

Bottom Line:

- Connecticut sugar kelp is a nutritious food containing valuable levels of calcium, magnesium, selenium, phosphorus, chromium, fiber and other beneficial nutrients.
- Connecticut sugar kelp contains low levels of lead, cadmium, mercury, and inorganic arsenic, unlikely to result in negative health impacts if consumed.
- Arsenic comes in two main forms: inorganic arsenic, which is highly toxic, and organic arsenic, which is much less harmful. Connecticut sugar kelp has high total arsenic levels, but more than 99% is the less toxic organic form.
- Iodine in Connecticut sugar kelp is very high and can be a good source for those who may be iodine deficient.
- Excess iodine intake can be a risk from eating Connecticut sugar kelp. Most individuals with normal thyroid function can tolerate excess iodine on occasion, but certain susceptible sensitive groups such as pregnant women, anyone with a thyroid condition, or kidney disease are at higher risk of thyroid dysfunction from excess iodine (Sohn S. Y. et al., 2024) and should talk to their doctor before eating CT grown sugar kelp.



Photo by Zachary Gordon

Summary:

Connecticut sugar kelp is rich in nutrients and minerals, especially iodine, which supports its image as a healthy food. However, iodine levels can be very high, especially in dried kelp, above the daily safety limit recommended in the United States. The effects of excessive iodine consumption vary significantly among consumers. Specific sensitive groups, such as people with thyroid issues, should consult their physician before consuming CT grown sugar kelp. Others should halt consumption if they begin to notice any adverse symptoms and consult their physician. Symptoms can include extreme fatigue, weight gain, hair loss or general pain (Ciaramella et al., 2025). Heavy metals were found at low levels that are below safety limits but are still important to understand and consider if you are consuming kelp at high quantities.



Photo by
Liz Ellenwood

Background:

Sugar kelp (*Saccharina latissima*) has been farmed in Connecticut for more than 10 years. In 2024, farmers harvested more than 60,000 pounds ([CT Department of Agriculture](#)). Most of this kelp is used for fertilizer, soil improvement or materials such as bioplastics and other non-food uses, as well as for research. A portion of the kelp harvested was sold as food or processed into various food products.

While only a small amount of Connecticut farmed sugar kelp is sold as food, various kelp species are common ingredients in food internationally, used in dashi or soup stocks as well as mixed with spices in seasoning blends. Kelp is commonly marketed in the United States as a “superfood” because it contains many healthy nutrients, minerals, and vitamins and is produced with sustainable farming practices. For farmers, selling kelp for food can provide the highest value for their product, but there are challenges in storing and processing it that make this difficult.

While kelp is known as a nutrient-dense and healthy product, it does also have the potential to absorb harmful substances from the water where it is grown. Sugar kelp can absorb heavy metals (Bryan and Hummerstone, 1973), iodine (Aakre et al. 2021), chemicals, and other micronutrients at much higher levels than the concentrations in the surrounding water. Kelp harvested for food in Connecticut is only permitted to be grown in waters considered safe for shellfish consumption as monitored by the state Department of Agriculture (DoAg). Because contaminants of concern in shellfish and kelp can differ, this guidance was developed to give consumers a better understanding of the risks associated with sugar kelp farmed in CT.

There are no U.S. federal standards for acceptable concentrations of heavy metals and other substances in seaweed. This document provides guidance related to how much heavy metal an adult can consume depending on body weight, without adverse effects. More detailed information about seaweed regulations and food safety guidance can be found in the recently released “[Seaweed Food Safety Guidance](#),” Ciaramella et al. 2025.

Connecticut Sea Grant collected samples from five farms at the beginning and end of the harvest season. Each sample was divided into a raw fresh sample to be tested and a sample that was dried in a commercial drier for 24 hours at 117 °F before testing. Testing included standard nutritional information, micronutrients known to be high in kelp and heavy metals. Understanding the balance between health benefits and risks is important so that people who purchase kelp grown in Connecticut know what they are eating.

Nutrition:

The nutrition panels provide the average nutrition information of all the kelp samples collected from Connecticut farms. For the fresh kelp (50g) label the kelp was tested in its raw unprocessed form. For the dry labels the kelp was dried in a commercial drier for 24 hrs. at 117° F. The labels were made following federal Food and Drug Administration (FDA) standards. Some nutrients not required to be on the label by the FDA that are common in kelp such as iodine, magnesium, and selenium were included in the labels.

