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Original Article

Phytochemical Profile and Antioxidant Properties of Extracts from *Sargassum flutans*

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Abstract

Many seaweeds, most notably brown algae, are suitable for human consumption. These plants have various possible biological actions and significant phytochemical components. The ethylacetate and dichloromethane extracts of *Sargassum flutans* were examined for their phytochemical composition and *in vitro* antioxidant activities in our research. The antioxidant capacity was evaluated using the DPPH (2, 2-diphenyl-1-picrylhydrasyl) method and the reducing power. The DPPH radical scavenging activity of an antioxidant is a well-known indicator of its capacity to eliminate free radicals. *Sargassum flutans* ethylacetate extracts had demonstrated effective DPPH radical reducing capability. The extract's capacity to eliminate DPPH radicals increased with concentration. The typical antioxidant and positive control employed was ascorbic acid.

Ethylacetate extracts from *Sargassum flutans* showed more reducing power than dichloromethane. The phenolic content was also determined using the Folin-Ciocalteau reagent to evaluate the extracts' impact on total antioxidant activity. The results show that the percentage of phenolic compounds of the *Sargassum futans* DCM extracts was higher than that of the ethylacetate extracts. Finally, it is also noteworthy to mention that, the DPPH scavenging, reducing power, and phenolic content in these extracts of maritime macroalgae were remarkably concentration dependent.

Keywords Antioxidants, Phytochemistry, Seaweed, *Sargassum Flutans,* brown algae.

Introduction

The extensive variety of aquatic life, which account for about half of all biodiversity worldwide and constitute valuable sources of chemically distinct bio-functional components, provide an ample supply of natural products due to the fact that over seventy percent of the land of the world is covered by oceans [1]. Marine algae are among the marine creatures that contain various bioactive chemicals with different chemical and biological properties [2].

A diverse group of plants with a lengthy fossil record is the marine algae. Algae can be divided into two main categories: The microalgae live in the littoral region; they are also found as phytoplankton across the ocean's waters and in benthic and littoral environments. Macroalgae, on the flip side are bigger and more sophisticated organisms that resemble plants and are generally referred to as underwater algae. They may be discovered in various marine environments, such as rocky coastlines, reefs of coral, and kelp woodlands [3].

Seaweeds, or ocean microalgae, are commonly divided into three types and can be found near the coast in both high and low waves as well as in the subtidal zone up to a point where there is 0.01% photosynthetic light. Chlorophyta, Phaeophyta, and red, green, and brown algae are different types of seaweeds. Brown seaweeds, in particular, contain various polysaccharides such as alginates, laminarins, fucans, and cellulose. These polysaccharides contribute to the brown color of brown seaweeds, mainly due to the presence of the carotenoid fucoxanthin [3].

According to Uribe *et al.* (2019) [4] seaweeds are low in calories and high in soluble dietary fiber, proteins, minerals, vitamins, antioxidants, phytochemicals, and polyunsaturated fatty acids. Abundant Vitamins A, Bl, B2, B3, B12, C, D, and E are found in them. According to Katsanos *et al.* (2006) [5], the amino acid composition of these foods is complete and comprises either all or the majority of the necessary amino acids required for a healthy lifestyle. In addition, physiologically active substances extracted from marine microalgae display a range of biological actions, including anti-oxidant, anti-viral, anti-allergic, anti-carcinogenic, anti-inflammatory, and anti-coagulant [6].

There are over 400 species of Sargassum, a genus of brown seaweed sometimes known as gulf weed or sea holly, which is a member of the Fucales order, subclass Cyclosporeae, and class Phaeophyceae [7]. In view of its many medicinal properties, it is widely considered as a nutritional supplement of the twenty-first century, and further research is now being done to identify additional prospective medicinal powers [8].

According to Carvalho *et al.* (2010) [9], an antioxidant is any molecule that, when present in low concentrations in contrast to those of an oxidizable substrate,

considerably slows down or stops that substrate from oxidising. According to Carvalho *et al.* (2010) [9], antioxidant effects are linked to lowered DNA damage, decreased lipid peroxidation, preserved immunological function, and suppressed malignant cell modification. Also, according to multiple research, phenolic compounds are the main phytochemicals with biological advantages for the wellness of humans. Furthermore, a number of scientists have noted a connecting the total phenolic content and antioxidant activity in various seeds, fruits, and vegetables [9].

