

Algae Consumption

Impact on Human Health and the Health of the Environment

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Introduction

Algae has been eaten by humans for hundreds of years and its popularity as a health food has recently been on the rise. Today, it can be found in many foods we eat on a daily basis. It can also be added to many foods in order to increase the nutritional quality of the food. Studies have shown some of these edible seaweeds can have a positive impact on individuals with certain cardiovascular diseases. Consuming algae in the diet can not only provide many nutrients, but may also have a positive impact on our food system. Environmental sustainability can also be affected in a positive way through consuming algae.

Porphyra umbilicalis, more commonly known as 'nori', is a species of algae is largely cultivated in Japan, and is the seaweed that is often seen wrapped around rice and other seafood to make sushi.¹

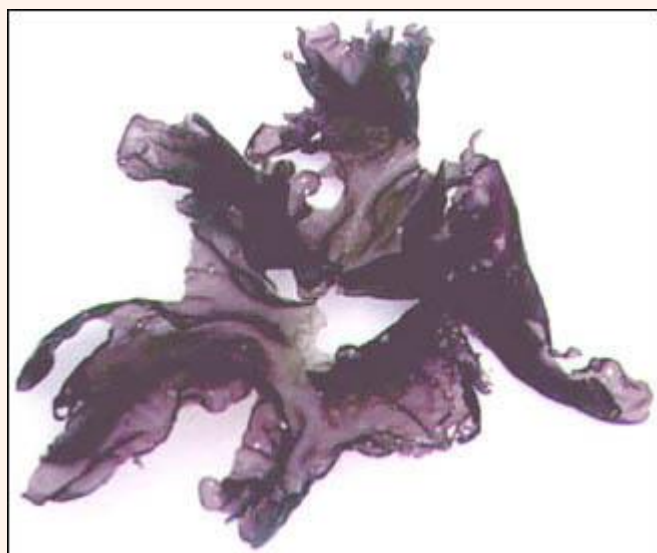


Fig. 1. *Porphyra umbilicalis*¹

Nutritional Qualities

The nutrients found in algae will vary based on the type, similar to the variety of nutrients in produce. However, seaweeds are generally low in calories and rich in vitamins, minerals, and dietary fiber. Some nutrients that can be found in significant amounts in many algae include protein, calcium, iron, and iodine. Research on the different types of edible algae has suggested red seaweeds may have a higher nutritional value than others.²

Macronutrient Profile per 100g of Common Edible Algae²

Type of Algae	Protein	Fat	Carbo-hydrates	Other Nutrients
Arame (raw)	8g	0.1g	56g	
Wakame (dried)	13g	2.7g	46g	Calcium
Kombu (dried)	6g	1g	56g	Calcium, iron, potassium, iodine
Hijiki (dried)	8g	0.1g	56g	
Kelp (raw)	1.7g	0.6g	10g	Iodine
Sea lettuce (raw)	17g	0.9g	37g	
Agar-agar (dry)	6g	0.3g	81g	Iron
Dulse	20g	3.2g	44g	Iron
Carrageen (raw)	1.5g	0.2g	12g	
Nori (dried)	17g	0.8g	36g	Vitamin A
Spirulina	60g	6g	18g	Beta-carotene, iron, thiamin, riboflavin, magnesium