The serving sizes are based on similar products and FDA guidance (**1 ounce = ~28g**):

Dry Kelp 1g Serving Size:

Nutrition Facts	
servings per container	
Serving size	(1g)
Amount per serving	
Calories	0
% Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 40mg	2%
Total Carbohydrate <1g	0%
Dietary Fiber 0g	1%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein 0g	
Vitamin D 0mcg	0%
Calcium 10mg	0%
Iron 0.2mg	1%
Potassium 71mg	2%
Phosphorus 5mg	0%
Iodine 2828mcg	1,885%
Magnesium 7mg	2%
Selenium 0.8mcg	1%
Chromium 0.9mcg	3%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Dry Kelp 5g Serving Size:

Nutrition Facts	
servings per container	
Serving size	(5g)
Amount per serving	
Calories	15
% Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 202mg	9%
Total Carbohydrate 3g	1%
Dietary Fiber 2g	6%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein <1g	
Vitamin D 0mcg	0%
Calcium 51mg	4%
Iron 1mg	6%
Potassium 359mg	8%
Phosphorus 25mg	2%
Iodine 14138mcg	9,426%
Magnesium 35mg	8%
Selenium 4mcg	7%
Chromium 4.6mcg	13%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Fresh Kelp 50g Serving Size:

Nutrition Facts	
servings per container	
Serving size	(50g)
Amount per serving	
Calories	25
% Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 288mg	13%
Total Carbohydrate 5g	2%
Dietary Fiber 3g	11%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein <1g	
Vitamin D 0mcg	0%
Calcium 104mg	8%
Iron 2.2mg	12%
Potassium 579mg	10%
Phosphorus 46mg	4%
Iodine 30342mcg	20,228%
Magnesium 57mg	14%
Selenium 18mcg	33%
Chromium 6.5mcg	19%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



Photo by Zachary Gordon



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Iodine in CT Sugar Kelp:

Iodine is a natural mineral present in food that is very important in helping the thyroid function properly. In the 1920s the United States introduced iodized salt to help combat iodine deficiency in the general population that was leading to goiter and other thyroid issues (Dasgupta et al. 2008). Iodized salt contains roughly 40 µg/g of iodine (micrograms of iodine per gram of salt). According to the FDA, adults need about 150 µg/day of iodine. High levels of iodine are naturally found in kelp. In sugar kelp from Connecticut, iodine concentrations ranged from 260 – 9,873 µg/g.

The recommended safe upper limit in the United States for adults is 1,100 µg/day. Other countries have different approaches to iodine and there is no universally agreed upon standard internationally for the safe upper limit. For example, in Japan the recommended upper limit for adults is 3,000 µg/day and the European Union recommends an upper limit for adults of 600 µg/day. Exceeding the daily limit once is not expected to cause adverse health effects, but continuous exposure to high levels can lead to negative health impacts. In most cases, negative impacts can be reversed by reducing iodine intake. Specific people may be at higher risk for adverse effects from iodine. If you have any thyroid conditions, kidney disease or other iodine-related diet restrictions, talk to your doctor before eating Connecticut sugar kelp. More information can be found on the National Institutes of Health (NIH) [Iodine fact sheet](#).

Table 1. Iodine concentration in Connecticut farmed sugar kelp.

Type of Sample	Average Iodine Content (µg/g)	Range (µg/g)	Amount per Serving (µg)*	Amount per Serving blanched (µg) Estimates**
Fresh Kelp (50g Serving Size)	562	260 – 1,074	28,100	1,405 – 11,521
Dried Kelp (1g Serving Size)	3,692	912 – 9,873	3,692	185 - 1,514
Dried Kelp (5g Serving Size)	3,692	912 – 9,873	18,460	923 – 7,569

*Calculated based on average content across all samples

**Estimates based on the range of 59 – 95% reduction of iodine from blanching reported in Blikra et al. 2024



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Heavy Metals in CT Sugar Kelp:

The heavy metals that are most commonly found in kelp are mercury and lead, which are neurotoxins, and cadmium and arsenic, which are carcinogens. Sugar kelp can absorb these metals at high concentrations (Shaughnessy et al., 2023). Heavy metal values are reported in parts per million (ppm) which are equivalent to micrograms per gram ($\mu\text{g/g}$) or milligrams per kilogram (mg/kg). The World Health Organization (WHO) recommends a provisional tolerable weekly intake (PTWI) that can be consumed over a lifetime and have no adverse health effects. The calculations shown in this report are based on the average adult body weight of 84 kg (185 lbs) in the United States as defined by the Centers for Disease Control and Prevention (CDC). Calculations are given below (Table 2) based on the maximum amount detected in any single sample to show the **maximum potential exposure**. More information can be found at the [FDA website on environmental contaminants in food](#). Heavy metals in kelp are usually reported in mg/kg , but kelp is commonly sold and referred to in ounces. These unit conversions can be valuable in understanding contaminants in kelp.

