

THERAPEUTICAL IMPORTANCE OF *HYPNEA MUSCIFORMIS* (WULFEN) J.V. LAMOUREUX : A RED ALGAL SEAWEED

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ABSTRACT

Red algae are rich in protein, crude lipid and fibre content and therefore ideal as food in terms of nutritional and biochemical point of view. Currently, red algae have gained importance due to their nutritional composition and various bioactive compounds they produce to accustom to the biodiversity of marine ecosystem. Biologically unique compounds of algal include carrageenan, sulpholipids, and pigments such as phycocyanin. Seaweeds are low in fats but contain vitamins and bioactive compounds such as flavonoids, terpenoids and sulphated polysaccharides, which are potential natural antioxidants not found in the terrestrial plants. *Hypnea*, a common seaweed distributed widely along the tropical and subtropical shores Nutraceutical value of *Hypnea musciformis* includes nutrients, vitamin, ash and large amount of sodium and potassium electrolytes. There were reports that they possess potent antitumour and antimicrobial activity.

Keywords: *Hypnea musciformis*, therapeutical, terpenoids, red algae.

1. INTRODUCTION

Seaweed record states that Japan and China from 4th century BC onwards utilized *Laminaria* species as marine food (Holdt and Karaan,2011). Gupta and Abu-Ghannam (2011), reported the therapeutical references in Traditional Chinese Medicine dates back. Meanwhile, the algal source and usage varies geographically. In East Asia, seaweed usage was mainly nutritional with scanty medicinal uses. *Unnidaria pinnifida* and *Laminaria japonica* popularized as Asian nutritional food for iodine and fiber sources. The Chinese Materia Medica narrates the ancient use for treating goiter, phlegm accumulation, and cleansing heat a key principle to restoring balance in Traditional Chinese Medicine (Yadav *et al.*,2015).Western countries documented dating back to the Greek and Roman empires, where mucilage was used to treat rashes, burns, scurvy treatment and parasite elimination (Shalab,2011) . Seaweeds are consumed as raw or cooked, fresh or dried food. Therapeutical applications ranges from physical application, to different solvent extractions/decoctions utilized for many ailments.

Sea weeds have been one of the promising resources of biologically active metabolites and their extraction has significantly expanded in the last few decades. *Hypnea musciformis*, a proven candidate among the sea weeds for its rich mucopolysaccharides. More than 150 species of

marine algae are commercially important food sources and over \$2 billion worth of seaweed is consumed each year by humans, mostly in Japan, China and Korea. Algae have long been recognized as rich and valuable natural resources of bioactive compounds because of their various biological properties (Mayer *et al.*, 2002). Since the finding of antimicrobial (antibacterial, antifungal or antiviral) activities in many species of marine algae and the isolation of some active compounds from them, marine algae have become recognized as potential sources of antibiotic substances (Fenical and Paul, 1984; Gonzalez *et al.*, 2001; Selvin and Lipton, 2004; Kornprobst, 2005; Salvador *et al.*, 2007).

Substances that currently receive the most attention from pharmaceutical companies for use in drug development, or from researchers in the field of medicine-related research include generally: sulphated polysaccharides as antiviral substances, halogenated furanones from *Delisea pulchra* as antifouling compounds and depsipeptides kahalalide F from a species of *Bryopsis* as a possible treatment of lung cancer, tumours and acquired immune deficiency syndrome (AIDS). Other substances such as macroalgal lectins, fucoidans, kainoids and aplysiatoxins are routinely used in biomedical research and a multitude of other substances have known biological activities (Smit, 2004; Kornprobst, 2005).

Many studies have reported wide array of active molecules from the sea weeds. Phaeophyceous species in particular has combination of active lead molecules. These include phlorotannins, fucoxanthins, and fucoidan. The categorization of seaweed in to brown, red or green algae is based on their photosynthetic pigments, reproductive method, micro and macro morphologies, and its phycopolymers. Seaweeds used cosmetics like body wraps, and baths, with the concept in blood circulation, detoxification, acne treatment, skin moisturizing, purification, exfoliation, or rejuvenating effects. Seaweeds and seaweed-derived products are underexploited bio-resources and source of such natural ingredients for functional foods.