Vitamins and polyphenols, two naturally occurring antioxidants found in fruits and vegetables, remain linked to the protection of chronic medical conditions such cancer and heart conditions [10]. Superoxide radicals, which are species with unbound electrons, are constantly generated during the regular oxidation process of oxygen. Due to the tendency of electrons to couple up and create stable bonds, radicals are often very active entities. Superoxide is also known as a "Reactive Oxygen Species" (ROS) due to its radical nature. Proteins, lipids, and DNA are just a few of the biological components that the ROS generated can oxidatively damage. As a result, there is growing attraction to the antioxidant activity found in food, as they are crucial components of the body's defense mechanism against ROS [11]. It has previously been shown that the plant-based molecules called phenolic compounds, which are widely present in plants, have powerful antioxidant capabilities and the ability to eliminate free radicals. They perform chemo-preventive effects and shield the organism from oxidative injury caused by free radicals by preventing the enzymatic pathways that create ROS and reducing highly oxidized ROS [12-14].

Ethyl acetate and dichloromethane extracts of *Sargassum flutans'* phytochemical composition and antioxidant capacities are the subject of this study. The DPPH technique and reducing power are used to assess the in vitro antioxidant properties in this study.

The study also looks at the extracts' phenolic composition and how much it contributes to overall antioxidant activity. The study advances knowledge about *Sargassum flutans*'s possible health advantages and its use as a source of antioxidants. Specific goals of the project are to:

(1) Examine the phytochemical components of extracts made from ethyl acetate and dichloromethane. Others are:

(2) Evaluating the extracts' capacity to scavenge DPPH radicals.

(3) Comparing the extracts' reducing potential to that of ascorbic acid.

(4) Using the Folin-Ciocalteau reagent to determine the phenolic makeup of the preparations.

(5) Examining effects of concentration on antioxidant activity.

By examining the antioxidant capabilities of *Sargassum flutans* and its phytochemical make-up, the study fills a knowledge gap and offers insightful information about the plant's potential as a natural source of antioxidants. This has implications for human well-being, diet, the commercial sector, and preservation of the environment.

Methodology

Preparation of Sargassum flutans plant extracts

The seaweeds were purchased from a neighborhood marketplace. The Botany Department in the Faculty of Science at Lagos State University was able to identify them.

The plant samples were broken up into little bits, fully dried by air, and kept until extraction in glass jars. A hundred

grammes of the dried plant material were left to macerate in methanol for five days straight. The extracts were lowered in pressure and evaporated at room temperature after being filtered through two layers of cotton fabric. Pending phytochemical and cytotoxic assessment, dried residues were kept in clean bottles.

Qualitative phytochemical screening

To ascertain plant chemicals in the specimens, standard techniques for phytochemical examination were used on all of the extracted material.

Frothing Test for saponins

A stable sustained froth formed after 3 minutes of vigorous shaking in a graduated cylinder containing 5 ml of the extract solution and 5 ml of distilled water. The development of an emulsion was then monitored in each of them.

Test for phlobatannins

In a test tube, 2 ml of the sample extract solution was combined with 2 ml of 1% aqueous hydrochloric acid (HCl). The samples were then heated for 3 minutes to reveal the presence of phlobatannins by looking for the formation of a red precipitate.

Test for tannins

Three mL of the extracted sample solution were mixed with some of the drops of 0.1% ferric chloride. After that, they were all tested for the development of brownish green or a blue-black hue.

Test for steroids

To each extracted sample solution, 2 ml of acetic anhydride and 2 ml of sulphuric acid (H_2SO_4) were added. When the samples' color changed from violet to blue or green, it was determined that steroids were present.

Test for alkaloids

2 ml of diluted ammonia was added to 5 ml of the extracted sample solution. The alkaloidal base was extracted using 5 ml of added chloroform and gently shaken. 10 ml of acetic acid were used to extract the layer of chloroform. There were two components to this. To a single part Mayer's reagent was applied, and to the other, Draggendorff's reagent. Alkaloids were identified by the appearance of a cream (when using Mayer's reagent) or a reddish-brown precipitate (when using Draggendorff's reagent).

Test for flavonoids

There were two ways to check for flavonoids.