1 ounce = 28 grams = 0.028 kg

1 kg = 1,000 g

1mg/kg = 1 $\mu\text{g/g}$ = 1ppm

Table 2. Maximum Heavy Metal Concentrations in CT farmed Sugar Kelp.

Type of Metal	Maximum Concentration Detected $\mu\text{g/g}$ (sample type)	Safe Weekly Exposure for Average Adult*	Amount consumed for someone eating 2 servings per week	Servings per week to not exceed the safety limit***
Mercury	0.09 (Dried)	134.4 $\mu\text{g/week}$	0.9 $\mu\text{g/week}$	298
Lead	3.52 (Dried)	2,100 $\mu\text{g/week}$	35.2 $\mu\text{g/week}$	119
Inorganic Arsenic	0.2 (Dried)	1,260 $\mu\text{g/week}$	2.0 $\mu\text{g/week}$	1,260
Cadmium	0.311 (Dried)	588 $\mu\text{g/week}$	3.12 $\mu\text{g/week}$	378

*According to WHO's Provisional Tolerable Weekly Intake (PTWI) Sourced from Ciaramella et al. 2025.

****Calculated** for a 5g serving of dry kelp.

***Based on 5g serving and considering only kelp as a source of heavy metal. You should consider all potential sources of heavy metal in the food you eat when calculating this number for yourself.

Mercury:

Mercury is a heavy metal commonly associated with seafood. The maximum level of mercury seen in seafood tested by the FDA is 4.54 $\mu\text{g/g}$ (FDA, 1990-2012). Fish tend to contain higher levels of mercury than other types of seafood and the FDA, as well as the Connecticut Department of Public Health, have regular testing and consumption advisories for various fish based on mercury levels. Connecticut sugar kelp was found to have very low levels of mercury and this is consistent with kelp levels tested around the world. The WHO's safe weekly level for mercury is 1.6 $\mu\text{g/kg}$ of body weight. For the average adult, this would be **134.4 $\mu\text{g/week}$** to stay below the safe level. In most samples in this study, mercury was not detected and the highest concentration of mercury that was detected was 0.09 $\mu\text{g/g}$ in dried kelp. A 1 g serving of this sample would have 0.09 μg mercury, and a 5 g serving would have 0.45 μg mercury.

Lead:

Lead is a well-known heavy metal due to its historic use in pipes, paints, and gasoline. Now that the negative impacts are more well known, its use is strictly regulated. Connecticut farmed sugar kelp was found to have very low levels of lead. The WHO recommends a maximum weekly intake of 25 $\mu\text{g/kg}$ of body weight. For the average adult, this would be **2,100 $\mu\text{g/week}$** to stay below the safe level. Lead was not detected in most samples in this study and the highest concentration of lead found was 3.52 $\mu\text{g/g}$ in dried kelp. A 1 g serving would contain 3.52 μg and a 5 g serving would contain 17.60 μg .

Cadmium:

Cadmium can be found in seawater depending on the historic industrial activity in the area. It can be absorbed by kelp at very high levels if it is present. In Connecticut, farmed sugar kelp was found to have very low levels of cadmium. The

WHO sets the safe weekly exposure level at 7 $\mu\text{g}/\text{kg}$ body weight. For the average adult, this would be **588 $\mu\text{g}/\text{week}$** to stay below the safe level. Most samples in this study did not detect cadmium and the highest concentration found was 0.311 $\mu\text{g}/\text{g}$ in a dried sample. This means that a 5 g serving would contain 1.56 μg of cadmium.

Arsenic:

Arsenic is a common element found in nature, and kelp can naturally absorb it from seawater. Not all types of arsenic are equally toxic to humans, but some can have harmful health impacts. Seaweeds are known to have arsenic mostly in the organic form, which is generally considered to be much less toxic to mammals, while arsenic in the inorganic form (iAs) is known to be highly toxic (Shaughnessy et al., 2023). Connecticut sugar kelp was found to have high levels of total arsenic (1 – 50 $\mu\text{g}/\text{g}$), which is a common finding in kelp around the world. A subsample of the kelp (5 samples) was tested to determine iAs levels. All Connecticut sugar kelp was found to have low levels of iAs (0.13 - 0.20 $\mu\text{g}/\text{g}$) less than 0.5% of the total arsenic. The WHO recommends a maximum weekly intake of iAs of 15 $\mu\text{g}/\text{kg}$ of body weight. For the average adult this would be **1,260 $\mu\text{g}/\text{week}$** to stay below the safe level. The maximum concentration of iAs detected was 0.2 $\mu\text{g}/\text{g}$ in dried kelp. A 1 g serving of this sample would have 0.2 μg iAs, and a 5 g serving would have 1.0 μg iAs.



Photo by Liz Ellenwood

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