine aminotransferase, or ALT and aminotransferase from aspartate (AST), can assist in diagnosing liver damage. Iodine-induced poisoning can also harm the liver.

Imaging tests: CT or ultrasound scans can evaluate the thyroid gland's or other affected organs' damage in serious instances of iodine-induced toxicity. It is significant to note that iodine-induced toxicity may not always be diagnosed by laboratory testing alone. Instead, a full medical evaluation is required to identify the underlying source of the symptoms.

## Treatment options for iodine-induced toxicity-

The severity of the problem and the symptoms that the affected person is experiencing determine the best course of treatment for iodine-induced toxicity. Here are some typical medical options:

Iodine consumption should be stopped as the first phase in treating iodine-induced toxicity. Avoiding iodine-rich foods, drugs, and supplements should do the work.

**Supportive treatment**: In order to treat symptoms of iodine-induced toxicity, supportive care can be used. This involves giving intravenous fluids, replacing electrolytes, and treating nausea and vomiting with medication.

**Medicine**: In cases where thyroid dysfunction has occurred by poisoning, thyroid hormone levels may need to be regulated with medication. This can involve taking medicine to either increase or decrease the synthesis of thyroid hormones.

**Hospitalization**: To control the symptoms and keep an eye on the patient's health in extreme cases of iodine-induced poisoning, hospitalization may be required. Close observation of health indicators, intravenous fluid administration, and electrolyte replacement may be part of this.

**Dialysis**: To eliminate extra iodine from the bloodstream in rare circumstances where iodine-induced toxicity has resulted in damage to the kidneys or failure, dialysis may be required.

**Long-term management**: To prevent the recurrence of symptoms for individuals with chronic iodine-induced toxicity, long-term care may be necessary. This could involve taking medicine to treat thyroid dysfunction, avoiding iodine-rich meals and supplements and routinely checking thyroid hormone levels [4].

## Prevention and management of iodine-induced toxicity

Iodine-induced toxicity can be prevented and treated by limiting iodine consumption and treating any symptoms that may develop. The following are some management and preventative tactics:

The simplest strategy for avoiding iron-induced poisoning is to avoid consuming excessive amounts of iodine. To do this, restrict your consumption of iodine-rich foods like seaweed, iodized sea salt, and shellfish, and avoid supplements with high iodine content.

Watch your iodine intake if pregnant: Too much iodine can harm the growing foetus. Therefore, pregnant women must be extra cautious about their intake. Consult your healthcare professional about your iodine consumption if you are pregnant or intend to become pregnant. People who take supplements or drugs should carefully study the labels to determine the amount of iodine included therein. Some drugs, such as amiodarone can have high iodine concentrations, which raises the possibility of iodine-induced toxicity [5].

## Chronic iodine toxicity and its effects on the thyroid gland-

Chronic iodine toxicity is the phrase used to describe the thyroid gland's potential harm from long-term exposure to high iodine levels. The gland that houses the thyroid is in charge of making the hormones that control growth, development, and metabolism. The thyroid gland may be harmed in the following ways by long-term iodine toxicity. Iodine-induced hyperthyroidism accompanied by hypothyroidism is a syndrome that can result from persistent iodine toxicity in some situations.

**Goitre development**: Acute iodine toxicity can potentially enlarge the thyroid gland and result in goitre. A widespread or nodular goitre may manifest as symptoms including coughing, shortness of breath, and difficulty swallowing. Chronic iodine poisoning may lead to autoimmune thyroiditis, a disorder in which the immune system attacks the thyroid gland. This may result in inflammation, thyroid cell death, and reduced thyroid hormone production. Despite its rarity, persistent iodine poisoning has been linked to a higher chance of developing thyroid cancer. The process is unclear, although it might be connected to how much iodine causes thyroid cells to grow and proliferate. Infants with impaired thyroid function: Chronic iodine poisoning in pregnant women can cause infants with impaired thyroid function. Congenital hypothyroidism can result from excess iodine exposure during pregnancy, disrupting foetal thyroid development.

Most of the world's population does not typically experience chronic iodine toxicity, especially in affluent nations where salt is enriched with iodine to avoid iodine deficiency. However, in regions where iodine-rich products such as supplements are eaten in excess, chronic iodine poisoning can happen. It is possible to treat chronic iodine toxicity by stopping iodine intake, taking medicine to treat thyroid dysfunction, and closely monitoring thyroid function [6].

## Acute iodine toxicity and its effects on other organ systems-

Acute iodine toxicity is the term used to describe the adverse effects that unexpected exposure to high quantities of iodine can have on the body's numerous organ systems. Acute iodine toxicity may result in the following effects on other organ systems. Inflammation and irritation of the gastrointestinal tract's lining can result from acute iodine toxicity, which can produce symptoms like nausea, vomiting, stomach discomfort, and diarrhea .

**Cardiovascular system**: Severe cases of acute iodine toxicity may result in cardiac arrhythmias, palpitations, and a rise in heartbeat and blood pressure.

**Renal system**: Iodine toxicity that occurs suddenly can harm the kidneys, resulting in diminished renal function and even kidney failure.

**Neurological system**: Acute Iodine toxicity can have an impact on the neurological system and result in symptoms like confusion, disorientation, seizures, including coma. It is crucial to remember that severe iodine toxicity is uncommon and typically only happens when a person accidentally consumes high iodine concentrations, such as when they accidentally poison themselves or are exposed to salt-containing contrast substances utilized for medical imaging. When acute iodine poisoning is severe, hospitalization may be required along with medical treatment, such as giving fluids and drugs to treat symptoms.