First, 2 ml of each aqueous extract filtrate and 5 ml of diluted ammonia were added to the test tube. Next, 1 ml of concentrated sulfuric acid was added. The flavonoids appearance was suggested by the creation of a yellow coloration that vanished upon standing. Second, a fraction of the filtrate was mixed with a few drops of a 1% aluminum chloride solution. In addition, the development of a yellow coloration pointed to the existence of flavonoids.

Test for cardiac glycosides

A brown ring at the interface showed indication of a deoxysugar characteristic of cardenolides when 1 ml of each extract was diluted with 5 ml of water, 2 ml of glacial acetic acid, and 1 drop of ferric chloride. In the acetic acid layer, a greenish ring may emerge slightly above the brown ring and eventually expand throughout this layer, indicating signs of cardiac glycosides, and then a violet ring was noticed below the brown ring.

Test for terpenoid

1 ml of the sample was added to 2 ml of chloroform, which was then carefully

layered with 3 ml of strong sulphuric acid (H_2SO_4). The interface's reddish-brown coloring shows the presence of terpenoids.

Test for reducing sugars

After being heated in a boiling water bath for 10 minutes, a test tube containing 2 ml of an aqueous extract, 1 ml of Fehling's A and 1 ml of Fehling's B solutions was combined. The emergence of a yellow and subsequently brick red precipitate shows the presence of reducing sugars.

Test for phenolic compounds

5 ml of aqueous extracts were treated with 2-3 drops of lead acetate. The appearance of a white-yellow tint is a sign of phenolic compound presence.

Quantitative chemical screening

Tannin determination

Quantitative tannin analysis was carried out using the method given by Burden and Robinson (1981) [15]. The aqueous extract, 500 mg, was put into a different 50 ml plastic container. After adding 50 mL of distilled water, the mixture was stirred for an hour. After that, it was filtered into a 50 mL volumetric flask and concentrated as needed. The sample was then pipetted into a test tube and mixed with 0.008 M potassium ferrocyanide and 2 ml of 0.1 M $FeCl_3$ in 0.I N HCl. The absorbance at 720 nm was measured after 10 minutes.

Determination of alkaloids

200 ml of 10% acetic acid in ethanol was added to a 250 ml beaker after weighing 5 g of the aqueous extract in the beaker. After being covered, the mixture was set aside for a few hours. The extract was purified and reduced in volume by one-fourth in a water bath after filtering. Concentrated ammonium hydroxide was gradually added to the extract until it entirely precipitated. The entire solution was collected, rinsed with mild ammonium hydroxide, and then filtered after being given time to settle. The remainder was then dried, measured, and the amount that was left was calculated.

Analysis of saponins

Using the method described by Obadoni and Ochuko (2002) [16], 100 ml of 20% aqueous ethanol was added to a conical flask along with 20 g of each sample to quantitatively measure saponin. The samples were heated in a hot water bath at 55 °C for 4 hours while being stirred continuously. After filtering the mixture, 200 mL of 20% ethanol was used to remove the leftover material once more. The combined extracts were concentrated to 40 ml over a water bath at 90 °C. The concentrate was poured into a 250 ml separating funnel, which was then vigorously agitated with 20 ml diethyl ether. The ether layer was removed, but the aqueous layer was retained. Once more, the purification process was conducted. (60 ml) of n-butanol was added. The combined n-butanol extracts were twice washed with 10 mL of 5% aqueous sodium chloride. The residual solution was warmed up in a water bath in a matter of minutes. After the samples were baked in the oven to a uniform weight, the percentage of saponins was calculated.

Determination of flavonoid

The flavonoids in the aqueous extracts were assessed using the aluminum chloride test. In separate test tubes, 150 ml of sodium nitrite (5 % $NaNO_2$, w/v) was added after the extracts were diluted with distilled water. The mixture was treated with 150 ml of aluminum chloride (10% $AlCl_3$, w/v) and let to sit for an additional 6 minutes after that.

Next, 2 ml of sodium hydroxide and 5 ml of distilled water were added, bringing the concentration to 5 ml. A spectrophotometer set at 510 nm was used to measure the absorbance after 15 minutes. Distilled water was used as a control.

