DOI:10.26524/krj.2023.13

Kongunadu Research Journal 10 (2): 31-34, 2023
Publisher: Kongunadu Arts and Science College, Coimbatore.

https://krjournal.com/index.php/krj/article/view/626

RESEARCH ARTICLE

An in vitro anticancerous and antioxidant potentials of the brown seaweed *Sargassum polycystum* C. Agardh

Aleena B. Eluvathingal[1], Amitha, T.V. [1], Carolin Joe Rosario, J. [1,*] and Vimal Priya, S.[2]
[1]Department of Botany, Nirmala College for Women, Coimbatore - 641018, Tamil Nadu, India.
[2]Department of Botany, Kongunadu Arts and Science College (Autonomous),
Coimbatore - 641029, Tamil Nadu, India.

ABSTRACT

Discovering new therapeutic agents for cancer treatment remains a significant issue in the search for a cure as, cancer is the preeminent reason of death worldwide. The majority of compounds used as chemotherapeutic medications to treat cancer have been found and isolated in plants for their synthetic derivatives. Biomaterials made from marine algae are crucial components of several medications used for the treatment of cancer and other diseases, due to their diverse bioactivities. The goal of the current study was to assess the marine algae *Sargassum polycystum* antioxidant capacity and anticancer efficacy against the A549 cell line. The antioxidants are crucial for preventing oxidative stress-related damage (OS). OS has been linked to the pathogenesis of several illnesses, including cancer, diabetes, and heart disease. Marine algae-derived natural compounds shield cells by reducing the effects of oxidative stress. From the algal extract DPPH radical scavenging activity in a concentration–dependent manner with maximum scavenging activity (IC50 value = 27.7±1.3µg/ml) was carried out. The in vitro anticancerous activity against the A549 Lung cancer cell line revealed that the IC50 value of *Sargassum polycystum* was 13±1.5 µg/ml. Thus we can deduce that the secondary metabolites from marine algae can advance with a substantial range of anti-cancerous medicaments.

Keywords: Marine algae, Anticancerous, Antioxidant, Oxidative stress, Lung cancer

1. INTRODUCTION

Cancer is a class of disease characterized by abnormal cell proliferation. These abnormal cells have the ability to divide uncontrollably, invade normal bodily tissue, and spread to other parts of the body. Cancer is the world's second-most prevalent cause of death. More than 40% of cancer-related deaths may be averted due to modifiable risk factors such as smoking, alcohol consumption, poor diet, and physical inactivity. Cancer can develop in almost any organ or tissue of the body, including the breasts, lungs, prostate, and skin. Chemotherapy, or anticancerous medications, are used for their ability to kill, shrink or slow the growth of cancer cells. The majority of these medicines work by inhibiting the signaling pathways that cancer cells use to divide. The cancer treatments work by interfering with specific proteins that facilitate tumor growth and spread throughout the body. This is in contrast to chemotherapy, which frequently destroys rapidly growing and dividing cells.

Breast, lung and bronchus cancers, as well as prostate and colorectal cancers, account for over half of all new cancer cases in the United States. Lung and bronchus cancer, as well as colorectal, pancreatic and breast cancer, account for roughly half of all mortality. Lung cancer develops when the cells in the lungs mutate or alter. Breathing in harmful chemicals, such as cigarette smoke, can trigger these alterations. Surgery, chemotherapy, radiation therapy, and targeted therapy can all be used to treat lung cancer. All lung cancer patients have an average five-year survival rate of 18.6%. The stage of lung cancer, on the other hand, is the most important predictive predictor. The prognosis of non-small lung cancer is better in the early stages (stages 0 and 1) than in later stages (stages 2, 3, or 4).

*Correspondence: Carolin Joe Rosario, J., Department of Botany, Nirmala College for Women, Coimbatore - 641018, Tamil Nadu, India. E.mail: cjeorosa@gmail.com

Antioxidants are compounds that can protect our body from free radicals, which are unstable molecules that may lead to inflammation and other health problems. Free radical damage to cells can be prevented or slowed by antioxidants. Free radicals can cause persistent inflammation and damage, which has been linked to the development of cancer. By supplying with one of their electrons, antioxidants eradicate free radicals. This helps to maintain more of the cell population in the body intact and less prone to cancer [6]. However, antioxidants are employed as a form of adjuvant therapy in cancer patients undertaking chemotherapy or radiotherapy.

Seaweed encompasses a variety of antioxidants, such as vitamins A, C and E, as well as carotenoids and flavonoids. These antioxidants protect the cells from harm. Carotenoids that are found in brown algae safeguard cell membranes and lipoproteins from free radical damage. Fucoidan from seaweeds, for example, can serve as an anticancer drug across multiple signaling pathways, including cell cycle arrest, apoptosis, and anti-angiogenesis via reducing VEGF synthesis and natural killer (NK) cell activation [3]

The discovery of novel medicines has implications for preventing disease-related pain and fatalities. Research into drugs intends to identify molecules with the potential to be therapeutic agents. The core objective of drug development initiatives is to identify novel molecules that may be useful in the treatment of diseases with unmet medical needs. In general, lung cancer victims have a life expectancy of 7-16 months. Lung cancer sufferers, on the other hand, can undergo treatments that help them to live longer lives and become survivors. With the proper medical care, some lung cancer patients have lived for decades.

