

Algae and algae-based products

Algae are a diverse group of aquatic organisms, ranging from microscopic single-celled species to large seaweeds, for example spirulina, chlorella, nori, kelp, dulse, wakame, and kombu.

While algae have been traditionally utilised in various industries, including pharmaceuticals, cosmetics, and biofuels, their potential as a food source has gained attention in recent years. This is primarily due to their high nutritional content, the fact that they do not need land to grow, but also that they are great at absorbing carbon dioxide from the atmosphere.

Traditionally, seaweed has been used in East Asian cuisines, for example in the form of roasted nori sheets, in soups, or as a salad. In Europe, seaweed is less commonly found in traditional cuisines, for example Welsh Laverbread.

While algae supplements (including powders and in pill form) have been on the market for many years, food products that contain algae are relatively new to the European market. Food manufacturers have introduced various product types on the European market, for example bread, energy bars, pasta, plant-based meat and soft drinks.

Additionally, seaweed extracts are used as thickeners, stabilisers, emulsifiers or flavour enhancers in various processed foods (e.g. plant-based milks, processed meats, sauces, and desserts).

The UK is one of Europe's leading algae consumers:

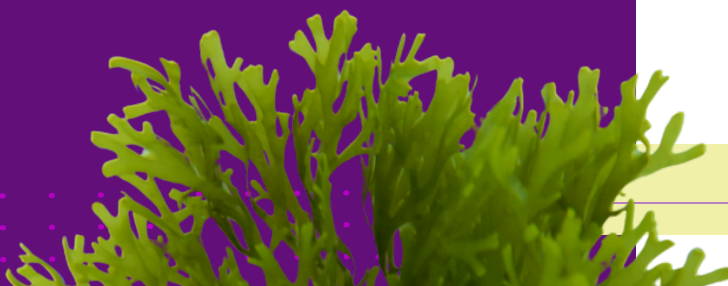
- The United Kingdom (UK), France and Germany are the main importers of seaweed in Europe. Other countries that import seaweed, although in smaller amounts, are Austria, Italy, Spain and the Netherlands.
- The UK leads in nori or dried seaweed consumption, the most popular product in Europe, while France tops the charts for consumption of dulse.
- About half of European consumers (the Netherlands, Germany, Hungary, Spain, and Italy) have never tried foods that contain microalgae, as far as they are aware.

The familiarity of algae is low:

- Most consumers are not familiar with algae and seaweed as a food. Those who are, are more often familiar with its usage in the Japanese cuisine (e.g. sushi) and this is the most common association that European consumers have with algae.
- Even though algae are used in many processed foods, most consumers are not aware of this.

Algae and seaweed are generally associated with healthiness :

- Perceived health benefits: Algae are recognized as a source of essential nutrients, particularly vitamins, and minerals and are often considered a healthful addition to the diet. As seaweed and algae are often green they are associated with being plant-based and health. However, the fact that algae are good sources of protein is less known among consumers.
- Natural, ethical and local production: Consumers value products that are produced organically, ethically and locally, aligning with their preferences for sustainable and responsible consumption practices.
- Environmental sustainability could be a motivation for consumers to try algae, however it is not a main driver. Primarily, consumers do not have enough knowledge on this topic, but even when they do, sustainability is not a main driver for incorporating this food in their diet.



The biggest barrier to consuming more algae is the lack of familiarity and knowledge about how to use these products :

Lack of familiarity and knowledge:

Many consumers are unfamiliar with algae-based foods and lack knowledge about their nutritional value, potential health benefits, production (foraged or cultivated), preparation methods and how to incorporate them in their meals, as well as sustainability advantages.

Taste and sensory attributes:

Some consumers expect not to like the taste of algae or algae-based foods. This is because they expect them to have distinct flavors and textures that they find unappealing, such as saltiness, a strong after taste (bitterness, fishiness) and a pungent smell.

Safety concerns:

Consumers express apprehension about the safety of algae, specifically if they believe that it has been harvested from the sea. They are concerned about potential contaminants including heavy metals, toxins, allergens, pathogens and pesticides.

Associations with algal bloom:

Some consumers are only familiar with algae in the context of algal bloom, and its toxicity and negative effect on nature. This association is negative in relation to the safety of algae, the taste and their sustainability.

Health-conscious consumers and those who enjoy east Asian cuisines are generally more open to algae :

- Health-conscious individuals and athletes: Consumers who prioritise health and wellness are more receptive to incorporating algae-based foods into their diets, viewing them as nutritious and beneficial. Women who tend to eat more green foods and are highly educated have higher expectations that they will like algae-based foods and more motivation to try them.
- Vegans, vegetarians, and pescatarians: Individuals following plant-based diets are more open to trying algae-based foods as alternative protein sources, as are consumers who like eating fish and other sea food.
- Consumers who have experience eating east Asian cuisines, such as Korean and Japanese, tend to be more open to trying algae-based products and seaweed. Consumers who enjoy trying new foods (low food neophobia) and do not prefer eating mostly traditional foods are more open to trying algae and algae-based foods.
- Environmentally conscious consumers: Those concerned about environmental sustainability are open to algae-based foods due to their perceived eco-friendliness and minimal environmental impact.

Framing and strategies to increase acceptance:

- Promote algae as a functional food and highlight the nutritional properties. Most consumers are familiar with the health reputation of algae compared to its sustainability. This makes healthiness claims, as long as they are not exaggerated, more persuasive than sustainability claims.
- Inform consumers about the environmental benefits of algae, as these are largely unknown to consumers. lgae are often (incorrectly) perceived as destructive or, at best, neutral for the environment. Cases of algal blooms, that make lake water undrinkable, contribute to this destructive perception. Consumers are generally unaware of how algae are produced or farmed.
- Instead of promoting algae as a broad category, focus on promoting specific species and their concrete benefits. While the term "algae" may not evoke many positive associations and is overly broad, certain types like spirulina are already recognised for their benefits. It would be more effective to highlight specific species of algae, outlining their distinct advantages and applications. Another name under which consumer acceptance may be higher is the term 'sea vegetables', however more research is needed on this term.
- Encourage consumers to integrate algae into their diets as an addition, rather than as a replacement. Since many consumers are not acquainted with the flavour of algae or the best ways to cook it, proposing it as a replacement for meat, fish, or even soy-based products can be quite daunting. Instead, it may prove more beneficial to introduce algae as a complementary ingredient that enhances their diet, rather than a substitute. Consumers also seek clarity on how to incorporate algae into their meals, making the promotion of specific recipes particularly helpful.

Extra resources:

[The European market potential for seaweed](#)

[Creating consumer demand for food from algae](#)

[A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat](#)

[Attitudes and perceptions towards microalgae as an alternative food: A consumer segmentation in Switzerland](#)

[The determinants of the adoption intention of eco-friendly functional food in different market segments](#)

[Consumer knowledge and attitudes towards microalgae as food: The case of Spain](#)

[Consumer segments less or more willing to adopt foods with microalgae proteins](#)