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Research Article

Phytochemical analysis of red alga *Champia parvula* (C. Agardh) collected from Mandapam coast of Tamil Nadu, India

Vinoth Kumar, R, Murugesan, S * and Bhuvaneswari, S

Unit of Algal Biotechnology and Bionano Technology, PG and Research Dept of Botany, Pachaiyappa's College, Chennai – 600 030.

***Correspondence Info:**
Murugesan, S
Unit of Algal Biotechnology and Bionano Technology, PG and Research Dept of Botany, Pachaiyappa's College, Chennai – 600 030.
Email: smurugesan5@gmail.com

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Abstract

The marine red alga *Champia parvula* showed the phytochemical constituents like sterols, glycosides, anthroquinones, phenols, alkaloids, triterpenoids, tannins, saponins, flavonoids, steroids. Flavonoid compounds have rutin, quercetin, kamferol and phenol compounds have gallic acid and cinnamic acid. Similarly, the fatty acids have palmitic acid, margaric acid, stearic acid, oleic acid, linolenic acid, alpha linolenic acid, moroctic acid were also present. Among the phytochemical contents the triterpenoids and glycosides are present in high. Among the seven fatty acid, stearic acid (6.03 ± 0.012%) and moroctic acid (5.58 ± 0.004%) were identified. The aim of the present study is to evaluate the phytochemical constituents of the marine red alga *Champia parvula*.

1. Introduction

The creature of nature possesses a magnificent primitive organism such as seaweeds or marine macroscopic algae which form an important component of marine vast living organisms. In several Asian countries seaweed consumption as vegetables in human diets has been a common practice [1]. They are well known as an excellent source of biologically active compounds. People who are living in coastal areas consume fresh and dry seaweeds [2]. Algae are very closely associated with the human health are being exhaustively used in numerous ways as a source of food, feed, fertilizer, medicine and chiefly for economically important phycocolloids [3,4]. The phytochemicals from marine algae are extensively used in various industries such as food, confectionery, textile, pharmaceutical, dairy and paper industry for mostly used as gelling, stabilizing and thickening agents [5]. The bioactive compounds isolated from seaweeds are used as medicine as well as food all over the world since 13,000 years [6]. Seaweeds are rich in antioxidant such as carotenoids, pigments, polyphenols, enzymes and diverse functional polysaccharide [7], Seaweeds have some of valuable medicinal compounds such as antibiotics [8] laxative, anticoagulants, [9]. Antiulcer products and suspending agents in radiological preparation [10]. Algae are the source of amino acids, terpenoids, phlorotannins, steroids, phenolic compounds, halogenated ketones and alkanes, cyclic polysulphides, fatty acids, acrylic acid [11,12] proteins, polysaccharides, vitamins, minerals and fibers [13,14]. Marine macroalgae are considered as an excellent source of bioactive compounds which has a broad range of biological activities including antibacterial [15-23], antiviral [24], antifungal [25], anticoagulant [26] antitumor [27] and anti-inflammatory activities [28]. Alginate, carrageenan and agar obtained from seaweeds have been used in medicine and pharmacy [29]. The presence of these secondary metabolites in seaweeds is highly evident of their pharmaceutical potential. Thus, the present investigation was carried to evaluate the phytochemical constituents of marine red alga *Champia parvula.*

2. Material and Methods

2.1 Sample collection and extraction methods

The marine red alga *Champia parvula* collected from the intertidal region of the Mandapam coastal water and immediately brought to the laboratory in plastic bags containing water to prevent evaporation. Then the sample was washed thoroughly with sea water to remove extraneous materials. Samples were dried at 37°C and ground in an electric mixer. The coarse powder was soaked in the methanol for 24 hrs after that the mixture was filtered by using filter paper to separate the extract. The extract was then concentrated and dried by a rotary evaporator. The quantitative phytochemical analyses of the sample were carried out by standard procedure.

2.2 Quantitative phytochemical analysis

The amount of phytochemicals present in the red alga *Champia parvula* extract was quantitatively determined by standard procedure.

2.3 Determination of total flavonoid compounds

This method is based on the formation of the flavonoids - aluminium complex, which has an absorptive maximum at 415 nm. The alga extract of 100 µL in methanol (10 mg/mL was mixed with 100 µL of 20 % aluminum trichloride in methanol and a drop of acetic acid, and then diluted with methanol to 5 mL. The absorption at 415 nm was read after 40 minutes. Blank samples were prepared from 100 mL of alga extract and a drop of acetic acid, and then diluted to 5 mL with methanol.

2.4 Determination of total phenolic compounds

The extract, 100 mg of the sample was weighed accurately and dissolved in 100 mL of double distilled Water (DDW). 1 mL of this solution was transferred to a test tube, then 0.5 mL 2N of the Folin-Ciocalteu reagent and 1.5 mL 20% of Na_2CO_3 solution was added and ultimately the volume was made up to 8 mL with (DDW) followed by vigorous shaking and finally allowed to stand for 2 hours after which the absorbance was taken at 765 nm [30].

2.5 Determination of Fatty acids compounds

The 100 mg of the extract of the sample was weighed accurately and dissolved in 100 mL of Double Distilled Water (DDW) 1 mL of this solution was transferred to a test tube, then 1 mL of ether solution was added and ultimately the volume was made up to 8 mL with (DDW) followed by vigorous shaking and finally allowed to stand for 2 hrs after which the absorbance was taken at 765 nm [31]. These data were used to estimate the total fatty acid content.