Determination of cardiac glycosides

8 mL of each aqueous extract were put into a separate 100 ml volumetric flask, to which 60 ml of distilled water and 8 ml of 12.5 percent lead acetate were added, mixed, and filtered. 50 ml of each sample was moved to a new 100 ml flask along with 8 ml of 47 percent Na_2HPO_4 in order to precipitate more Pb^{2+} ions. The liquid was filtered twice using the same filter paper to get rid of excess lead phosphate. In a clean Erlenmeyer flask, 10 mL of pure extract and 10 mL of Baljet reagent were added. In a blank titration, 10 mL of distilled water and 10 mL of Baljet reagent were employed. For a full hour, this was allowed to sit to completely develop the colors. The strength of the colors was measured using a colorimeter calibrated to 495 nm.

Determination of phenol

The folin-ciocalteu reagent was diluted 1:1 in distilled water and added to 0.5 ml of the aqueous extract. The mixture was left to incubate at 22 °C for 5 minutes. Sodium carbonate (20%) was added in 2 ml. After that, the mixture was left to sit for 90 minutes at the same temperature, and the absorbance at 650 nm was measured.

Determination of reducing sugar

1 g of the aqueous extract was macerate in 20 ml of distilled water before being filtered. The aqueous extract was then moved to a fresh test tube and given 1 ml of alkaline copper reagent. The mixture boiled for five minutes before being allowed to cool. 2 ml of distilled water and 1 ml of the phosphomolybdic acid reagent were added to the mixture. The absorbance was read at 420 nm.

Estimation of the anthraquinone

After a sufficient pre-treatment, the anthraquinone content was measured via spectroscopy in duplicate. A volume of 1.0 mL of the crude extract fraction was alkalinized with 50 mg of $NaHCO_3$, and 20 mL of a solution containing 1.05% $FeCl_3$ was used to oxidize it. The mixture was reflux boiled for 5 minutes. The reaction medium was then treated with 1 mL of concentrated hydrochloric acid (HCl, and the same conditions were maintained for another 20 minutes. The mixture was extracted three times with diethyl ether at ambient temperature. To create the stock solution, the ether portion was placed into a 100 mL volumetric flask and the remaining volume was filled with this organic solvent. The stock solution was then dried off using a water bath at 60 °C. The leftover material was dispersed in 10 mL of methanol solution containing 0.5% magnesium acetate. To analyze the absorbance, a UV-Vis spectrophotometer was used at 515 nm. To create the analytical curve, standard solutions of 1,8-dihydroxyanthraquinone (0.005-0.06 mg/mL in ether) were similarly treated with 0.5% magnesium acetate in methanol. As a control, the methanol solution was employed. mL of hydroxyl-anthracene derivatives per 100 g of the dry sample were used to express the results.

Determination of cardiac glycosides

In line with Solich *et al.* (1992) [17] with some changes. A 10% extract from each generation and the entire sample were combined with 10 mL of freshly made Baljet's reagent to determine the presence of cardiac glycosides. After an

hour, the mixture was diluted with 20 mL distilled water and the absorbance was measured at 495 nm by UV-Vis spectrophotometer.

Antioxidant Analysis

DPPH radical scavenging activity assay

Using UV-Vis spectrophotometry at 517 nm, the radical scavenging abilities of the plant extracts against the 2,2-Diphenyl-1-picryl hydrazyl radical were identified. The extracts were prepared in the following concentrations: 25, 50, 75, and 100 g/ml in methanol (Analar grade). Ascorbic acid, a form of vitamin C, was used as the antioxidant standard at levels that matched those of the samples. A test tube containing 1 ml of 1 mM DPPH in methanol and 1 ml of the extract was filled with 1 ml of the extract first. The identical amounts of methanol and DPPH were used in the preparation of a blank solution.

Nitric oxide scavenging activity assay

At a physiological pH of 7.2, sodium nitroprusside produced nitric oxide, which when combined with oxygen produced nitrite ions, which could then be measured using the Griess reagent. Test tubes containing various concentrations of the extracted samples (25, 50, 75, and 100 g/ml) were filled with the reagent mixture (5 ml), which contained 10 mM of sodium nitroprusside in phosphate buffered saline. The test tubes were then incubated at 25 ^{o}C for 150 minutes, during which time 0.5 ml of the incubated samples were removed and 0.5 ml of Griess reagent was added. At 550 nm, the chromophore's absorbance was measured after it was coupled to napthylethylene diamine after being diazotized by nitrite with sulphanilamide. A positive control substance was ascorbic acid. The following formula was used to calculate the percentage (%) of inhibitory activity:

$$Nitric\ oxide\ scvenging = \frac{A_0 - A_1}{A_0} x100$$

Where, A_0 is the absorption of the control sample and A_1 is the absorption of the extract.

