



SPIRULINA - (Arthrospira): An Important Source of Nutritional and Medicinal Compound.

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ABSTRACT

Spirulina is free-floating filamentous micro algae growing in alkaline water bodies. With its high nutritional value, it has been consumed as food for centuries in various parts of the world. It is now widely used as nutraceutical food supplement worldwide. Spirulina platensis has gained popularity as the food of the universe. Various researches have proved it to be a potent source of nutrient. Spirulina's nutritional qualities are truly-one-of-a-kind. The following paper has focused on the different biomolecules which are present in spirulina namely, proteins, carbohydrates, lipids, vitamins, minerals, nucleic acids, antioxidant Arthrospira is a photosynthetic, filamentous, spiral-shaped, multicellular and blue-green micro alga. Cell division occurs by binary fission. As it contains chlorophyll a, like higher plants, botanists classify it as a micro alga belonging to Cyanophyceae class; but according to bacteriologists it is a bacterium due to its prokaryotic structure. Mexicans (Aztecs) started using this microorganism as human food. Its chemical composition includes proteins (55%-70%), carbohydrates (15%-25%), essential fatty acids (18%) vitamins, minerals and pigments like carotenes, chlorophyll a and phycocyanin. Pigments are used in food and cosmetic industries. Spirulina is considered as an excellent food, lacking toxicity and have anticancer, antiviral, immunological properties and it also acts as a potent antioxidant. There has been a significant change in Spirulina functions under stress conditions, pigments and enzymes.

Keywords: Arthrospira, Cyanophyceae. Spirulina, nutritive values, nutraceuticals, proteins, antioxidants.

INTRODUCTION

Global demand for nutritional food apart from traditional and nutritional values is to use the food for functional values too. One such food is blue green algae, spirulina which has been a part of human diet since thousands of years as per archeological evidences. Apart from the basic needs, foods are consumed for the role of bioactive components in the body due to the presence of various phytochemicals present in them. The foods which play a role as nutraceuticals is called as functional foods 1. Widespread approach of the world to comprehend the use of Spirulina platensis (S. platensis) from a basic algal component to a potential nutritional food was made possible by the cooperation of several organization, research institutes and

industries which joined hands to identify, study, prove, and launch ready to consume product 2 . Spirulina (Arthrospira platensis) is a ubiquitous spiral-shaped blue-green microalgae, commonly found in seawater and brackish water. Among the various species, S.platensis and S. maxima are the only two used as food. The blue-green colour is due to the presence of various types of photosynthetic pigments like chlorophyll, carotenoids, phycocyanin and phycoerythrin 3 .

BOTANICAL DESCRIPTION



Fig 1: *spirulina plant*

Botanical Name: Arthrospira platensis

Kingdom: *monera*

Class: Cyanophyceae

Order: Spirulinales

Family: Spirulinaceae

Species: Spirulina platensis and Spirulina maxima

Nutritional Composition

Proteins: In the urge to develop potential, effective protein sources for preventing malnutrition, attention has been turned to microalgae. Single cell protein, i.e., crude or refined sources carbohydrates like rhamnose, xylose, galactose and glycogen. Simple carbohydrates like glucose, fructose and sucrose are present in small quantities. From the nutrient standpoint, mesoinositol phosphate (a carbohydrate) which is an excellent source of organic phosphorus and inositol occurs in higher volumes. This inositol content is about eight times that of beef and several hundred times that of the vegetables with the highest levels. Spirulina's polysaccharides are believed to have a stimulating effect on DNA repair mechanisms, which might explain the radio-protective effect mentioned several times in relation to spirulina. Certain polysaccharides are also thought to have immune-stimulating and immune-regulating properties

Lipids: Human requirement for fatty acids is said to be 1-2% for adults and 3-4% for children which can be achieved from *S. platensis*. It is considered one of the best known source of gamma-linolenic acid, after human milk and vegetable oils (evening primrose, borage, blackcurrant seed and particularly hemp oil) 10. Other fatty acids which are present are linoleic acid (18:2 omega-6), high proportion of palmitic acid (16:0), which forms more than 60% of lipids in *Spirulina maxima*, but only about 25% in *S. platensis*. The importance of these fatty acids lie in their biochemical evolution: they are the precursors of the prostaglandins, leukotrienes and thromboxanes that serve as chemical mediators of inflammatory and immune reactions

