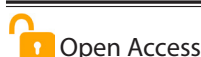




Seaweeds as Functional Foods: Nutritional Composition and Health Benefits

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Abstract

Seaweeds found in seawater and the near-shore shallow zones are known to be a highly sustainable nutrient-rich potential raw material for many varied aspects from food, health care, agriculture and industrial use. Their high nutritional profile (abundant in essential fatty acids, amino acids, vitamins and minerals) has made them the “*Medical Food of 21st Century*” adored traditionally in Asian diets as Wakame, Nori, Kombu and Laverbread are now receiving international attention on their astounding health-imparting benefits.

Keywords: Kombu, Laverbread, Nori, Wakame

Introduction

Seaweeds are a fascinating group of marine plants that grow primarily in the oceans and in feeble coastal locations, particularly found on rocky shores. Fast-growing and adaptable, they are a renewable natural resource of broad use. Wakame, Nori, Kombu and Laverbread are widely popular traditional foods in many Asian meals and have gained global recognition due to their nutritional and medicinal qualities. Moreover, these seaweeds are providing not only dietary fiber, protein and essential lipids, but bioactive compounds that support the cardiovascular system, hormone balance, cancer prevention and bone growth (Fleurence, 1999; Marsham *et al.*, 2007). They are also commercially important seaweeds derivatives. This article focuses on seaweeds as a prospective food source and its nutritional aspects, medical applications.

Types of Seaweeds Used as a Food Source

1. Nori

Porphyra yezoensis and *Porphyra tenera* species yield Nori, a highly sustainable edible seaweed increasingly recognised as natural food source cultivated shallowly. It remains an eco-friendly option amidst global food sustainability quandaries because its impact on environment and ecosystem remains

negligible. This nutrient-rich plant contains copious amounts of protein vitamins and minerals but has surprisingly few calories and negligible fat (Admassu *et al.*, 2018). Nori occupied a crucial niche in Asian gastronomic customs for centuries especially in Japan where it got harvested sun-dried and processed. Nori has gained widespread global popularity, particularly among health-conscious individuals alike due to its largely remarkably high nutritional value and sustainable farming practices.

Nutritional Profile

The nutritional value of Nori per 100 g contains:

- Protein: 30-35 g.
- Fiber: 30 g.
- Carbohydrates: 40-45 g.
- Fat: very low 0.5-1.0 g.
- Vitamins (A, C, B₁₂).
- Minerals: Rich in Calcium, Magnesium, Iodine, Iron.

Medicinal Applications

Beyond its nutritional value, Nori (an edible type of seaweed) also offers significant medicinal benefits. It is usually used for wrapping sushi. High in iodine, it contributes the thyroid

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to work healthy and contains dietary fibre for digestion & gut health. The plant is an excellent vegan source of Vitamin B₁₂, which assists with energy production, brain function and mood regulation. A great source of antioxidants this food helps prevent cell damage and protects your heart. Nori has anti-inflammatory substances, calcium for bone health as well as some additional nutrients that are beneficial to including in a full diet and overall wellbeing.

Note: Vitamin B₁₂ is usually found in animal foods. Nori gives it naturally, which is great for vegetarians and vegans.

2. Kombu

Kombu (edible brown seaweed) is a member of *Laminariaceae* family under *Kelp* genus, common in Chinese, Japanese and Korean food. It is perfect for making dashi (the flavour of the base that many soups and sauces get their taste from). Underneath that, it is just saturated with minerals especially iodine and has glutamic acid for the umami (Kolb et al., 2004). Although Kombu is very mild-flavoured, it is a common food in East Asia for its health and medicinal goodness.

Nutritional Profile

The nutritional value of Kombu per 100 g contains:

- Protein: 8-10 g
- Fat: 1-2 g
- Carbohydrates: 45-50 g
- Dietary fiber: 30 g
- Calcium: 600-1000 mg
- Iron: 2-5 mg
- Magnesium: 100 mg
- Iodine: 1500-3000 µg
- Vitamin K, Folic acid (B₉): Present
- Glutamic acid: HIGH; gives umami flavour

Medicinal Applications

A thick and nutrient-dense seaweed called Kombu (common in Japanese recipes) is incredibly tasty due to it has a strong umami and health benefits to the max. Its high iodine content and dietary fiber support healthy thyroid function and digestive health. Additionally, it is a mineral powerhouse which promotes heart health and bones/ knee joint strength Kombu-rich in antioxidants, anti-inflammatories that protect against cell damage and inflammation that leads to chronic issues. It is calorie-free but high in nutrients and may even aid weight loss since it only adds flavour without any burden to calories. The physical characteristics of Kombu, Wakame and Nori are illustrated in figure 1.

