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ETHNOBOTANICAL AND PHARMACOLOGICAL ACTIVITY OF ARTHROSPIRA PLATENSIS

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ABSTRACT

Spirulina is also known as Arthrospira platensis is algae that belong to cyanobabcteria having lots of bioactivities. Cyanobacteria (blue-green algae) are among the most primordial life forms on the planet. It contains proteins, vitamins, carbohydrates, and lipids.

It has been established that Arthrospira platensis has strong antioxidant activity, inhibits the colonisation of wounds by multi-resistant bacteria, and stops viruses from entering target cells. Anti-cancer action was also seen in mouth cancer, melanoma, and UV-induced non-melanoma skin cancer animals. Arthrospira platensis has an immunostimulating impact on humans, animals, chickens, and fish by increasing their resistance to infections, altering hemopoiesis, and stimulating the synthesis of antibodies and cytokines. Here we discussed about some pharmacological activities of Arthrospira platensis.

1. INTRODUCTION

Spirulina (Arthrospira platensis) is a microscopic, filamentous cyanobacterium considered a sustainable and environmentally favourable microalga for bioremediation, nitrification, and CO2 fixation. Spirulina is a potential for the elimination of toxic elements such as heavy metals (1,2,3,4) and phenol (5) in the context of bioremediation.

Cyanobacteria also include unicellular organisms, which are not always spiral-shaped (Spirulina is spiral-shaped). They are primarily planted in ponds and small lakes, where they grow naturally in warm climates' water. Microalgae (Spirulina) is a type of microalgae that does not require organic, inorganic, nutritional, or other carbon sources for growth and can survive at higher alkaline pHs and higher bicarbonate and carbonate concentrations than other living organisms(6).

Cyanobacteria have been used by African and Mexican people as a traditional food source since the sixteenth century. The most extensively cultivated microalgae species include Spirulina maxima (Arthrospira maxima), Spirulina platensis (Arthrospira platensis), and Spirulina fusiformis (Arthrospirafusiformis) (7). More than 3,000 tonnes of Spirulina are grown each year for human nutrition and the manufacturing of excellent commercial chemicals around the world (8).

People have been interested in taking Spirulina in tablet and powder form in recent years due to its relatively high protein (58%) content, carbohydrates (30%), fat (8%), dietary fibres (3%), sugars (3%), vitamins (1%), and phytochemicals (1%) (9,10).Linoleic acid, docosahexaenoic acid, eicosapentaenoic acid, arachidonic acid, and stearidonic acid are among the fatty acids found in spirulina. Spirulina also has moderate amounts of vitamins like vitamin A, vitamin C, vitamin E, vitamin B12, thiamine, nicotinamide, pyridoxine, riboflavin, and folic acid, as well as beneficial pigments like chlorophyll-a, zeaxanthin, diatoxanthin, 3′-hydroxyechinenone, echinenone, beta-carotene, xanthophyll, canthaxanthin, phycobiliprotiens(10,11).

Apart from the high (up to 70%) content of protein, it also contains vitamins, especially B12 and provitamin A (β-carotenes), and minerals, especially iron. It is also rich in phenolic acids, tocopherols and γ-linolenicacid (12) . Spirulina lacks cellulose cell walls and therefore it can be easily digested (12). Microalgae chemical analysis Spirulina has been shown to be a good source of several macro and micronutrients. This high protein, vitamin, and mineral content necessary amino acids, dietary minerals and critical vitamins are all important.

Spirulina contains fatty acids, which have a variety of health benefits properties. The following are some of the possible health consequences: anticancer, antioxidant, antiviral, and immunomodulation antibacterial properties, as well as antiviral properties nutrient deficiency, hyperlipidemia, obesity, diabetes, and heavy metal/ Toxicity caused by chemicals, inflammatory allergic responses, anemia and radiation damage (13,14).

Geographical source:

Found in freshwater lakes and ponds.

Mostly found in Mexico, Africa, and Asian society.

In Japan popularly used as a nutritional food supplement (15).