## Iodine supplementation and potential risks of excessive intake

Iodine is a necessary ingredient for the creation of thyroid hormones that are crucial for preserving healthy metabolism, growth, and development. A lack of iodine is a widespread nutritional issue, particularly in underdeveloped nations, and it can cause various health issues, including goiter, hypothyroidism, or mental impairment. Iodine shortage is frequently prevented and treated by taking iodine supplements, such as salt with iodine or dietary supplements. However, consuming too much iodine can also be harmful to your health. Here are some possible negative effects of consuming too much iodine. Excessive iodine consumption can disturb the synthesis of thyroid hormones and result in either an overactive or underactive thyroid gland, which can cause diseases like hyperthyroidism or hypothyroidism [7-10].

Excessive iodine consumption can enlarge the thyroid gland and result in the development of goitre. A widespread or nodular goitre may manifest as symptoms including coughing, shortness of breath, and difficulty swallowing. Excessive iodine consumption has been linked to the emergence of acneiform eruptions, a type of skin lesion that resemble acne. Abdominal pain, nausea, vomiting, diarrhoea and other gastrointestinal disorders can all be brought on by consuming too much iodine. Unfavourable pregnant outcomes: Excessive iodine consumption during pregnancy has been linked to complications like miscarriage, stillbirth, or congenital abnormalities. The recommended daily intake of iodine for adults is 1,100 micrograms. Excessive iodine consumption is uncommon in much of the globe, particularly in affluent nations where salt is iodine-fortified to avoid iodine deficiency. However, those who ingest a lot of seaweed and kelp supplements or who are exposed to a lot of the iodine-containing contrast materials used in medical imaging may absorb too much iodine. As a result, it's crucial to speak with a doctor when taking iodine supplements, particularly if either have a history of thyroid issues or are pregnant [11].

## Iodine-induced toxicity in vulnerable populations such as pregnant and breastfeeding women

Iodine-induced toxicity can harm both the health of the mother and the fetus, making it more dangerous in vulnerable populations like pregnant and nursing mothers. The following are some possible consequences for iodine-induced toxicity in expectant and nursing mothers:

**Thyroid dysfunction**: Both mother and the growing baby or newborn may experience thyroid dysfunction as a result of excess consumption of iodine during pregnancy or nursing. This might result in illnesses like hypothyroidism or hyperthyroidism that can harm the growth and development of a foetus and a newborn.

**Unfavorable pregnancy results**: Excessive iodine consumption while pregnant has been linked to complications like miscarriage, stillbirth, or congenital abnormalities. Inadequate growth and development in newborns can result from high iodine intake during lactation, which can also impact breast milk quality and quantity. Excessive iodine consumption during pregnancy can also influence foetal thyroid function, which can result in neonatal thyroid dysfunction, which can impair development, retard growth, and result in intellectual impairment [12-15].

**Allergic reactions**: Iodine and iodine-containing supplements may cause rash, hives, and edema in some pregnant and nursing women who are allergic to them.

It's crucial for women expecting or nursing to get enough iodine, but not too much. Iodine should be consumed in amounts of 250–290 micrograms per day for lactating women and 22–290 micrograms per day for pregnant women. In instances of iodine deficiency, iodine supplementation might be required. However, it must be done under the supervision of a healthcare professional to ensure a safe and effective dose. Women who are pregnant or nursing should also avoid consuming large amounts of iodine-containing foods or supplements, including seaweed and kelp supplements, and they should speak with a doctor before starting any fresh vitamins or drugs.

## Public health measures to prevent iodine-induced toxicity

By ensuring that the general population consumes enough iodine without going beyond, public health initiatives can be very effective in reducing iodine-induced toxicity. The following steps can be taken to avoid iodine-induced toxicity. Iodine is added to salt using a technique known as universal salt iodization (USI), which can be a useful method of preventing iodine shortage and associated health issues. Many nations have embraced USI as a public health policy to guarantee that the population consumes enough iodine. Campaigns for education and public awareness can assist people in understanding the value of iodine in health and the possible dangers of both an excess and a shortage of the mineral. Such efforts can be directed at certain groups, including expectant mothers or medical professionals.

Iodine-containing supplement regulation: Iodine-containing supplement regulation can assist in guaranteeing their safety, proper dosage, and accurate labelling of their iodine content. Control for iodine-containing contrast agents: Controlling iodine-containing contrast agents utilized for medical imaging can assist in protecting at-risk groups, including pregnant women and nursing mothers, from receiving too much iodine. Iodine-induced toxicity surveillance can help identify instances of iodine toxicity and provide information for public health treatments and policies. In order to minimize iodine-induced toxicity and guarantee appropriate iodine consumption in the population, a thorough public health approach is required.

## Conclusion

Iodine is a vital micronutrient that is crucial for thyroid health and general well-being, to sum up. Excessive iodine consumption, however, might result in iodine-induced toxicity that can harm multiple organ systems and general health. Iodine poisoning that persists over time can harm the thyroid gland and result in diseases like hypothyroidism or hyperthyroidism. Other organ systems, including the gastrointestinal, cardiovascular, the renal systems, may be impacted by acute iodine toxicity. Iodine consumption needs to be sufficient but not excessive in order to prevent iodine-induced toxicity. Iodine-induced toxicity can be prevented, and adequate iodine intake within the population is ensured by public health measures like universal salt iodization, intake monitoring, awareness-raising campaigns, regulation for iodine-containing supplements, monitoring of iodine-containing contrast substances, as well as surveillance of iodine-induced toxicity. To avoid iodine-induced toxicity, people should follow suggested daily intake guidelines and speak with their healthcare practitioners before using supplements or drugs containing iodine. Iodine-induced toxicity may be prevented and managed well, allowing for the benefits of iodine intake on one's general health and well-being.

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