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# Culture production and Nutritional Aspect of Spirulina for Human: A Review

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**Abstract**
Blue-green algae known as spirulina are multicellular and thread-like. In this research, we have examined the medical benefits of spirulina, including its antioxidant, antiviral, and antifungal capabilities. Spirulina has specific preparation techniques and an original morphology under specific circumstances. It is used to treat certain illnesses. Here, we've included the data on the applications and clinical potential of spirulina for humans, as well as its classification. Spirulina's chemical makeup, which includes protein, amino acids, carbs, fatty acids, vitamins, and colours, is what makes it so valuable. Its cultivation and generation of other vital sources has also been examined. The evaluation offers crucial details on productivity and spirulina farming. Traditional products based on the protein system also require cultivation and inventive formulation. It took a lot of effort to compile the nutritional and therapeutic benefits, applications, preparation techniques, cultivation, and morphology of spirulina in the extensive spirulina literature.

**Keywords:** spirulina, antioxidant, antiviral, anticancer, cultivation

## Introduction

'Super food' spirulina (Arthrospira Plantensis). It is filamentous, multicellular blue-green algae. It contributes significantly to the growth of the health food sector.
and contribute to improving the proteins, vitamins, and nutrients in the diet of aquaculture. Spirulina functions as a potential therapeutic agent for the treatment of illnesses involving oxidative stress. It contributes to the synthesis of anti-cancer agents and helps to strengthen the immune system. According to Charpy, Langlade, and Alliod (2008), spirulina is produced extensively, which means at low cost and with high productivity, all over the world. Warm, alkaline, nitrogen- and phosphorus-rich water is the ideal environment for S. plantensis growth. It is primarily found in lakes in South Asia, Latin America, and Africa. According to Castennolz et al. (2001), it can also be found in tropical and semitropical regions. The blue-green algae S. plantensis possesses a spiral cellular structure and a remarkable capability. another algae must be able to endure these extreme circumstances in order to survive. S. plantensis is known by several names depending on where in the world you are, such as "sembe" in the north of Cameroon. referred to as "Didhe" in Chad. High levels of protein, minerals, trace amounts of metals, and numerous vitamins, including B1, B2, B12, and E, are all present in S. plantensis. Arthrospira plantensis is the formal name for spirulina. In the beginning, Spanish scientists named "Hernandez Cortez" discovered spirulina. as well as "Conquistadors" in 1519. S. plantensis is employed as an additional dietary component of for aquaculture feed China uses S. plantensis to partially replace imported fodder in an effort to boost prawn viability and growth. Spirulina has numerous uses in agriculture, food production, pharmaceuticals, cosmetics, medicine, and science. It is also marketed as a food supplement and sold as pills, capsules, powders, cakes, biscuits, health drinks, etc. [1-10]

**Fig 1:** Spirulina Tablet

## Objective

- The main goal of this review is to access and assess the knowledge that is currently available on the culture production and usage of spirulina as human and animal feed.
- Consuming spirulina maxima has been linked to improved metabolic and cardiovascular health.
- Spirulina is a filamentous synobacterium well-known for its medicinal and high nutritional value.

- The goal of this research was to determine how effective spirulina is as a nutritional supplement for growth.

**Uses of Spirulina [1]**

**A. Spirulina and human consumption**
Spirulina has shown promise in clinical trials as a supplementary treatment for a variety of ailments. After radiotherapy and chemotherapy, spirulina capsules have good results in lowering blood lipid levels and reducing the number of white blood cells.

**B. Nutritional augmentation**
High-quality protein, vitamins, minerals, and several biologically active substances can all be found in spirulina. The polysaccharide that makes up the spirulina cell wall is 86% digestible and readily absorbed by humans. The powdered S. plantensis is used in food tables. Linavina and Pirulamin are the names of the brands.

**C. Anemia**
In 30 days, the anaemia patient received 4 g of spirulina daily. Then, the blood haemoglobin increased from 10.9 to 13.2 and spirulina significantly lowered the blood glucose level in both male and female between the ages of 40 and 60.

**D. Use as fertiliser**
The FAO published a report on the possibility of blue-green algae replacing chemical fertilisers in 1981. the blue-green algae raised in India in small clay ponds. When farmers in India didn't utilise chemical fertilisers, algae nevertheless provided benefits. Spirulina is a basis for fertiliser, however its application is hindered by its high cost.