2. MATERIALS AND METHODS

2.1. Preparation of extracts

The Brown algae *Sargassum polycystum*, was collected from the Thikkodi coast of Kerala. After washing the plant materials separately, they were shade-dried for several days. The grinder was used to break down the dried materials into coarse powder, which was subsequently kept at room temperature (RT) for later on. The powder was extracted with different solvents like chloroform, methanol, ethyl acetate, water, petroleum ether, and acetone. As the methanolic extracts have revealed better activity in preliminary phytochemical screening, the extract was further taken to proceed with the analysis.

2.2. DPPH Radical Scavenging activity

The extract's ability to scavenge free radicals was assessed using the DPPH radical scavenging assay, as described by Mtaki [3]. The ability of plant extracts to donate hydrogen atoms was tested by decolorizing a methanol solution of 2,2-diphenyl-1-picrylhydrazyl (DPPH). A 0.1 mM DPPH solution in methanol solution was made, and 2.4 mL of this solution was combined with 1.6 mL of extract in methanol at various concentrations (10-50 µg/mL). The reaction mixture was completely vortexed and left in the dark at room temperature for 30 minutes. At 517 nm, the absorbance was determined spectrophotometrically. BHT was used as a standard. The following equation was used to compute the percentage of DPPH radical scavenging activity:

$$\% \text{ RSA} = \frac{\text{Abs Control} - \text{Abs Sample}}{\text{Abs Control}} \times 100$$

The percentage of inhibition was then plotted against concentration, and the IC50 was derived from the graph. At each concentration, the experiment was performed three times.

2.3. MTT Assay

After being treated with the mixed algal extracts, the cells were cultured for 72 hours at 37°C, 5% CO2. Each well-received 20µl of filter sterilized MTT (2mg/ml) in phosphate-buffered saline (PBS) was incubated at 37°C for 3 hours. The MTT medium was withdrawn, and the generated formazan crystals were solubilized with 100µl of DMSO before being measured at 540 nm with a universal microplate reader. Untreated cells were compared to treated cells. Tetrazolium salts are cleaved to formazan dye by cellular enzymes only in viable cells. Doxorubicin was used as a standard [1].

$$\% \text{ of viability} = \frac{\text{OD value of the experimental sample}}{\text{OD value of the experimental control}} \times 100$$

3. RESULTS AND DISCUSSION

The antioxidant and cytotoxic effects of the marine algae *Sargassum polycystum* were examined in the present investigation. In accordance with the findings, the selected algae possessed better anticancerous and antioxidant capabilities. In the presence of antioxidants, DPPH generates a violet/purple colour in methanol extracts and fades to shades of yellow. The degree of discoloration suggests that the antioxidant chemical scavenging capacity in terms of hydrogen-donating ability. The IC_{50} value 27.7±1.3 µg/ml was observed from the experiment.

The MTT assay was used to assess cell viability, proliferation, and cytotoxicity by measuring cellular metabolic activity. The MTT assay works on the premise that only living cells have active metabolism and can convert MTT to purple formazan. A spectrophotometer was used to measure the amount of formazan generated, which is proportional to the number of live cells cellular enzymes only can reduce the tetrazolium salt MTT to colored formazan molecules in metabolically active cells (viable cells). As a result, the amount of formazan dye generated directly correlates to the number of live cells in the culture and is quantified spectrophotometrically as absorbance. Toxins reduce cell activity. Here the IC_{50} value of the sample was observed to be 13±1.5 µg/ml. The results of these tests reveal that extracts had low cytotoxicity after 48 hours of incubation.

There is a substantial link between oxidative stress and cancer prevalence. Several in-vivo and in-vitro investigations have revealed that administering exogenous antioxidants may reduce the generation of free radicals and damage to DNA and proteins, reducing the chance of getting cancer. The use of naturally occurring antioxidants alone or in combination with conventional chemotherapy appears to be an ideal technique for combating tumor development [2]. Several research on the cytotoxic efficiency of various macroalgae and their possible anti-proliferative effect on cancer cell development have been documented. However, research suggests that algae could be a source of cancer medicines that promote natural killer cell generation, apoptosis-mediated cell death, cell cytotoxicity, and tumor cell invasion via a caspase-dependent or caspase-independent pathway [5]. Algae can be genetically altered to improve their biological activity, and physical and also treat chemical attributes, and treat certain tumors. These developments have the potential to greatly expand the usage of algae [7].