Total antioxidant capacity

According to Hinneburget *et al*. (2006) [18], the reduction power of the samples was calculated. With 2.5 mL of phosphate buffer (200 mM; pH 6.6) and 2.5mL of potassium ferricyanide (1%), the extracts or fractions (1.0mL) of various concentrations were combined. The mixture was left to stand for 20 minutes at 50 °C. 2.5 mL of 10% TCA was added to the mixture, which was then centrifuged at 3000 rpm for 10 min. The absorbance at 700 nm was measured after the supernatant (2.5 mL) was combined with 2.5 mL of distilled water and 0.5 mL of $FeCl_3$ (0.1%). The reaction mixture's increased absorbance was understood to indicate that the tested samples' reducing activity had increased. For the calibration curve, ascorbic acid served as the standard. The extracts' and fractions' reducing power was calculated in mL of ascorbic acid equivalents per gram.

Results

The results of various assays carried out and their method principle are shown in this section. The extracts in general showed great antioxidant potentials. They scavenged various radicals in a dose-dependent manner. The presence and quantity of various phytochemical constituents of the extracts was also reported.

Reducing power scavenging assay

The reducing power scavenging assay method is based on the principle that

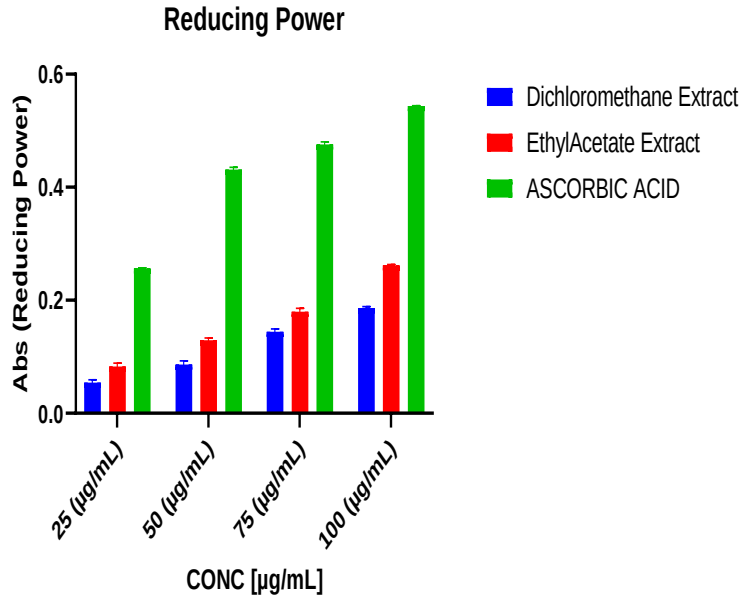

Figure 1 Reducing power radical scavenging activity of the DCM and ethylacetate extracts of *Sargasssum fucales*

substances, which have reduction potential, react with potassium ferricyanide (Fe^{3+}) to form potassium ferrocyanide (Fe^{2+}), which then reacts with ferric chloride to form ferric-ferrous complex with an absorption maximum at 700 nm (Figure 1).

DPPH radical scavenging activity

The assay is based on the measurement of scavenging capacity of antioxidants towards it. The odd electron of nitrogen atom in DPPH is reduced by receiving a hydrogen atom from antioxidants to the corresponding hydrazine (Figure 2 & Table 1).