Vitamins: Vitamin B12 is the largest and most complex; it represents all of the biologically active cobalamins. The fact that *Spirulina* has an exceptionally high content of vitamin B12 -as other sea weed do- is of great importance because such vitamin is only in animal origin foods. Thus this alga might be considered as a good source for vegans 12. It is also a good source of beta-carotene, containing about 700-1700 mg/kg, which once absorbed will be biotransformed into vitamin A. Human requirements of vitamin A are of approximately 1 mg/day; hence 1-2 g of algae will be enough to assure this need 13. *Spirulina* is an abundant source of vitamin B1 (thiamine), B2 (riboflavin), B3 (nicotinamide), B6 (pyridoxine), B9 (folic acid), B12 (cyanocobalamin), vitamin C, vitamin D and vitamin E 14

Minerals: Calcium and phosphorous contents are comparable to those of the milk due to the best availability. The relative proportion (Ca:P) of these micronutrients is compatible with the preservation of bone health since it reduces decalcification risk. Moreover, as it was previously stated, the cyanobacteria of interest is an oxalate-free plant food, thus -as with iron- it provides calcium with high availability and improves its absorption¹⁵. *S. platensis* does not have pericardium like cereals, hence it does not present phytates/oxalates that chelate iron and lower its absorption like that of spinach¹⁶. Studies show iron in *Spirulina* is 60% better absorbed than iron supplements such as iron sulfate and minerals, including calcium, iron, magnesium, manganese, potassium, zinc, and selenium

Antioxidants: Algae like other life forms contain antioxidant organic compounds and enzymes that inhibit the oxidative damage, which results primarily from reduced states of oxygen. This leads to the production of reactive oxygen species like superoxide radical anion, hydrogen peroxide, the hydroxyl free radical, and singlet oxygen 21. The foremost enzymes that restrict oxidative damage are superoxide and catalase which are present in the algae along with polyphenols which act as good antioxidants 22. Some of the other antioxidants include water-soluble ascorbate (vitamin C) and the lipid-soluble tocopherol (vitamin E) and carotenoids such as astaxanthin 21. Other species found are glutathione peroxidase. Mycosporin-like amino acids, mainly considered as UV screening compounds, are also antioxidants that act as scavengers and quenchers of reactive oxygen species in algae

Enzymes: *Spirulina* can also be exploited for the production of various enzymes, especially antioxidant enzymes. It has a very high amount of the superoxide dismutase enzyme, which is an important free radical scavenging enzyme. This enzyme can be used therapeutically for the treatment of various diseases related

to oxidative stress or as a component in anti-wrinkle skin lotions and face masks as aging is believed to a consequence of oxidative stress

Food usage: Among the varied products in which dried, flaked, or powdered Spirulina is now incorporated are: baked desserts, beer, breakfast cereals, confectionary, corn chips, crackers, doughnuts, food bars, frozen desserts, juice smoothies, muffins, pasta, popcorn, salad dressing, snack foods, and soups. Several cookbooks dedicated to Spirulina have been published

Ethnobotanical Uses Of Spirulina

1. External use of Spirulina can speed up hair growth. Moreover consumption, this algae is used as a component in shampoos and conditioning treatments.
2. It also helps in hair re-growth. The bioactive potential of Spirulina is still being evaluated in preclinical studies using animal models.
3. On the other hand, these studies seem to indicate Spirulina's strong anti-oxidant, anti-cancer, and anti-viral properties as well as its capacity to fight diabetes, obesity, and inflammatory allergic responses.
4. It also shows great benefit in Hypercholesterolemia, hyperglycemia, cardiovascular disease, and cancer treatments using nutraceuticals.
5. Spirulina is additionally used to prepare food with alternative ingredients. For example, nutritious blocks, stylish noodles, instant noodles, cookies and beverages.
6. Spirulina is one of the extraordinary quality natural feed additives that can be used in animal and poultry nutrition.
7. It has the capability to strengthen the immune system, release anxiety and help the body to cleanse. Thus, Spirulina effectively release IBS by detoxifying the intestine and stop constipation.

CONCLUSION

Spirulina - a wonder food supplement with low or negligible side effects. The highly diverse nutritive nature of spirulina together with its antioxidant and protective health benefits have been utilized in various health related problems. The potential health benefits of spirulina must be adequately recognized and implemented thus making full use of this nature's gift. As it is easily cultivated in most regions of the world it can be made easily available at economical prices for access to all classes of population. In the foregoing essay, various nutritional and medicinal potencies have been attributed to metabolites from the cyanobacteria, Spirulina (Arthrospira) sp. In the present clamor for alternative medicine, these organisms serve as very viable potential sources of bioactive products with commercial imports. Therefore, more should be done in the study, culture, isolation, and purification of these organisms to enable beneficial harvest of their important inclusions

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