**E. Use as a medication**
According to research, spirulina consumption within four weeks lowers serum. Spirulina causes macrophages to produce tumour necrosis factor, indicating a potential tumour demise. Vitamin A is found in spirulina. It is crucial for preventing eye illness. Additionally, pernicious and hypoferric anaemia can be treated with vitamins B12 and B12. Animal cell growth is stimulated by spirulina, which is also used to clean leftover water.

**F. Antioxidant**
Spirulina contains vitamins, nutrients, and other beneficial components. In addition, it is significant as food. There is a lot of potential for medical properties in the accumulated for supplemental dietary proteins. Antioxidant properties are among spirulina's most significant qualities. Antioxidants are the substance that counteracts the free radicals produced as a result of oxidative stress. Spirulina's chelating (EDTA) abilities were investigated after human neuroblastoma cells were *in vitro* subjected to hazardous levels of the substance. The antioxidant in spirulina explains this quality.

**G. Antiviral**
The ability of a nutrient supplement or treatment to strengthen the immune system as a result of antiviral activity would be of great interest to medicine. A fascinating work (19) on antiviral properties research from Japan was written in opposition to regularly hinder the replication of each other. Many compounds with antimicrobial properties have been extracted from various organisms and have an impact on the antiviral activity of spirulina. Chelation's influence on molecules has been theorised to be the cause of antiviral activity. S. plantensis crude extract exhibits antititherpetic properties. 0.056-0.101 m, enter virus 71-induced apoptosis was preserved by the pigments to a 50% extent.

**H. Anticancer**
Human cell development is inhibited by S. plantensis water extraction techniques. In an experiment conducted in 1987 at Harvard University, spirulina and Dunaliella were combined and extracted from mouse oral tumours to aid in their regression. Spirulina's anticancer properties have been proven in a variety of animal experiments. Significant clinical improvements, scorching, blanching, and unpleasant observations, as well as safe management of oral submucous fibrolysis, are more important than anticancer benefits. Diabetes mellitus is one of the metabolic disorders that is increasingly posing a threat to people's health. A variety of medications can have varying adverse effects.

**I. Use of Spirulina in Poultry**
Spirulina is a high-quantity natural feed addition that can be used to improve the nutrition of livestock and poultry. When compared to controls, spirulina-containing meals in birds result in higher reproductive and productive performance. By adding spirulina to laying hens' meals, the colour of the birds' eggs' yolks improved.

**J. Spirulina Use in Aquaculture**
Spirulina costs more to feed than other animal sources. The cultivation time and mortality were shown to be reduced with spirulina-containing feed. Spirulina use as feed improved the illness resistance of high-value resultant fish.

**Conclusion**
Spirulina has emerged as a miraculous dietary supplement. Spirulina's chemical makeup and great nutritional value make it nutrient in relation to various food sources. Spirulina appears to be able to prevent and treat cancer. Other nutrients offered by blue-green algae include protein, minerals, vitamins, antioxidants, and antivirals. The study, culture, cultivation, morphology, production, method of preparation, harvesting, taxonomy, and beneficial usage of their significant inclusion should therefore be improved. Spirulina exhibits antiviral, anticancer, and antioxidant effects against a number of dangerous viruses, it can be inferred from this review. This review supports more research and promotes thinking about daily S. plantensis supplements.