2.6 Statistical analysis

All the data for phytochemical analysis subjected to analysis of variance (ANOVA) using SPSS version (16.0). The results were expressed as mean ± standard error (SE).

3. Results and Discussion

There are many studies were reported on the presence of different phytochemical compounds of marine red algae collected from the coastal area [16,32]. The present investigation reveals that the red alga *Champia parvula* extract contained 20.17 mg of sterols, 35.33 mg of glycosides, 10.43 mg of anthroquinones, 25.50 mg of phenols, 12.56 mg of alkaloids, 55.33 mg of triterpenoids, 14.20 mg of tannins, 22.50 mg of saponins, 10.17 mg of flavonoids, 24.30 mg of steroids, and 5.45 mg of fatty acids. The flavonoid contents were 5 mg of rutin, 2.87 mg of quercetin, and 2.10 mg of kamferol and phenol contents were 3.40 mg of gallic acid and 2.02 mg of cinnamic acid and fatty acid content are 1.82 mg of palmitic acid, 2.07 mg of margaric acid, 6.03 mg of stearic acid, 1.16 mg of oleic acid, 3.86 mg of linolenic acid, 4.89 mg of alpha-linolenic acid, and 5.58 mg of moroctic acid. The extract showed different amount of phytochemicals. Similarly phytochemical analysis shows triterpenoids are rich than other phytochemicals. (Table 1). The composition of flavonoids (Table 2), phenols (Table 3) and fatty acids (Table 4) were rich in the red alga *Champia parvula* compared to other bioactive compounds.

Table 1: Quantitative analysis of phytochemicals composition (mg/g) in *Champia parvula*

S. No.	Phytochemicals (mg/g)	Mean ± S.E
1	Sterols	20.17 ± 0.01
2	Glycosides	35.33 ± 0.14
3	Anthroquinones	10.43 ± 0.00
4	Phenols	25.50 ± 0.11
5	Alkaloids	12.56 ± 0.17
6	Triterpenoids	55.33 ± 0.14
7	Tannins	14.20 ± 0.05
8	Saponins	22.50 ± 0.11
9	Flavonoids	10.17 ± 0.01
10	Steroids	24.30 ± 0.11
11	Fattyacids	05.45 ± 0.01
	F – Value	1498.0
	P- Value	0.000

Table 2: Quantitative analysis of Flavonoid composition (mg/g) in *Champia parvula*

S. No.	Flavonoid composition (mg/g)	Mean ± S.E
1	Rutin	5.00 ± 0.05
2	Quercetin	2.87 ± 0.06
3	Kamferol	2.10 ± 0.00
	F – Value	101.9
	P- Value	0.000

Table 3: Quantitative analysis of phenol composition (mg/g) in *Champia parvula*

S. No.	Phenol composition (mg/g)	Mean ± S.E
1	Gallic acid	3.40 ± 0.031
2	Cinnamic acid	2.02 ± 0.020
	F – Value	19.455
	P- Value	0.000

Table 4: Quantitative analysis of Fatty acid compositions (mg/g) in *Champia parvula*

S. No.	Fatty acids	Mean ± S.E
1	Palmitic acid	1.82 ± 0.064
2	Margaric acid	2.07 ± 0.014
3	Stearic acid	6.03 ± 0.012
4	Oleic acid	1.16 ± 0.017
5	Linolenic acid	3.86 ± 0.052
6	Alpha linolenic acid	4.89 ± 0.006
7	Moroctic acid	5.58 ± 0.004
	F- Value	3526.3
	P- Value	0.000

Flavonoids are proved to have antitumour and antioxidant properties [33]. Glycosides are known to lower the blood pressure [34]. In the present study the *Champia parvula* showed the presence of glycosides. Tannins bind to proline rich protein and interfere with the protein synthesis [35]. Tannin containing remedies are in use as antihelmintic [36], antioxidant [37], antimicrobial and antiviral [38] and for cancer treatment [39] terpenoids have antioxidant activity [40]. Alkaloids are commonly found to have antimicrobial [41-43], cytotoxic [44] and antiplasmodic properties [45,46]. Steroids isolated from marine algae have medicinal value [10,47] saponins have unique residue like 2, 3-dihydro-2, 5-dihydroxy-6-methyl-4H-pyran-4-one (DDMP), which allows saponins to scavenge superoxides by forming hydroperoxide intermediates which prevent bio-molecular damage [48].

The presence of different bioactive constituents in the methanolic extract of *Champia parvula* could contribute to different biological activities. The phenol compounds were reported to be responsible for the antioxidant activity in

Spyridia fusiformis and *Chondrococcus hornemanni* [49], The presence of glycosides, carbohydrates, tannins, alkaloids, steroids, terpenoids, phytosterols and saponins were recorded in marine alga [50] phenolic compounds are commonly found in plants, including seaweeds, and have been reported to have a wide range of biological activities including antioxidant properties [51]. Phytochemical screening of marine red alga *Champia parvula* is very important to identify new sources of therapeutically and industrially important compounds. It is important to initiate an urgent step for the screening of the red alga for secondary metabolites.

4. Conclusion

In conclusion, the results of this phytochemical investigation suggest that the marine red alga *Champia parvula* contains important phytochemicals like phenols, flavonoids and fatty acids, which may contribute to its biological activities. The pharmacological properties require further investigation of these active ingredients by implementing techniques of extraction, purification, separation, compound isolation and identification.

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