



## Review Article

# Therapeutic potential and pharmacological significance of the marine algae *Gracilaria corticata*

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Received: 03 February 2017

Revised: 14 February 2017

Accepted: 17 February 2017

## ABSTRACT

Generally seaweeds are an essential source in the field of pharmaceutical industry because of their bioactive metabolites. Life threatening diseases like acquired immuno deficiency syndrome (AIDS), cancer and other infectious diseases can be treated with the constituents present in the *Gracilaria* species. This paper deals with a compilation of the literature for *Gracilaria corticata* algae extracts from the beginning of this century with its pharmacological benefits and recognizes opportunities for forthcoming research.

**Keywords:** *Gracilaria*, Seaweed, Bioactives, Review

## Introduction

Among the heterogeneous group of plants, Seaweeds or Marine algae has a long fossil history and has great medicinal value. They are found in the coastal region and in the sub-tidal region of the availability of 0.01% of photosynthetic light and also classified into three main category: brown algae (phaeophyta), green algae (chlorophyta), and red algae (rhodophyta).<sup>1</sup> More than 600 trace elements are found in high concentration in the seaweeds compared to the terrestrial plants, because of which it has various pharmacological activities.<sup>2</sup> Many protein rich seaweeds such as *Monostroma* (green algae); *Sargassum*, (brown algae); *Gracilaria*, (red algae) are still consumed by the humans in the form of salad, soup, etc. Some of the most favourite eatables including chocolates, jam, pickle, jelly and wafer can also be prepared using certain seaweeds and used by the humans.<sup>3</sup>

The *Gracilaria corticata* (Figure 1) are generally considered to be important because of their industrial and biotechnological uses due to the presence of constituents like,  $\alpha$ -(1,4)-3,6-anhydro-l-galactose and  $\beta$ -(1,3)-d-galactose which is one of the main source of agar with cell wall has slight esterification in it.<sup>4,5</sup> Discovery of novel moieties using these natural sources is an immense assignment and was successful to a great extent, thus serve as a source of many useful drugs with fewer side effects has reached about 30% of pharmaceutical market.<sup>6</sup> According to the previous literature, nearly 877 innovative molecules between the years were 1981 and 2002 entered into the market, in which approximately 49% of substances were isolated, characterised and identified from natural origin including seaweeds and the skeleton of these structures can be used as a template for the synthetic and semi-synthetic derivatives.<sup>7</sup>

Ever since scientists faces a great challenge in identifying new effective medicines for many

life threatening diseases. Therefore all over the place in the world, many scientist have an eye on the natural sources for new molecules identification. Hence this review article related to the So in this study we reviewed the literature related to bioactivities of *Gracilaria corticata* algae which is one of the important species rich in various constituents responsible for various pharmacological activity.



**Figure 1:** *Gracilaria corticata*.

### Antioxidant activity

Previous investigations states that seaweeds are taxonomically diverse and the bioactive compounds which was extracted using various solvents have a potential application in medicine.<sup>8</sup> They reported that the methanolic extracts has generally rich in phenols and hence has higher percentage scavenging activity towards nitric oxide, hydroxyl radicals, hydrogen peroxide. Especially the crude methanolic extracts of *G. corticata* was found to possess potential antimicrobial activity which was tested using well diffusion technique and it also shows significant anticancer activity that was tested using various cancer cell lines like MCF7, normal VERO cell lines and Hep-G2 by MTT assay. They concluded that, based on the above results methanolic extracts of seaweeds *Enteromorpha antenna*, *Enteromorpha linza* and *Gracilaria corticata*, possess good free radical scavenging activity and anti-cancer property because of the presence of high phenolic content and also suggested that they might serve as a good lead molecule that can be further taken for

investigations in order to develop it as a novel potential anticancer drug.

Anti-oxidant properties of methanoic extracts in two brown and red algae especially *Gracilaria corticata* was carried out by using ferric reducing ability of plasma (FRAP) method and di phenyl picryl hydrazyl (DPPH).<sup>9</sup> According their results, 50 mg/ml concentration both algae had no anti-oxidant activity with ABTS ( $\mu\text{mol} / \text{g}$  extract) and also there were no significant differences ( $p > 0.05$ ) between the studied algae in phenolic compounds and antioxidant activities that was tested by the DPPH and FRAP tests.

Mole Megha N., assessed the antioxidant potency of few methanolic and ethanolic extracts of seaweeds consisting of red seaweeds (*Gracilaria corticata* and *Gelidiella acerosa*), green seaweeds (*Chaetomorpha media* and *Enteromorpha intestinalis*) and brown seaweeds (*Padina tetrastratica* and *Dictyota dichotoma*) and it is tested for its anti-oxidant activity using FRAP, ferrous ion chelating activity, DPPH assay, reducing power assay and total antioxidant capacity.<sup>10</sup> Results proved that methanolic extract of *Enteromorpha intestinalis* and ethanolic extract of *Dictyota dichotoma* had an appreciable radical scavenging activity, total antioxidant activity and reducing power among the selected species and concluded there was a significant correlation between the DPPH activity scores.

### Anti-cholesterolemic activity

Dist et al, revealed the antioxidant, anti-cholesterolemic and anti-tumor activity of some seaweed constituents. They proved the ethanolic extract of *G. corticata* (J. Agardh) by performing antioxidant and cytotoxic potency of *in-vitro* antioxidant assay using DPPH radical and reducing power.<sup>11</sup> The whole study shown that *G. corticata* has appreciable free radical scavenging activity along with significant cytotoxic property with a scope of further bioassay guided screening of the active components.