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**Reference**


1. Shinde S, Bhosale V, Thorat M, Shingade A, Urhe M, Shinde A. Spirulina (Arthrospira plantensis) the 'Super food' as a nutritional supplement: A review. International Journal of Research in Pharmacy and Pharmaceutical Science,2021:6(1):21- 24.
2. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy. Mumbai India,2008:42:16-9.
3. Radha P, Chandra V. Therapeutic uses of spirulina; A Review. International journal of current innovation research,2018:(4):975-979.
4. Nuhu AA. Spirulina (Arthrospira); An Important source Of Nutritional and medicinal compounds. Journal of marine biology,2013:1-8:4.
5. Soni RA, Sudhakar K, Rana RS. Spirulina-from growth To nutritional product: A review. Trend in food science And technology,2017:(60):157-171.
6. Vidya K, Selvakumar S, Sangeetha S. Single cell protein spirulina A nutrient treasure -Review. Research journal of pharmacology and Pharmacodynamics,2020:(12):1-6.
7. Ghaeni M, Roomiani L. Review for application and Medicine effect of spirulina, Spirulina plantensis Microalgae. Journal of advanced agriculture Technology,2016:(3):114-117.
8. Salnean GG, Castillo LF, Cevallas GC. Nutritional and toxicological aspects of spirulina (Arthrospira). Nutrition hospitalaria,2015:(32):34-40.
9. Ama moor VJ, Pieme CA, Nya Biopa PC, Nga matip ME, Moukette Moukette B. Tankeu Nzufo F *et al*. Chemical composition of spirulina platensis of nomayos-yaounde (Cameroon). Annals. Food science And technology. 2016; (17):524-528.
10. Arpita M, Neeta M. Deepak S, Deepak U, Shiva K. Spirulina -The nature's wonder: A review, scholar's journal of applied medicinal sciences. 2014; (2):1334-1339.
11. Vonshak A. Spirulina platensis (Arthrospira) Physiology, Cell-biology and Biotechnology. Taylor & Francis, London, 1997.
12. Campanella L, G Crescentini and P Avino. Chemical composition and nutritional evaluation of some natural and commercial food products based on Spirulina Analysis, 27, 1999, 533-540
13. Harriet Volkmann, Ulisses Imianovsky, Jorge LB. Oliveira and Ernani S. Santanna. Cultivation of Arthrospira (Spirulina) platensis in desalinator wastewater and salinated synthetic medium, protein content and amino-acid profile. Brazilian Journal of Microbiology, 39, 2008, 98-101.
14. Silveira ST, JFM Burkert, JAV Costa, CAV Burkert, SJ Kalil. Optimization of phycocyanin extraction from Spirulina platensis using factorial design. Bioresource Technology, 98, 2007, 1629-1634.
15. Harriet, Volkmann, Ulisses Imianovsky, Jorge LB Oliveira and Ernani S Santanna. Cultivation of Arthrospira (Spirulina) platensis in desalinator wastewater and salinated synthetic medium, protein content and amino-acid profile. Brazilian Journal of Microbiology, 39, 2008, 98-101.
16. Silveira ST, JFM Burkert, JAV Costa, CAV Burkert, SJ Kalil. Optimization of phycocyanin extraction from Spirulina platensis using factorial design. Bioresource Technology,2007:98:1629-1634.
17. Orio Cifferi. Spirulina, the Edible Microorganism. Microbiological Reviews,1983:47:551-578.
18. Susan Spiller, Greg Denbeaux, Gideon Jones and Angelic Lucero Pearson. Fine structure of Cyanobacteria, Spirulina platensis and Spirulina subsalsa, as viewed by X-ray microscope, XM-1, beamline 6.1.2. Susan Coates Spiller, Department of Biology, Mills College, 1999.
19. Martha, Sanchez and Jaime Bernal. Spirulina (Arthrospira), an edible microorganism. Journal of phycology, 2006, 20-35.
20. Basirath Roof, Ayflegul Zeker and Knur. The Growth of Spirulina platensis in Different Culture Systems under Greenhouse Condition. Turkey Journal of Biology,2006:31:47-52.
21. Dao-lun, Feng and WU Zu-cheng. Culture of Spirulina platensis in human urine for biomass production and O2 evolution. J Zhejiang Univ science,2006:7(1):34-37.
22. Raoof B, Kaushika BD, Prasanna R. Formulation of a low-cost medium for mass production of Spirulina. Division of Microbiology, Indian Agricultural Research Institute, New Delhi 110 012, India and the Centre for Conservation and Utilization of Blue–Green Algae, Indian Agricultural Research Institute, New Delhi, 110 012, India, 2006.
23. Harriet Volkmann, Ulisses Imianovsky, Jorge LB Oliveira, Ernani S Santanna. Cultivation of Arthrospira (Spirulina) platensis in desalinator wastewater and salinated synthetic medium, protein content and amino-acid profile. Brazilian Journal of Microbiology,2008:39:98-101.
24. Bohra F. Role of light and photosynthesis on the acclimation process of the cyanobacterium Spirulina platensis to salinity stress, 1996.
25. Usharani GP Saranraj, D Kanchana. *In vitro* cultivation of Spirulina platensis using Rice mill effluent. International Journal of Pharmaceutical and Biological Archives,2012:3(6):1518–1523.
26. Usharani G, Saranraj P, Kanchana D. Spirulina Cultivation, A Review. International Journal of Pharmaceutical and Biological Archives,2012:3(6):1327–1341.
27. Saranraj D Stella, Usharani G, Sivasakthi S. Effective recycling of Lignite Fly Ash for the laboratory cultivation of Blue Green Algae – Spirulina platensis. International Journal of Microbiology Research,2013:4(3):219 - 226.
28. Pinero M, Baasch KH, Pohl P. Biomass production total protein, chlorophyll, lipids and fatty acids of freshwater green and blue–green algae under different nitrogen regimes. Phytochemistry,2001:23:207–216.
29. Iijima N, Jensen S, Knutsen G. Influence of light and temperature on photoinibition of photosynthesis in Spirulina platensis. Journal of Applied Phycology,1982:5:495–504.
30. Hirahashi BL, Sato S. E Aguarone. Influence of the nutritional sources on the growth rate of cyanobacteria. Arquivos-deBiologiaTechnologia,2002:34:13–30.
31. Roamy G. The mass culture of spirulina platensis (nordstedt) geiteler in kitchen wastewater and fermented solution of oil- extracted soybean. 31st Congress on Science and Technology of Thailand at Suranaree University of Technology, 2003, 18–20.