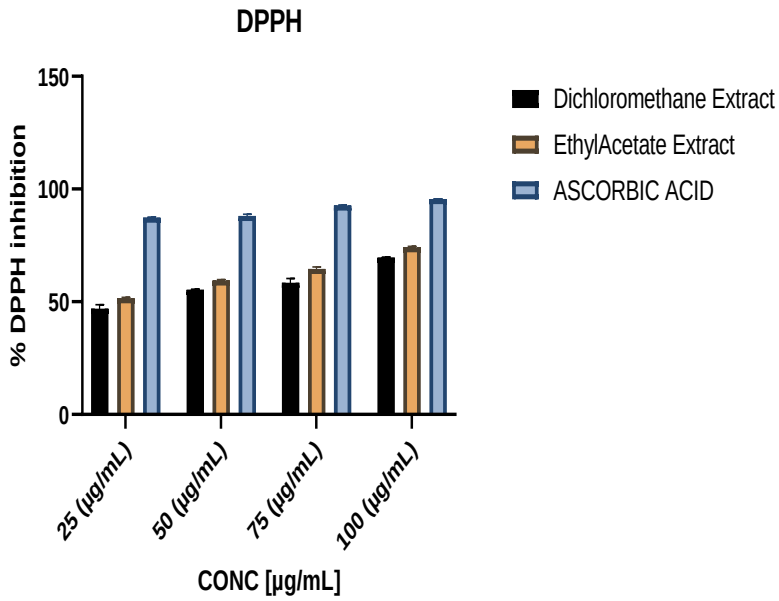

Figure 2 DPPH radical scavenging activity of the DCM and ethylacetate extracts of *Sargasssum flutans*

Table 1 DPPH screening analysis of *Sargassum flutans* extracts

Fraction	IC_{50} (%)
Ethylacetate	25.57 ± 4.016
Dichloromethane	29.31 ± 4.016
Ascorbic acid	13.56 ± 4.016

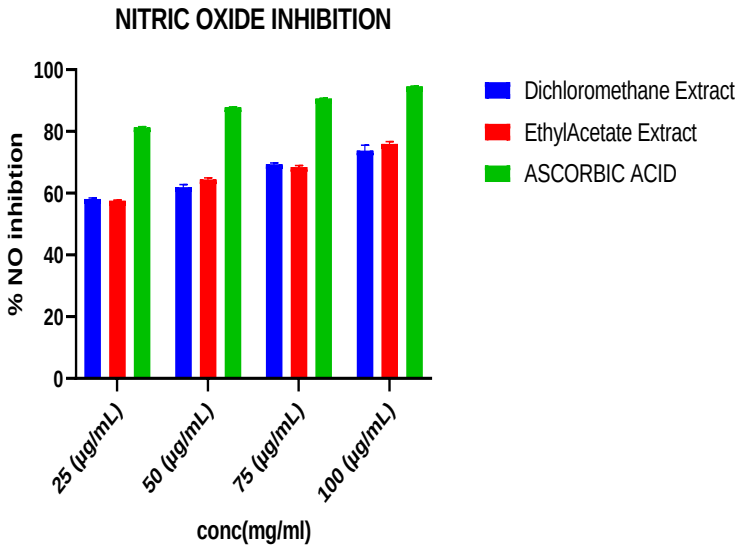

Figure 3 NO inhibition of the DCM and ethylacetate extracts of Sargasssum flutans

Table 2 NO screening analysis of *Sargassum flutans* extracts

Fraction	IC_{50} (%)
Ethylacetate	22.01±3.68
Dichloromethane	22.43 ±3.68
Ascorbic acid	14.53±3.68

Nitric oxide inhibition

In acid medium and in the presence of nitrite the formed nitrous acid diazotise sulphanilamide and the product are coupled with *N*-(1–naphthyl) ethylenediamine. The resulting azo dye has a bright reddish-purple color which can be measured at 540 nm (Figure 3 & Table 2).

Total antioxidant capacity

In the presence of antioxidants, copper (II) is reduced to copper (I). In turn, the copper (I) ions react with a chromogen to produce a color with the maximum absorbance at 490 nm (Figure 4).