Culinary Uses for Common Edible Algae²

Algae-type	Culinary Uses
Arame	<ul style="list-style-type: none">Good with tofu and vegetablesAdded to soups and saladsDelicious when marinated in vinegar, soy sauce, and sugarFrequently served as a vegetable side dishOften fried
Wakame	<ul style="list-style-type: none">Mild flavorGoes well with rice, pasta, vegetables, tofu, meat, poultry, fish, shellfish, and legumesAdded to soups, salads, and marinadesSoftens the hard fibers of foods that it is cooked with, shortening required cooking time
Kombu	<ul style="list-style-type: none">Used primarily in brothsCan be used to make kombu teaAdded to marinated, boiled, roasted, and fried dishesWhen boiled for longer than 10-15 minutes, inorganic magnesium, sulfuric acid, and calcium are released into the water, giving the broth an unpleasant flavor and dissolving carbohydrates that make it sticky
Hijiki	<ul style="list-style-type: none">Served with root vegetables, grains such as rice and millet, fish, and shellfishAdded to soups, sandwiches, salads, and pancakesServed as a vegetable or an infusion
Kelp	<ul style="list-style-type: none">Byproducts used as thickening, stabilizing, and emulsifying agentsCan be ground and compressed into capsules to be used as a nutritional supplementCan also be used as a condiment when ground
Sea lettuce	<ul style="list-style-type: none">Added to salads and soups
Agar-agar	<ul style="list-style-type: none">Used to thicken jellies with fruit juices or pureed fruitCan be used as a substitute for gelatinUsed as a stabilizing agent for fruit jellies, cream, flavored milk, ice cream, and sherbets
Nori	<ul style="list-style-type: none">Can be eaten fresh, dried, or rehydratedUsually roasted over a small flame to add a crisp texture and greater flavor, then crumbled into a powderRoasted nori has a sardine-like tasteUsed to make sushiAdded to soup, salads, appetizers, and breadsCooked with fish, tofu, vegetables, pasta, and riceUsed as a condimentDrunk as an infusion
Spirulina	<ul style="list-style-type: none">Often dissolved in juice or water, or mixed with yogurt or cerealAdded to broths, soups, sauces, rice, and pastaOften consumed in the form of tabletsHighly concentrated food, should be incorporated into the diet gradually. (Starting with consuming 1 gram per day for a week, then increasing daily intake by 1 gram each week until 5-10 grams are being consumed per day.

Potential Impacts on Human Health³

Obesity:

- Hall, Fairclough, Mahadevan, & Paxman (2012) – found a significant decrease in the energy intake of overweight males after consuming bread enriched with *Ascophyllum nodosum*
- Oben et al. (2007) – found a group of overweight and obese individuals with metabolic syndrome had a lower body weight and body fat after the 10 week study than those in the placebo group

Dyslipidemia:

- Olivero-David et al. (2011) – reported adding certain seaweeds (Wakame or Nori) to meat products can reduce the hypercholesterolemic effect of cholesterol-enriched diets

Antioxidant Potential:

- Chew, Lim, Omar, & Khoo (2008) – suggested that the seaweed varieties *Padina antillarum*, *Caulerpa racemose*, and *Kappahycus alvarezzi* can be used as food preservatives
- O’Sullivan et al. (2011) – found natural antioxidant extracts derived from seaweeds can have the potential to be used in food and pharmaceutical industries

More human studies need to be done on this subject in order to further solidify the above findings.

Environmental Impacts

Pros and Cons of Consumable Algae

Pros	Cons
<ul style="list-style-type: none">Algae can be harvested using saltwater, desert land, and CO2, all of which are wasted resources otherwise.A specific strain of algae, produced by the company iWi, produces about seven times more protein than soybeans while using the same amount of land.⁴The productivity rates of seaweed production can be as high as 20 times that of traditional food production systems.⁵Seaweeds can be grown and harvested at any time of the year, and they require no chemicals, fertilizers, pesticides, or freshwater to grow.Algae will not deplete the minerals of the environment in which they grow, unlike the effect that traditional farming has on the soil. In fact, algae can actually improve the quality of the water it is growing in.Brown seaweeds can positively impact the nitrogen content of the water, which can also be a solution to nitrogen pollution from agricultural run-off.⁶	<ul style="list-style-type: none">Excessive accumulations of algae, known as algae blooms, can sometimes have harmful effects on the environment.Harmful algal blooms can cause dissolved oxygen levels in water to be lowered, disturb the food-web, cause an alteration in the taste and/or odor of a body of water, increase water treatment costs, cause allergic reactions for swimmers, and some algal species can even make the water toxic.⁷

Conclusions

- It has been known for centuries that algae can be used as a food source. Consuming algae may improve our health, as well as our environment.
- Different types of algae provide different nutrients. However, seaweeds are often good sources of protein and carbohydrates, and are generally low in fat. Many varieties also contain essential vitamins and minerals. Different types of algae provide different nutrients.
- A wide variety of algae are available for human consumption. These varieties all have different flavors and culinary qualities, but they all can be used in an everyday diet.
- Few studies have been done on the relationship between seaweed consumption and cardiovascular health. While existing research has found positive effects, more research is needed.
- Using algae as food can have a positive impact on our environment by using resources that would otherwise be wasted. Seaweed is also environmentally friendly, as it requires no chemicals, fertilizers, pesticides, or freshwater, and will not deplete the nutrients
- This “old-new” food source can be added to our everyday lives and can improve the health of our population, as well as the health of our planet.



Fig. 2. A tofu and cucumber dish garnished with Shio-konbu, a type of edible kelp.⁸

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