There are reports that marine Rhodophyta from the coast of Morocco have certain inhibitory compounds against Herpes simplex virus type 1 (HSV-1) by cell viability method (Dhivya *et al.*, 2012). The aqueous extracts of *Hypnea musciformis* were capable of inhibiting the replication of HSV-1. Fifty-five aqueous, methanolic, chloroform-methanolic and dichloromethanolic extracts derived from sixteen species of marine Rhodophyta from the coast of Morocco have been screened for the presence of inhibitory compounds against Herpes simplex virus type 1 (HSV-1) by cell viability method. The aqueous extracts of *Asparagopsis armata*, *Ceramium rubrum*, *Gelidium pulchellum*, *Gelidium spinulosum*, *Halopitys incurvus*, *Hypnea musciformis*, *Plocamium cartilagineum*, *Boergesenella thuyoides*, *Pterosiphonia complanata* and *Sphaerococcus coronopifolius* were capable of inhibiting the replication of HSV-1 in vitro at an EC₅₀ (Effective Concentration 50%) ranging from < 2.5 to 75.9 µg mL⁻¹. Marine algae from Morocco can be a rich source of potential antiviral compounds. The screening showed positive results in orcinol sulfuric acid reaction from extracts *H. musciformis*, suggesting that the main effective components in these extracts could be polysaccharides.

Several reports regarding the metabolic and pharmacological effects of common species of seaweed, *H. musciformis* shows that the blood lipids, cholesterol and triglycerides were shown to be decreased after the administration of *H. musciformis*. This is an important finding since decreased levels of cholesterol and total lipids minimize the incidence of many cardiovascular problems. (Bersot *et al.*, 2003). The level of glucose is also increased after the administration of *H. musciformis*, which could be a transient increase only, through action on glucagon, and could also be

attributed to the fact that the *H. musciformis* contains many amino acids, which may form glucose. Administration of *H. musciformis* significantly increased the level of dopamine. The possible effect of *H. musciformis* on dopamine and other brain biogenic amines indicate that *H. musciformis* probably have psychotropic and anxiolytic profile. The increased level of dopamine could also be beneficial keeping in view the etiology of Parkinsonism. In present study the level of serotonin was found to be decreased after the administration of *H. musciformis*. The regular use of seaweeds as a diet will relieve the symptoms of anxiety because the known anxiolytics also manifest their effect by decreasing the concentration of serotonin.

Preliminary pharmacological investigation of the algae belonging to the genus *Dictyota* revealed its content of considerable antibacterial, antifungal, antiviral (Nizmuddin, and Campbell, 1995) antimicrobial, antineoplastic, antifungal and cytotoxic activities (Shameel *et al.*, 1991; Melo *et al.*, 1997). Methanolic extract of *H. musciformis* was reported in regulating serum total cholesterol, triglyceride and low-density lipoprotein cholesterol levels of rabbits and there by mitigate many cardiovascular problems. *Kappaphycus alvarezii* was reported to have antimicrobial activity against certain bacterial and fungal strains by Prabha *et al.*. Antioxidant and free radical scavenging capacity of red seaweed *Hypnea valentiae* was reported by Revathi *et al.*. There are reports of antispasmodic a activity of *Hypnea musciformis* by Salimabi and Das (1980). Studies on *Hypnea musciformis* shows that the level of 5-HT was found to be decreased after its administration. This shows the possibility of the seaweed species having anxiolytic properties may not be ruled out since known anxiolytics are known to produce their effect by decreasing the concentrations of 5-HT. There are reports of gastroprotective activity against ethanolinduced gastric damage in mice and evaluated the role of NO/KATP channels in this effect and the mechanism underlying due to the activity of a sulfated-polysaccharide fraction extracted from the algae *Hypnea musciformis* (Wulfen) J.V. Lamour (Samara *et al.*,2013) .

In Haawai and Indonesia, the red seaweed *Hypnea nidificia* J.Agaardh and *Hypnea musciformis* are used as a vermifuge remedy for stomach troubles caused by parasitic infections. Anti-inflammatory effect of a sulphated polysaccharide fraction extracted from the red algae *Hypnea musciformis* via the suppression of neutrophil migration by the nitric oxide signalling pathway were also reported (Brito *et al.*, 2013). The secondary metabolites of seaweeds

Ulva fasciata and *Hypnea musciformis*, collected from southeast and southwest coast of India, were tested for biotoxicity potential. Both species showed potent activity in antibacterial, brine shrimp cytotoxicity, larvicidal, anti-fouling and ichthyotoxicity assays. The green alga *U. fasciata* exhibited broad-spectrum antibacterial activity whereas the red alga *H. musciformis* showed narrow spectrum antibacterial activity. The brine shrimp cytotoxicity profile indicated that the seaweeds were moderately toxic. The overall activity profile indicated that *U. fasciata* contained more biological potency than *H. musciformis*.

In conclusion, the study underscores the therapeutic potentials of the common seaweed, *H. musciformis*. Further work is planned in this seaweeds to isolate, fractionate terpenoids and to evaluate its biological potentialities.

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