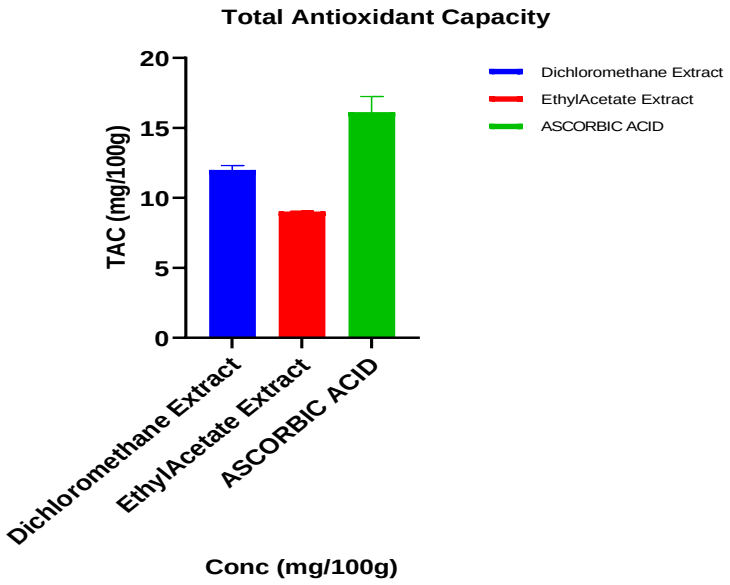

Figure 4 Total antioxidant capacity of the DCM and ethylacetate extracts of *Sargasssum flutans*

Quantitative phytochemical screening analysis of Sargassum flutans extracts with different solvent

Quantitative phytochemical screening analysis is used to determine the percentage of a particular element or ion in a sample. In a typical gravimetric analysis, the percentage of an ion of interest in a solid compound is determined (Table 3).

Qualitative phytochemical analysis

Qualitative phytochemical analysis confirms the presence of phyto-constituents like alkaloids, flavonoids, glycosides, phenols, lignins, saponins, sterols, tannins, anthraquinone, and reducing sugar by using coloring and/or the precipitations tests (Table 4).

Table 3 Quantitative phytochemical screening analysis of *Sargassum flutans* extracts

Solvent	Values (mL)						
Hexane	26.83	18.32	2.41	3.64	16.78	10.86	9.04
	24.66	16.83	2.64	3.69	17.14	10.62	8.67
DCM	16.82	11.48	0.00	3.76	0.00	0.00	14.18
	16.91	11.54	0.00	3.81	0.00	0.00	14.48
Aq. Methanol	45.44	31.02	0.00	4.81	0.00	0.00	12.71
	45.07	30.76	0.00	4.23	0.00	0.00	12.34
Ethylacetate	31.08	21.22	0.00	6.15	0.00	0.00	15.06
	31.56	21.54	0.00	5.99	0.00	0.00	14.48

Table 4 Qualitative phytochemical screening analysis of *Sargassum flutans* extracts

Samples	Hexane	DCM	Aq. Methanol	Ethyl acetate
Tannin	+	+	+	+
Phenol	+	+	+	+
Phlobatannin	+	+	+	+
Alkaloid	+	+	+	+
Saponin	+	-	-	-
Flavonoid	+	+	+	+
Steroid	_	+	+	+
Anthraquinone	+	+	+	+
Terpene	-	+	+	+
Cardio glycosides	+	-	-	-
Reducing sugar	+	-	-	-

Discussion

Phenolic molecules, which are employed as antioxidants, are abundant in plant tissues. Due to the presence of hydroxyl groups, which are crucial to their ability to scavenge free radicals, this antioxidant activity is beneficial and useful for treating specific disorders [19]. They can consequently interact with hydroxyl radicals and other active oxygen radicals. Some of the health advantages of fruits and vegetables can be attributed to flavonoids, which are polyphenolic substances with numerous phenolic groups [20]. They have been seen to actively take part in the removal of free radicals to stop damage or to actively assist in the dissipation of free radicals due to their redox abilities.

Sargassum flutans was evaluated for phytochemicals in the current investigation. These secondary metabolic products, which include alkaloids, flavonoides, saponins, tannins, and terpenoids and have a long history of usage in the pharmaceutical and medical industries, are abundant in this marine alga [21].

Alkaloids, protein and amino acid molecules, carbohydrates, flavonoids, phenols, terpenoids, tannins, saponins, and other phytochemicals are some of the most significant compounds present in this species and were positively detected during phytochemical testing [22]. Each phytochemical demonstrated promise for a certain biological effect; for instance, flavonoids contribute to antioxidant potential, alkaloids are significant for their antibacterial, analgesic, and other antispasmodic effects, and steroids have the capacity to cause inflammation. Plants are mentioned to contain pure phytochemicals used to make nutritional supplements and minerals as well as to cure a variety of illnesses [23]. Only the flavonoids, which are polyphenols and serve an essential role in antibiotic activity, are phytochemicals that exhibit unique medicinal activities that might boost the likelihood of discovery of new substances like antibiotics against pathogens. Flavonoids form complexes with bacterial proteins, cell wall, and other components that are responsible for biological activity. In addition, a variety of other substances, including terpenoids, tannins, steroids, and saponins, demonstrate the plants' capacity for antimicrobial (both bacterial and fungal) activity. [24]. Steroids cause the lipid-bilayer membrane to burst and release liposomes, and terpenoids are involved in the weakening of cell wall and tissue of the microorganisms [25].