Table 1. Scientific classification of spirulina (15)

Domain	Bacteria
Phylum	Cyanobacteria
Class	Cyanophyceae
Division	Cyanophyta
Order	Spiruinales
Family	Spirulinaceae
Genus	Spirulina
Species	Plantesis

Table 2. Chemical constituents of spirulina (16)

Protein	Threonine,Alanine, Arginine , Histidine, Tryptophan, Cystine , Lysine etc.
Carbohydrate	Sugars , Dietary Fibres.
Fat	Saturated, Monosaturated, Polysaturated.
Vitamins	Thiamine, Niacin, Ascorbic acid, Beta carotene, Riboflavin etc.
Minerals	Iron, Calcium, Magnesium, Manganese, Potassium, Sodium etc.

Some of the chemical structures are present in the spirulina are added below.

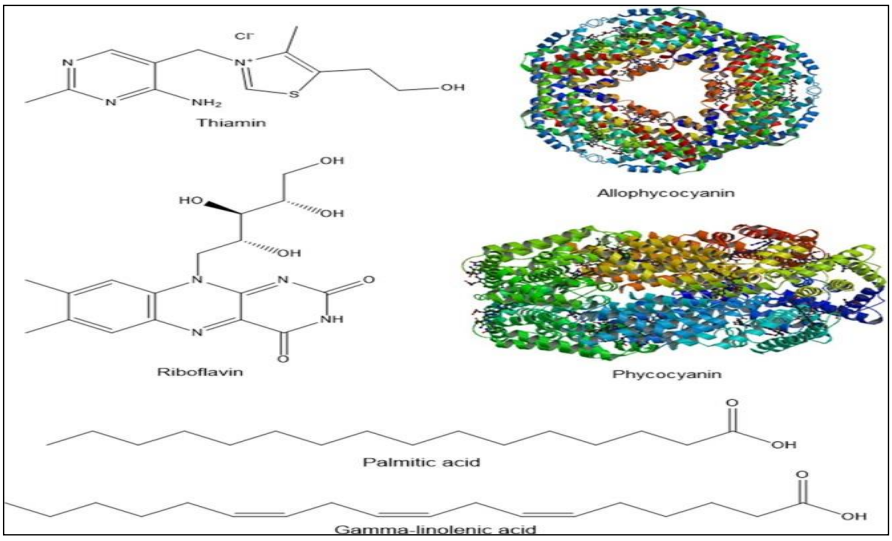

Fig . 1 chemical structures present in spirulina (16)

The nutritional components and other phytochemicals in Spirulina primarily exhibit anti-inflammatory, antioxidant, antidiabetic, neuroprotective, hepatoprotective, and anticancer activities (16).

Because to its low cost and excellent nutritional value Spirulina has been recommended as a sustainable way to prevent Protein Energy Malnutrition (PEM) and Protein Energy Wasting (PEW) in humans (17)and has been utilised as a protein-rich animal feed for increasing meat production and quality (18).

Spirulina, on the other hand, has hypolipidemic (19), hypoglycaemic (20) and antihypertensive (21) characteristics. Spirulina has been shown in rats to boost lipoprotein lipase activity (22)and insulin production from the pancreas (23). The latter effect was also shown in mice treated with Spirulina-derived phycocyanin, which was followed by a decrease in cholesterol, triglycerides, and malondialdehyde (MDA), as well as an increase in blood total antioxidant capacity (24).

As a result, the biomass of this rich source of components is used as feed and food additives in a variety of industries (agricultural, perfumery, pharmaceutics, and food). The same microalgal category can be classified differently depending on the source. Even the culture condition, harvest timing, and extraction procedure are all factors to consider. if they have a similar appearance composition, in general, can be the following is a summary (in percentages of dry weight): 50-70 per cent protein; Carbohydrates account for 15–25%, lipids for 6–13%, and nucleic acids for 4.2–6%.2.2-4.8 per cent minerals (25,26).

