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Research Article

VITAMIN CONTENT OF MARINE RED ALGA *CHAMPIA PARVULA*

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ABSTRACT

Objective: The current investigation focuses on determining the vitamin content of marine red alga *Champia parvula*.

Methods: Vitamins were divided and analyzed using Milichrom A-02 LC and multiwavelength ultraviolet visible as a detector. A 2 mm (ID)×250 mm (l) column was used to filter comprising C18 in the inverse stage used for separation.

Results: The results suggest that the seaweed, *C. parvula,* contains 0.583±0.01, 3.43±0.01, 4.95±0.01, 1.95±0.01, 6.33±0.00, 174.74±0.01, and 15.75±0.01 µg of Vitamin A, B1, B5, folic acid, B12, C, and E, respectively, per gram of dry weight of the seaweed.

Conclusion: The findings indicate that the seaweed, *C. parvula*, has a higher nutritional value and could be used as great dietary supplements for vitamins.

Keywords: Marine algae, vitamins, *Champia parvula.*

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INTRODUCTION

Seaweeds are a precious source of food as they contain protein, lipids, vitamin, and minerals [1]. Seaweeds are not only a helpful food source for humans, whole crops and seaweed mixtures have been used in animal nutrition [2-4]. The dietary characteristics of seaweed are poorly understood and are usually assessed from the chemical composition [5]. A few reports has been published in the quantitative dietary composition studies in the Egyptian seaweeds [6-8]. Given their potential for use as food and fodder, there is an increasing need to evaluate the food quality of marine algae. The edibility value of algae is derived not only from the amount of nutrients supplied but also from the essential vitamins contained. Before identifying the vitamins, the significance of keeping a good diet was recognized. Vitamins are nutrients and each plays a part in creating and retaining a healthy, functional human being. Vitamins are vital for various chemical and physiological tasks in the human body. Seaweeds are naturally a higher supply of B complex (B1, B2, B3, B6, B9, and B12) [9]. Vitamins are very essential for all organisms as they present in the precursors as enzyme cofactors that are essential for metabolism. Seaweeds comprise both water-soluble vitamins (Vitamin B and Vitamin C) and fat-soluble vitamins (Vitamins A, D, E, and K) [10]. The objective of this research is to evaluate the vitamin content of the marine red alga *Champia parvula*.

METHODS

Collection and authentication

C. parvula (C. Agardh) was collected from Mandapam, Mannar Gulf, Mandapam Coast, Ramnad, Tamil Nadu. The morphological nature of the alga was referred to with the Rhodophyta monograph [11] and was authenticated by Dr. M. Baluswami, Retired Professor, Department of Botany, Madras Christian College, Chennai, Tamil Nadu, India.

Processing of collected sample

In addition to epiphytes, sand particles, and shells, the gathered seaweeds were washed with seawater to eliminate dirt and debris. Then, the seaweeds were cleaned with running tap water followed by distilled water and dried completely at room temperature under shade. The subsequent dried material was approximately powdered (passing through 40 size sieve) and used for further considerations.

Preparation of extract

The red seaweed extract *C. parvula* was obtained by adding methanol to the round bottom flask followed by the addition of 50 g of seaweed powder and was subject to Soxhlet apparatus for 72 h at 64°C. *C. parvula* extract (representing both reduced polar, polar, and non-polar elements) was pooled together and the solvents removed under condensed pressure using a rotary flash evaporator (Superfit, India). The crude extract has been quantified and used for further examination.

Reagents and apparatus

Vitamins were isolated using multiwavelength ultraviolet detection on a Milichrom A-02 fluid chromatograph (ZAO EcoNova, Novosibirsk, Russia). A 2 mm (ID) ×250 mm (l) column with the reversed-phase sorbent Nucleosil 100-5 C18 (Macherey-Nagel, Germany) was used. We used the gradient elution mode for water-soluble vitamins and the isocratic mode for fat-soluble vitamins (elution conditions are shown in the text below). The solution acidity was monitored with a precision of 0.2 pH using an Anion 7000 pH meter (ZAO Infraspak-Analit, Novosibirsk, Russia).