The DPPH radical is a stable free radical with strong synthetic solid characterization that can be used to assess the antioxidant capacity of compounds or plant extracts. Accepting the electron or hydrogen will cause the DPPH to decrease. When a comparison of *Sargassum flutans* extracts from dichloromethane and ethyl acetate was made in relation to controls, it was discovered that the inhibition was comparable in both cases. When it came to scavenge hydrogen peroxide and DPPH, ascorbic acid outperformed *Sargassum flutans* extracts (Figure 2). In addition, the ABTS and the reducing power scavenging experiment revealed that *Sargassum flutans* extracts had less antioxidant activity than the control (Table 3).

Even though the control group exhibits a large increase in comparison to the two treated categories, the "dichloromethane" extract from *Sargassum flutans* exhibited only a minor increase in comparison to the ethyl acetate extract.

It has been effectively established that various algae species have the capacity to scavenge free radicals and so limit the development of cancer cells, similar the preliminary results of studies on seaweeds. They can defend themselves from the damage brought on by oxidative stress thanks to this capacity. Traditional Chinese medicine has used specific species of algae for the treatment of tumors [26]. Numerous studies are being conducted right now on the physiologically active compounds produced by marine algae. In this area, it is known that brown algae of the genus *Sargassum* (*Sargassaceae*, *Fucales*) possess uniquely structured secondary metabolites such plastoquinones, chromanols, and polysaccharides.

According to the findings of the current investigation, *Sargassum flutans* extract with the highest concentration of phenolic compounds could have a higher antioxidant activity [27]. An essential member of the Sargasseae family is *Sargassum flutans*. This family of algae's various members have shown cytotoxic, antibacterial, antiviral, antioxidant, and antitoxin activities. They appear to have properties that protect the liver showed to lower blood sugar in pharmacological investigations [28].

The biological benefits of the bulk of these crude isolates are substantial, particularly given their high flavonoid and phenolic content. According to Engwa (2018) [29], flavonoids are excellent and extremely effective free radical scavengers for the majority of oxidising substances, including singlet oxygen and other forms of free radicals. In the generation of free radicals, chelate elements are used specifically to scavenge reactive species, which promote while safeguarding antioxidant defenses (Engwa, 2018) [29]. Flavonoids prevent the development of reactive oxygen. Similarly, phenolic chemicals help plants tolerate oxidative stress. These basic plant extracts are made feasible by phenolic chemicals, which are prized for their antioxidant properties in the food and drug industries as well as for enhancing health. These basic extracts of plants include grains, herbaceous plants, fruits, greens, and several other plant-based resources [25]. It has been determined that their capacity for a stable DPPH is due to the presence of flavonoids, which have the capacity to act as antioxidants [30-31].

Conclusion

Sargassum flutans is found to have a wide range of beneficial antioxidant properties and almost all significant types of phytochemical constituents. The effects of various oxidative stressors may be stopped or reversed thanks to the antioxidant activity of derived fraction. The major phenolic compound, as well as

other bioactive compounds, should be isolated and purified for additional bioactivity tests mediated by free radicals; biochemical compounds with a higher likelihood of being used in medicine could result from the separation and identification of antioxidant components in plants. Further research and analysis are highly advised.

Conflict of Interest

The authors whose names appeared declared that they have no affiliations with or involvement with any organization or entity with any financial interest such as honoraria, educational grants, participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or any other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Consent for Publication

Not applicable.

Availability of Data and Materials

All supporting data are available on request.

Authors Contributions

Omiyale Olumakinde Charles: Conceptualization; literature review; writing; methodology design; validation; review; and editing and article.
Yussuf Mubaraq Damilare: Conceptualization; literature review; writing; methodology design; validation; review; and editing.
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