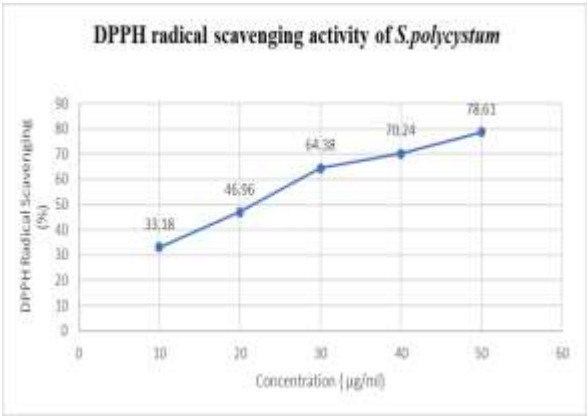

Figure 1. The DPPH radical scavenging activity of *S. polycystum*.

Table 1. The IC_{50} value of *S. polycystum* in DPPH Antioxidant activity

EXTRACTS	IC_{50} VALUE (µg/ml)
Standard (BHT)	36.34±0.21
Methanolic extract of *S. polycystum*	27.7±1.3

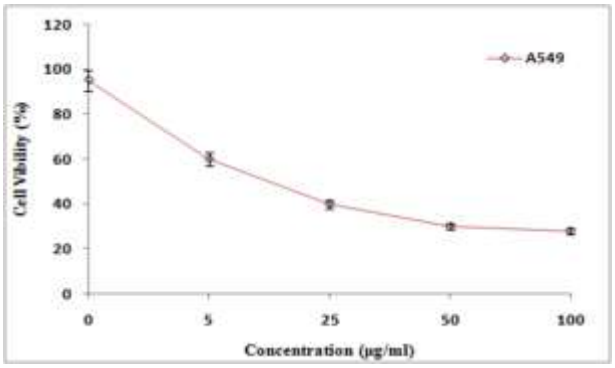

Figure 2. The MTT assay of the A549 cell line in *Sargassum polycystum*

Table 2. The IC_{50} value of *S. polycystum* in anticancerous activity

EXTRACTS	IC_{50} VALUE(µg/ml)
Standard (Doxorubicin)	21.34±0.3
Methanolic extract of *S. polycystum*	13±1.5

4. CONCLUSION

Algae could potentially be used as a cancer treatment delivery system, delivering chemotherapy or genetic medicines to cancer patients. Some algal extracts have been revealed to decrease cell proliferation, metastasis, and tumor angiogenesis while also inducing apoptosis, resulting in an antitumor effect. Polysaccharides, proteins, terpenoids, sterols, polyphenols, cyclic polysulfide compounds, macrolides and other bioactive chemicals have been discovered to be abundant in algae. These ingredients have powerful antiviral, anticancer and antioxidant effects. Algae can also be used in tumor therapy for diagnostic purposes using imaging techniques. The ultimate goal of pharmaceutical research is to bring to market a unique molecule with a revealed therapeutic benefit. A transition from preclinical to clinical stages is a significant turning point when the new pharmaceutical product approaches the market.

REFERENCES

1. Ala, A. A., Olotu, B. B. and Ohia, C. M. D. (2018). Assessment of cytotoxicity of leaf extracts of *Andrographis paniculata* and *Aspilia africana* on murine cells in vitro. *Archives of Basic and Applied Medicine* 6(1), 61-65.
2. Haq, S. H., Al-Ruwaished, G., Al-Mutlaq, M. A., Naji, S. A., Al-Mogren, M., Al-Rashed, S., Ain, Q. T., Al-Amro, A. A. and Al-Mussallam, A. (2019). Antioxidant, Anticancer Activity and Phytochemical Analysis of Green Algae, Chaetomorpha Collected from the Arabian Gulf. *Scientific Reports 9*(1), 18906.
3. Lee, H., Selvaraj, B. and Lee, J. W. (2021). Anticancer effects of seaweed-derived bioactive compounds. *Applied Sciences* 11(23), 11261.
4. Mtaki, K., Kyewalyanga, M. S. and Mtolera, M. S. P. (2020). Assessment of antioxidant contents and free radical-scavenging capacity of chlorella vulgaris cultivated in low-cost media. *Applied Sciences* 10(23), 8611.
5. Sharma, R., Mondal, A. S. and Trivedi, N. (2023). Anticancer potential of algae-derived metabolites: recent updates and breakthroughs. *Future Journal of Pharmaceutical Sciences* 9(1), 44.
6. Wang, N., Pei, H., Xiang, W., Li, T., Lin, S., Wu, J., Chen, Z., Wu, H., Li, C. and Wu, H. (2023). Rapid Screening of Microalgae as Potential Sources of Natural Antioxidants. *Foods 12*(14), 2652.
7. Xin, Z., Zhang, M., Cui, H., Ding, X., Zhang, T., Wu, L., Cui, H., Xue, Q., Chen, C. and Gao, J. (2023). Algae: A Robust Living Material Against Cancer. *International Journal of Nanomedicine 18*, 5243–5264.