32. Cifferi O. Spirulina. The edible microorganism. Microbial. Revs,1983:47(4):551-578.
33. Pinero M, Baasch KH, Pohl P. Biomass production total protein, chlorophyll, lipids and fatty acids of freshwater green and blue–green algae under different nitrogen regimes. Phytochemistry,2001:23:207–216.
34. Iijima N, Jensen S, Knutsen G. Influence of light and temperature on photoinibition of photosynthesis in Spirulina platensis. Journal of Applied Phycology,1982:5:495–504.
35. Hirahashi BL, Sato S, Aguarone E. Influence of the nutritional sources on the growth rate of cyanobacteria. Arquivos-de- Biologia-Technologia,2002:34:3–30.
36. Lorenz SJ. Principles of Microbe and Cell Cultivation. Blackwell Scientific Publications, Oxford, London, 1998.
37. Cheyla Romay, Nuris Ledon, Ricardo Gonzalez. Effects of Phycocyanin Extract on Prostglandin E2 Levels in Mouse Ear Inflammation Test. Arzeim.Forsch./Drug Res,2000:50:1106-1109.
38. Noam Adir, Yelena Dobrovetsky, Natalia Lerner. Structure of c-phycocyanin from the thermophilic cyanobacterium synechococcus vulcanus at 2.5 aê, structural implications for thermal stability in phycobilisome assembly. Journal of Molecular Biology,2001:313:71-81.
39. Minkov B, Kaushika BD, Prasanna R. Formulation of a low-cost medium for mass production of Spirulina. Division of Microbiology, Indian Agricultural Research Institute, New Delhi 110 012, India and the Centre for Conservation and Utilization of Blue–Green Algae, Indian Agricultural Research Institute, New Delhi, 110 012, India, 2003.
40. Jose O Valderrama, Michel Perrut. Extraction of astaxanthine and phycocyanin from microalgae with supercritical carbon dioxide. Journal of Chemical Engineering Data,2003:48:827-830.
41. Noam Adir, Yelena Dobrovetsky, Natalia Lerner. Structure of c-phycocyanin from the thermophilic cyanobacterium synechococcus vulcanus at 2.5 aê, structural implications for thermal stability in phycobilisome assembly. Journal of Molecular Biology,2003:313:71-81.
42. Zhang, Xiu Lan Chen, Wei Liu, Yu Zhong Zhang, Bai Cheng Zhou. The stabilization effect of glutaraldehyde on the Spirulina platensis. phycobilisomes,2004:5:1083-1086.
43. Ying Zhang, Si-Yuan Guo, Lin Li. Study on the process, thermodynamical isotherm and mechanism of Cr (III) uptake by Spirulina platensis. Journal of Food Engineering,2004:75:129 –136.
44. Badrish, Beena Kalavadia, Ujjval Trivedi, Datta Madamwar. Extraction, purification and characterization of phycocyanin from Oscillatoria quadripunctulata—Isolated from the rocky shores of Bet-Dwarka, Gujarat, India. Process Biochemistry,2005:41:2017-2023.