Bioactivity:

Bauer et al. introduced the Disc diffusion method to determine the antifungal activity of Spirulina platensis preparations (27).Bauer et al. proposed the Disc diffusion method for determining the antibacterial activity of Spirulina platensis preparations 27). Spirulina presents hypolipidemic, hypoglycaemic, and antihypertensive properties (28).Spirulina contains phenolic acids, tocopherols and ß-carotene which are known to exhibit antioxidant properties (29)**.**

The methanol extract showed more potent antimicrobial activity than dichloromethane, petroleum ether, ethyl acetate extracts and volatile components (30). Spirulina (Arthrospira) shows antitumor, anticancer and antimicrobial (antibacterial, antifungal, and antiviral) activities via the production of valuable products, phycobiliproteins including c-phycocyanin (C-PC), phycocyanobilin, allophycocyanin (APC)(30).

ANTICANCER EFFECT OF SPIRULINA:

The potential cancer chemopreventive effect of Spirulina has been reported (8,9). Carcinogenic steps can be inhibited or reversed by some specific agents (natural or synthetic) before the onset of cancer (31). Grawish reported a tumour suppressive effect in hamster cheek pouch mucosa by Spirulina extract due to repair of the damaged DNA. Repair of DNA damage is due to endonuclease activity, which can be stimulated by the unique polysaccharide contents of Spirulina (32).

Cox-1 (as a constitutive enzyme) is in charge of maintaining proper physiologic function, and the PGs it produces are protective. (as an inducible form) Cox-2 Mitogens, oncogenes, and tumour stimulators are some of the stimulators. The promoters and growth factors) are in charge of the PGs are produced at inflammatory sites (33).

It was demonstrated. that the activity of Cox-2 (rather than Cox-1) increases in cancer colorectal cancer tissues, as well as human stomach and intestinal tissues breast cancer (34). C-phycocyanin is a pigment produced by A. platensis. Cox-2 inhibitor with high selectivity. This owes to the fact that Phycocyanin conformation and large structure; this makes it easier to bind to the active site of Cox-2 (35).

ANTIVIRAL ACTIVITY:

In S. platensis, the main polymer is a branched polysaccharide with a structure similar to glycogen. High anionic polysaccharides of low molecular weight extracted from Spirulina (36) have antiviral and immunomodulatory properties. activities. Antiviral sulphated polysaccharide fraction activity (calcium spirulan) has been thoroughly purified. 3-O-methylrhamnose has been found to be a component of rhamnose. 3-O-methylxylose, 2,3-di-O-methylrhamnose, acofriose Sulphate and uronic acids (37) a polysaccharide that is acidic. It has also been reported that a fraction of S. platensis has been isolated. Tumour Necrosis Factor-alpha is produced as a result of this (36).

ANTIBACTERIAL ACTIVITY:

The antimicrobial activity of Spirulina extracts prepared with various solvents has been investigated. Demule and colleagues (38) reported that methanolic acid has antibacterial activity. The presence of -linolenic acid in S. platensis extract is due to the presence of -linolenic acid, an antibiotic-active fatty acid found in high concentrations(39).

HEAVY-METAL POISONING ACTIVITY:

Different metals cause damage to different organs by creating oxidative stress. the effects oxidative stress Aerobic organisms can be protected from a variety of threats. Antioxidants, which are produced naturally, neutralize free radicals. reduced glutathione, for example, is a manufactured molecule (GSH), Nitric oxide (NO) and superoxide dismutase (SOD) (40).

ANTIOXIDANT ACTIVITY:

In vitro and in vivo investigations have shown that spirulina possesses antioxidant capabilities (38). Protective properties Spirulina's protective effects against CCl4-induced liver damage are related to scavenging of free radicals It is credited with this observation. high protein, fat, and mineral content (zinc, manganese, etc.) Some vitamins (beta carotene, magnesium, and selenium) as well as minerals (magnesium and selenium) alfa-tocopherol, carotene, riboflavin, cyanocobalamin, and lipoic acid (alpha-lipoic acid) (41,42)

2. CONCLUSION

Arthrospira platensis is a high source of protein that's why it can be used as a protein supplement and taken as dietary food material. It is also used as feed and food additives. Arthrospira platensis have activities like antitumor, anticancer and antimicrobial (antibacterial, antifungal, and antiviral) activities. It also possesses hypolipidemic, hypoglycaemic, and antihypertensive properties. Arthrospira platensis contains phenolic acids, tocopherols and ß-carotene which are known to exhibit antioxidant properties. It gives anticancer activity by acting on cox-2.

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