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A STUDY ON THE NUTRITIONAL AND THERAPEUTIC PROPERTIES OF SPIRULINA

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Abstract:
Spirulina, a blue-green microalgae belonging to *the Cyanobacteria group,* has gained significant attention as a natural food supplement due to its rich nutritional content and potential health benefits. It is a sustainable source of high-quality protein, essential amino acids, vitamins, minerals, and phytochemicals (e.g., phycocyanin and gamma-linolenic acid). The purpose of this review is to examine the nutritional components of Spirulina and evaluate its effects on human health, such as immune support, antioxidant activity, lipid regulation, and anti-inflammatory effects. Current clinical and experimental findings suggest that Spirulina supplementation may contribute to overall health and well-being, making it a promising ingredient in the field of functional nutrition. Its increasing use in the sector in recent years has been notable. This study provides information on the composition of Spirulina.

Keywords: Spirulina, food supplement, antioxidants, immune system, functional food

1. Research Introduction and Importance

With the growing interest in natural and functional foods, microalgae are gaining increasing importance as sustainable food sources. These microorganisms are attracting significant interest in food technology and health sciences due to their high biomass yield, rich nutritional profile, and low environmental impact potential (Becker, 2007). Spirulina, particularly *Arthrospira platensis* is one of the most researched and widely used microalgae species worldwide due to both its high protein content and its positive health effects (Belay, 2002; Habib *et al.*, 2008). Thanks to its rich content of vitamins, minerals, antioxidants, and essential fatty acids, this species is evaluated not only for nutritional purposes but also for the prevention and supportive treatment of various diseases (Karkos *et al.*, 2011). Its unique biochemical structure has made Spirulina a popular additive for

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functional foods, nutraceuticals, and pharmaceutical applications. This study aims to provide information on the Spirulina species with the support of the literature.

2. Nutritional Composition of Spirulina

Spirulina contains approximately:

- 60–70% protein (contains all essential amino acids),
- Vitamins: B complex (especially B12), vitamin E and beta-carotene (provitamin A),
- Minerals: Iron, calcium, magnesium and zinc,
- Essential fatty acids, especially gamma-linolenic acid (GLA),
- Phycocyanin: A pigment with antioxidant and anti-inflammatory properties,
- Chlorophyll and detoxifying polysaccharides (Karkos *et al.*, 2011).

These properties make Spirulina not only a nutritional source but also a therapeutic agent.

3. Spirulina Therapeutic Effects

3.1 Supporting the Immune System

Spirulina may enhance the immune response by stimulating lymphocyte and macrophage activity. Clinical observations support its ability to increase resistance to viral and bacterial infections (Selmi *et al.*, 2011). For example, in a study of elderly individuals, spirulina supplementation reduced the frequency of infections and increased immune cell activity.

3.2 Antioxidant and Anti-inflammatory Effects

Phycocyanin have a free radical-scavenging effect (Romay *et al.*, 2003). These compounds have been reported to help reduce oxidative stress and may be effective in preventing neurodegenerative diseases and cardiovascular disorders.

3.3 Lipid Profile and Blood Sugar Regulation

The cholesterol-lowering effects of Spirulina are supported by studies in patients with hyperlipidemia. Parikh, Mani, and Iyer (2001) reported decreased LDL levels, increased HDL levels, and improved HbA1c levels in individuals with type 2 diabetes who took Spirulina for 12 weeks.

3.4 Anticancer Effect

In vitro studies have shown that Spirulina components trigger apoptosis in tumor cells. Wu *et al.* (2005) reported that Spirulina extract suppressed cell proliferation in oral, colon, and breast cancer cells.

3.5 Anemia and Nutritional Deficiency

Selmi *et al.* (2011) reported that Spirulina supplementation significantly increased hemoglobin levels and reduced fatigue in elderly individuals.

3.6 Performance Improvement in Athletes

Spirulina may increase physical endurance by reducing oxidative stress during exercise . A review by Gershwin and Belay (2008) indicates that Spirulina reduces muscle damage and speeds recovery.

3.7 Effect on Microbiota

Spirulina is reported to enrich the intestinal microbiota by having a prebiotic effect (Karkos *et al.*, 2011). Various experimental studies have shown that it supports the growth of Lactobacillus and Bifidobacterium species and improves intestinal barrier function.

4. Safety and Dosage

Spirulina has been categorized as "*generally recognized as safe*" (GRAS) by the FDA (Gershwin & Belay, 2008). The recommended daily dose is between 1 and 10 grams. However, since Spirulina grown in open waters may contain traces of heavy metals, microorganisms, and toxins, it is recommended to use only products produced and certified in controlled environments. The presence of toxins, especially microcystins, may pose a health risk (Ruas *et al.*, 2022). Furthermore, patients with phenylketonuria should be careful, as Spirulina may contain phenylalanine (Kaplan *et al.*, 2016).

5. Conclusion

Spirulina is a microalgae noted for its rich bioavailable nutritional content and is considered a functional food. Numerous studies have demonstrated its antioxidant, anti-inflammatory, lipid-lowering, and immunomodulatory effects. It is widely used as a dietary supplement and appears to have a supportive role in conditions such as aging, obesity, metabolic syndrome, and immune deficiency (Nielsen *et al.*, 2020). However, more randomized controlled trials are needed to evaluate the efficacy and safety of Spirulina in different individuals. Caution is advised when consuming it in patients with chronic diseases, pregnant women, and children.

Conflict of Interest Statement

The author declares no conflicts of interest.

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