



Spirulina, a Super Food

Vishan Kumar, Anand Pratap Singh and Surbhi Mittal

1. Department of Zoology, NREC College, Khurja, C. C. S. University, Meerut
2. Department of Zoology, Agra College, Agra
3. Department of Zoology, Kisan P.G. College, Simbhoali, Hapur, U.P.

Abstract

Cyanobacterial biomass (blue-green algae) called spirulina can be eaten by both humans and animals. *A. platensis*, *A. fusiformis*, and *A. maxima* are the three species that make up this genus. As a food or dietary supplement, *Arthrospira* is grown over the world. It is also utilised as a feed additive in the aquaculture, aquarium, and fowl sectors. Spirulina is blue - green algae that has some nutritional value but is also thought by some to have health benefits. This includes the prevention or treatment of allergies, diabetes, fatigue, high cholesterol, and even certain cancers. While most of these claims are poorly supported by research, there is weak evidence that spirulina can help lower cholesterol or aid in the control of blood sugar. Spirulina is generally safe to use but may cause allergy, headaches, insomnia, muscle pain, and sweating in some. Because of its possible effect on the immune system, spirulina should be avoided in people with autoimmune diseases or on immunosuppressive therapies. Pregnant and nursing people or those with phenylketonuria should also avoid spirulina. Always opt for spirulina supplements certified by third-party authorities like ConsumerLab, NSF International, or U.S. Pharmacopeia (USP). There is no recommended dose for spirulina. A Word from Very well As with all supplements, it's important to talk with your health provider before using spirulina to determine if it's appropriate for you and if there are any interactions that may cause you harm. It is important to remember that just because a remedy is "natural" doesn't mean that it is safe.

Keywords - Spirulina, taxonomy, carnivorous, environment.

Introduction

A. maxima and the letter *A.* In the past, *platensis* were thought to be part of the *Spirulina* genus. *Spirulina* is a generic term for the dried biomass of *A. spirulina*. This is *platensis*, which belongs to the Cyanobacteria and Prochlorophyta phototrophic bacteria. *Spirulina* and the *Arthrospira* genera are separate in the scientific community. In tropical and subtropical locations, *Arthrospira* species have been found in alkaline, brackish, or saline waters. *Arthrospira* is a genus that includes many different species. Most often found in Africa, *platensis* may be found across Asia as well. *A. Maxima* may be found in Mexico and California. Historically, the word "spirulina" is still used to refer to this plant. Free-floating cyanobacteria of the *Arthrospira* family have cylindrical, multicellular trichomes with an open left helix. A high pH and high carbonate and bicarbonate concentrations in tropical or subtropical lakes are the natural habitats for these organisms. *A.* There are no known locations where *A. platensis* can be found. In Central America, *maxima* is only found. Paddle wheels are commonly used to agitate the water in open-channel raceway ponds. As long as the pH and temperature are at least 8.8 and 30 degrees Celsius (86 degrees Fahrenheit, respectively), *Spirulina* can thrive. They are autotrophic, which means they can produce their own food without the assistance of a living energy source or organic material source. It needs a nutrient-rich feed to grow:

Baking soda 16 g/l (61 g/US gal)

Potassium nitrate 2 g/l (7.6 g/US gal)

Sea salt- 1 g/l (3.8 g/US gal)

Potassium phosphate 0.1 g/l (0.38 g/US gal)

Iron sulphate 0.0378 g/l (0.143 g/US gal)

Historical review

Before the 16th century the Aztecs and other peoples of Mesoamerica ate spirulina, which was harvested from Lake Texcoco in Mexico and sold as cakes by one of Cortés' soldiers. Tecuitlatl was the Aztec word for it. It is possible that the draining of the surrounding lakes for agriculture and urban development explains why no mention of *Spirulina* as a daily food source by the Aztecs was made after the 16th century. There was no further mention of tecuitlatl until 1940 when Belgian phycologist Pierre Dangeard mentioned the Kanembu tribe's consumption of a cake called dihe, which is harvested from Lake Chad in Africa. Dihe samples were examined by Dangeard, who discovered that they contained a dried purée of the blue-green algae from the lake. It is also offered in markets for use in broths and other dishes. In the Lake Chad region, the *Spirulina* is obtained from tiny lakes and waterways. Jean Leonard, a botanist, researched a bloom of algae in a sodium hydroxide production plant in 1964 and 1965 and established that dihe is composed of spirulina. Because of this, the first comprehensive investigation of the

growing needs and physiology of spirulina was conducted in the 1970s as a foundation for commercial production.