3. Laverbread

Laverbread is a celtic food originating from laver an edible variety of seaweed that grows in Wales' coastal area as well as all over Western Britain and Ireland. Commonly used seaweed was *Porphyra umbilicalis* (which is rich in iodine, iron, etc.) and due to its naturally salty flavour, it can be consumed raw, often accompanied by olive oil or oysters (Admassu et al., 2018). After being washed over and



Figure 1: Kombu, Wakame, Nori and Arame

over again, seaweed is steamed to a firm soft dark green textuality called Laverbread that can be eaten as it is, with oatmeal or fried. Traditionally consumed with bacon and cockles, the quintessentially Welsh breakfast, Laverbread has been popular in Wales since at least the 17th century and is celebrated for its unusual flavours as well as nutrition. An example of traditional presentation is shown in figure 2.

Nutritional Profile

The nutritional value of Laver bread per 100 g contains:

- Carbohydrates: 5.11 g
- Sugars: 0.49 g
- Dietary fiber: 0.3 g
- Fat: 0.28 g
- Protein: 5.81 g

Medicinal Applications

Laverbread, composed of a kind of seaweed that has been high in nutrients provides the body with many beneficial health properties. For instance, it is particularly rich in iodine (which works well thyroid, regulates metabolism). Also likely

to help with digestion and a little goes a long way generally helps the gut healthy due to its fibre content, combined with antioxidants and minerals for the immune support. The natural bioactive compounds in seaweed may further protect cardiovascular and may stabilize blood sugar levels, reduce risk of type-2 diabetes.



Figure 2: Laverbread and toast

4. Wakame

Wakame (*Undaria pinnatifida*), is one of the most widely consumed brown seaweeds. It is rich in fucoxanthin. Fucoxanthin characteristic of aqua xanthophyll pigment carotenoid and the major of the estimated aquatic carotenoids, more than 10% of total marine production being fucoxanthin. Fucoxanthin and its derivatives possess antioxidant, anti-carcinogenic, anti-obesity and anti-inflammatory properties. Wakame is very nutritious, over 15% protein and an array of known bioactive compounds. Wakame also has plenty of bioactive components besides that it is known for having high protein concentration. There have been reports of numerous studies demonstrating that intake of wakame decreases human blood pressure.

Nutritional Profile

The nutritional value of Wakame per 100 g contains:

- Protein: 3 g
- Fat: 0.6 g
- Carbohydrates: 9 g
- Dietary Fiber: 0.5 g
- Calcium: 150 mg
- Iron: 2.2 mg
- Magnesium: 107 mg
- Iodine: Very High
- Vitamin A: (as beta carotene) High
- Vitamin K: Very High
- Folate (B₉): 196 mcg

Medicinal Applications

Wakame is rich in essential nutrients and bioactive compound and offers a wide range of health benefits that have been recognised in traditional and modern medicine. It is rich in iodine which helps in thyroid health. Wakame contains bioactive compound called Fucoxanthin which helps to burn fat and weight loss (Kolb *et al.*, 2004; Marsham *et al.*, 2007). The presence of anti-oxidants and omega-3-fatty acids maintain brain and heart functions, and also restricts the cancer specifically breast and colon cancer. The fibre richness supports the intestinal health. Additionally, it aids in controlling the blood sugar, reduces inflammation and improvises the immunity. Also we should note that excessive iodine can affects the thyroid health.

Conclusion

Seaweeds are very high nutritious and sustainable option of source of food that shows some uncommon functional therapeutic properties (Fleurence, 1999; Anonymous, 2000). Varieties of Nori, Kombu Laverbread & Wakame are good for proteins, dietary fibers and many important minerals as well vitamins also contain some special bioactive compounds fucoxanthin. They all contribute drastically to the healthful benefits of cardiovascular wellness, thyroid modulating, weight control, phenomenal digestion and support immune function. Seaweeds may be a functional food owing to their antioxidant, anti-inflammatory and anti-cancer property. Due to low environmental foot print and high nutritional density, seaweeds are essential dietary components that can promote food security and improve global health outcomes. In short, the integration of edible seaweed into everyday dietetic practices is expected to have a positive impact in sustainable nutrition and prevention-based healthcare pathways.

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