Kannan et al, estimated the lipase inhibitory activity of *G.corticata* and *Spirulisna platensis*

using methanolic extract using olive oil as substrate.<sup>12</sup> They concluded that the *Spirulina platensis* showed better inhibition of pancreatic lipase enzyme as compared with *Gracilaria corticata*. Thus it has mild anti-obesity activity as compared to *Spirulina platensis*.

### Anti-inflammatory

Sradhasini rout et al, has reviewed marine red algae *Gracilaria corticata* and presented in her review article stating that, this algae has high impact on treating cancer, inflammation and infectious disease.<sup>13</sup>

Lee et al, did a mini review about the bioactivities and biological functions of biomaterials from red, green, brown and blue-green algae and concluded that oxidative stress can be modulated by protecting cells that are derived from natural products especially from marine algae.<sup>14</sup> Because oxidative stress is one of the reasons that leads to and plays an important role in many of the inflammatory reactions and also in carcinogenesis. Thus marine algal natural products have potential role that it can be used as anti-cancer and anti-inflammatory drugs.

### Antipyretic activity

Paul et al, evaluated antipyretic activity of methanol extract of *Gracilaria corticata* (red Seaweed) on albino mice.<sup>15</sup> Antipyretic prospective of methanol crude extract *Gracilaria corticata* was estimated by defining the rectal temperature on yeast-induced pyrexia. This study, research exposes the methanolic extract of *Gracilaria corticata* have a noticeable antipyretic activity in parallel to the standard drug paracetamol. This extract provided the highest marked antipyretic activities in a dose dependent manner. Doses like 200mg/kg and 40mg/kg body weight dropped the body temperature up to 4 hours after subsequent administration.

### Anticancer activity

Possessions of various Seaweeds on Human Colon and Breast Cancers Ghislain was published by Moussavou et al.<sup>16</sup> Seaweeds as

well as seafood are generally the utmost essential eatable with novel healing compounds for humans. Numerous compounds mined from seaweeds that have been revealed to eradicate or to lessen the development of cancer. Fucoidan that has been extracted from the red algae *Gracilaria corticata* was active against both colorectal and breast cancers. Yuvaraj & Arul., studied the antitumor activity by the human colon carcinoma cell line, the anti-inflammatory assay by peripheral blood mononuclear cells (trypan blue exclusion test are used to count and assess the total number of cells, the antioxidant assays was resolved by the method of DPPH radical scavenging activity, superoxide anion scavenging activity, reducing power by comparing with a standard ascorbic acid and by studying progress of inhibition using the paper disc diffusion method to prove its antibacterial activity by measuring the diameter of the zone of inhibition of microbial growth.<sup>17</sup>

### Antidiabetic activity

The antidiabetic usage of water extract of *G corticata* in diabetic rats was valued for two dissimilar doses such as 200 mg/kg and 400 mg/kg by considering the method of blood glucose level, glycosylated hemoglobin and hepatic glycogen level.<sup>13</sup> The authors administered the extract orally for 28 days. Pretreatment of aqueous extract of *Gracilaria corticata* drop blood glucose and glycosylated hemoglobin level in a dose dependant way and matched against the standard glipizide followed by the dose of 200 mg/kg and 400 mg/g showed 22.23 mg/g and 24.78 mg/g respectively in hepatic glycogen content which was ominously diminished by alloxan treated diabetic rats.

### Hepatoprotective activity

Sampathkumar et al, investigated the hepatoprotective activity using aflatoxin B<sub>1</sub> (AFB<sub>1</sub>) induced hepatotoxicity effect of marine algae *Gracilaria corticata* in contrast to AFB<sub>1</sub> (1 ppm) induced hepatic damage which were examined using important refereeing parameters like total protein content, weight of the liver albumin, body weight gain and tested along transaminases (SGOT and SGPT), lactate dehydrogenase (LDH) and alkaline phosphatase

(ALP) as enzyme markers.<sup>18</sup> Decreased level of the above said parameters authenticated the Hepatic damage significantly ( $p < 0.05$ ) with the aqueous extract concentration of  $250 \text{ mg kg}^{-1}$  body weight. Thus the research conducted validated the hepatoprotective potential of aqueous extract of *G. corticata*.

### Antimicrobial activity

Eahamban et al, investigated the phytochemical analysis using Harborne method and UV-VIS, HPLC profiling and the anti-bacterial activity of *G. corticata* J.<sup>19</sup> Ag against various Gram positive and Gram negative strains using agar disc diffusion technique. The results put forth clearly the presence of alkaloids, steroids, flavonoids, etc. HPLC profiling and UV-VIS spectrum was recorded and also the maximum degree of anti-bacterial activity was observed in isopropanol soxhlet extracts followed by isopropanol cold extracts. They concluded that the *G. corticata* was one of the rich sources of phytoconstituents with good anti-microbial property.

### Conclusions

Huge number of studies were carried out in the selected seaweed *Gracilaria corticata* which contain sulphated polysaccharide, Fucoidan, flavonoids, phlorotannins, etc. as a major constituents. Additionally, these bioactive components and various extracts exhibited substantial valuable therapeutic potential and could be announced for the preparation of novel efficient ingredients in pharmaceuticals for the treatment and or prevention of numerous disease complaints. Consequently, advanced research studies are desired to exploit its supreme therapeutic potential in the field of pharmaceutical sciences for unique and successful application of the extracts or isolated constituents loaded formulation.

Funding: No funding sources

Conflict of interest: None declared

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