Food and nutrition

It is being studied as an environmentally sound, nutrient-rich dietary supplement to address food security and malnutrition, as well as as a nutritional support for long-term space flight or Mars expeditions. Its benefit for food security is that it requires less space and water to generate protein and energy than cattle does. – About 60 percent (51–71 percent) of the protein in spirulina is found in dried spirulina. A 100-gram serving of dried spirulina provides 1,200 calories and 20 percent or more of the Daily Value (DV) for numerous essential nutrients, including protein, B vitamins (thiamin (306 percent DV), and niacin (85 percent DV), and minerals like iron (219 percent DV) and manganese (90 percent DV). Spirulina is also a good source of fibre, which helps keep you fuller for longer (table). EPA, DHA, and gamma-linolenic acid (GLA) are all included in spirulina's 8 percent fat content (table). It also contains linoleic acid, stearidonic acid, and arachidonic acid. Spirulina products "had no detectable omega-3 fatty acids" in contrast to the 2003 estimations (of DHA and EPA each at 2% to 3% of total fatty acids) (less than 0.1 percent, including DHA and EPA). Different strains of microalgae were shown to generate significant levels of DHA and EPA in an in vitro research.

Vitamin B₁₂

Not only is there no vitamin B₁₂ found in Spirulina (see the table), but the vitamin B₁₂ found in Spirulina supplements is physiologically inactive in humans, making them unsuitable for use in supplementation. The American Dietetic Association said that spirulina is not a dependable source of active vitamin B₁₂ in a 2009 policy paper on vegetarian diets. It is also stated in medical literature that spirulina is not a good source of vitamin B₁₂.

Animals and aquaculture

Spirulina as an additional feed for animals and aquaculture has been the subject of several research. Up to 10% of Spirulina can be fed to poultry, however quail need no more than 4%. The buildup of the yellow pigment zeaxanthin in the flesh of 21-day-old broiler male chicks fed a spirulina supplement of up to 40 g/kg (0.64 oz/lb) resulted in yellow and red colouring of the flesh. Increasing the amount of spirulina in cattle's diet resulted in an increase of milk production and weight in the animals. Big-mouth buffalo, dairy fish, cultured striped jack, carp, red sea bream, catfish, yellow tail, zebrafish, shrimp, and abalone may be fed up to 2% spirulina per day in aquaculture feed, according to a study published in the Journal of Aquaculture Research.

Research

More study is needed to determine whether spirulina supplementation has any health advantages, according to the National Institutes of Health in the United States of America. Spirulina has been studied as a possible treatment for diabetes, however in 2013 the European Food Safety Authority dismissed the claims. Researchers looked at the possibility of spirulina as a dietary supplement for HIV-infected adults and children, but they found no evidence that it had any influence on mortality risk, body weight, or immunological responses.

Advocates

When it came to long-term space missions in the 1990s, NASA (CELSS) and the European Space Agency (MELiSSA) both advocated for the cultivation of spirulina as a key food source. Drugs that impact the immune system and blood coagulation may have negative interactions with Spirulina. Toxicology and safety

Toxins like microcystins are produced by various cyanobacteria, including spirulina. Microcystins have been identified in certain spirulina supplements, albeit at amounts below the Oregon Health Department's standard. In addition to gastrointestinal distress, microcystins can induce muscular soreness, facial flushing and perspiration in the face and body. Chronic usage may result in liver damage. Chronic exposure to even low levels of microcystins is a worry because of the possibility of toxicity to a number of different organ systems. Spirulina alone does not create these harmful substances, but spirulina batches can be contaminated with other blue-green algae that produce toxins. Its manufacture is unrestricted and no safety regulations are enforced since it is classified as a dietary supplement in the United States. If free of microcystin contamination, the spirulina supplements are considered "probably safe" by the US National Institutes of Health, but if contaminated, they are deemed "likely dangerous" (particularly for youngsters). Spirulina and other blue-green algae supplements may not be free of contamination due to the absence of regulatory requirements in the United States, according to some public health specialists. Microcystin was found to be absent from one spirulina sample tested by Health Canada in the same year. Spirulina was found to be free of microcystins in all 10 samples tested. Spirulina supplement heavy-metal contamination has also been an issue. According to the Chinese State Food and Drug Administration, spirulina supplements sold in China were contaminated with lead, mercury, and arsenic. A sample from a commercial supplement had up to 5.1 parts per million (ppm) lead, according to one investigation. There is no danger in taking 10 to 19 grammes of spirulina every day for several months.

Safety issues for certain target groups

When a person has the uncommon genetic ailment Phenylketonuria, which inhibits the body from breaking down the amino acid Phenylalanine, it builds up in the brain and can lead to brain damage, hence spirulina should not be consumed by anyone with this condition. Toxic effects on the liver, shock, and even death have been reported in the case of spirulina contaminated with microcystins, especially in youngsters and pregnant women. Toxicology studies have shown that Spirulina consumption may be linked to an increased immunological response, such as lupus or dermal myositis or autoimmune blistering disorders, in those with autoimmune illnesses.

Possible Side Effects

Spirulina is typically safe to consume, although some people may experience headaches, muscular soreness, sweating, and sleeplessness as a result of taking the supplement. People with seafood, seaweed, and other sea veggies allergies have been found to be allergic to spirulina. Those who suffer from autoimmune illnesses including multiple sclerosis, rheumatoid arthritis, or lupus should stay away from spirulina, which has been linked to boosting the immune system. An hyperactive immune system destroys healthy tissues in many disorders. As a result, persons using immunosuppressive medications like Cellcept (mycophenolate), Enbrel (etanercept), and Humira should not consume spirulina at all (adalimumab). The immune system is inhibited in various ways by these medications, which are used to treat illness. Spirulina may reduce the effectiveness of the medications. 6 Spirulina should be avoided by those with phenylketonuria, who are unable to digest a specific amino acid, because of its high concentration of amino acids. Spirulina is not known to be safe for pregnant or breastfeeding women. Prior to taking spirulina if you are currently pregnant, nursing, or trying to become pregnant, consult with your doctor first. Spirulina is typically safe to use, although some people may experience allergic reactions, headaches, sleeplessness, muscular soreness, or excessive perspiration after taking it. It's best to stay away from spirulina if you're expecting or breastfeeding, have an immune system disorder, or are using immunosuppressants, or have phenylketonuria.

Preparation and Administration of Medication

Spirulina does not have an effective dose recommendation. Up to 3,000 mg per day was safe and well tolerated for up to 12 months in certain studies, with no noticeable adverse effects. Don't go beyond the recommended dosages on the product labels, as a general rule of thumb. In addition to powder, capsules, pills, and liquids are other delivery methods for spirulina. The powder may be used to make smoothies. There are several variables that might affect the amount of medication you should take. Talk to your doctor about what dosage is best for you. Spirulina does not have a suggested daily dosage. Never go beyond the recommended dosage on the packaging. Some kinds of blue-green algae are known as "spirulina," however supplements most typically contain *Aphanizomenon flos-aquae*, *Spirulina maxima* or *Spirulina platensis*, all of which are blue-green algae species. Products labelled "wild-crafted" may include spirulina that was produced in water that was tainted with toxic metals or contaminants. Always use supplements made in laboratories and verified by third-party organisations such as the USP, ConsumerLab, or NSF International if you want to be safe.

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