As vitamin reference, we used pure biotin (Vitamin H), nicotinic acid, nicotinamide, calcium pantothenate, pyridoxine hydrochloride (Vitamin B6), folic acid (Vitamin B9), riboflavin (Vitamin B2), thiamine hydrochloride (Vitamin B1), and cyanocobalamin (Vitamin B12) as well as pharmaceutical preparations, 30% solution of α-tocopherol acetate in oil (Vitamin E) and 3.44% solution of retinol acetate in oil (Vitamin A). We used 0.4 M lithium perchlorate aqueous solution with pH 2.4 (solution no. 1) and 0.1% butyl hydroxytoluene solution in methanol (solution no. 2). Stock solutions for calibration mixtures were prepared in the following solvents: Vitamins B1, B2, B6, B12, and nicotinic acid and calcium pantothenate in solution no. 1 with the addition of solution no. 2 with volume ratio 99:1; Vitamin H in solution no. 2; and Vitamin B9 in lithium perchlorate solution with pH 8 (solution no. 3).

The solution's pH was adjusted with lithium hydroxide. Acetates of Vitamin A and E have been dissolved in propanol. Stock solutions of water-soluble vitamins were filtered if necessary and mixed to prepare the calibration mixture with the following concentrations of vitamins (mg/cm^3): B1, 0.05; B2, 0.08; B6, 0.1; B12, 0.05; H, 0.1; nicotinic acid (or nicotinamide), 0.6; and calcium pantothenate, 0.6 (stock reference mixture). This combination was diluted with solution no. 1 to prepare calibration solutions with reduced vitamin levels. For Vitamin B9, calibration was performed separately starting from 0.02 mg/mL concentration and diluting this solution with solution no. 3. An analogous combination of fat-soluble vitamins was prepared in solution no. 2; Vitamin A and E levels were 0.2, 0.03, and 1.5 mg/mL, respectively. This combination was diluted with solution no. 2 to obtain reduced levels. For each vitamin, the smallest concentration was one-tenth of the greatest concentration.

Sample preparation

Samples for the determination of vitamins were drawn and prepared in accordance with regulations for pharmaceutical preparations and premixes [12]. Premixes and capsule contents were crushed in a porcelain mortar until a homogeneous mixture was acquired. For the determination of water-soluble vitamins, a mixture of solution no. 1 and solution no. 2 with the volume ratio 19:1 was added to a weighed portion of the triturated sample (0.1–0.2 g) and stirred in the dark at pH 5–5.5 and temperature 30–35°C for 10 min. When dissolution of the sample parts did not attain the required pH, it was modified to the necessary value with a lithium hydroxide solution. The pH of the sample was adapted to 2.4 after dissolution for 10 min at pH 5.5, and dissolution proceeded for 10 min more. Added amounts were taken into consideration when calculating vitamin levels. 5 mL of solution no. 2 was added in 0.05–0.1 g of the sample for the determination of fat-soluble vitamins, kept in the dark for 2 h in a tightly shut vessel and then stirred at room temperature for 20 min. Before injection into the column, samples were centrifuged and analyzed within 1 h.

Statistical analysis

All studies were conducted in triplicates and vitamin investigation information were subjected to variance assessment (ANOVA) using SPSS version (17.0). The results were presented as mean ± standard error.

RESULTS

C. parvula has been observed to contain Vitamin A, Vitamin B12, Vitamin B1, Vitamin B2, Vitamin C, Vitamin E, niacinamide, folic acid, and calcium pantothenate. It includes the most notable measure of Vitamin C (174.74±0.01 µg/g dry wt.) relative to the other vitamins and Vitamin A (0.583±0.01 µg/g dry wt.) was present in a lesser amount (Table 1). Based on the dry weight of the specimens, calcium pantothenate, folic acid, Vitamin B12 and Vitamin B2 were present in 4.95±0.01, 1.95±0.01, 6.33±0.00 and 6.16±0.01 µg/g, respectively.

Table 1: Vitamin content of *Champia parvula* (µg/g dry wt.)

S. No.	Vitamins	Mean±SE
1.	Vitamin A (Retinol)	0.583±0.01
2.	Vitamin B1 (Thiamine)	3.43±0.01
3.	Vitamin B2 (Riboflavin)	6.16±0.01
4.	Vitamin B3 (Niacinamide)	12.04±0.02
5.	Vitamin B5 (Calcium pantothenate)	4.95±0.01
6.	Vitamin B9 (Folic acid)	1.95±0.01
7.	Vitamin B12 (Cobalamin)	6.33±0.01
8.	Vitamin C (Ascorbic acid)	174.74±0.01
9.	Vitamin E (α-tocopherol)	15.75±0.01

Values are expressed as mean±SEM, n=3 as ANOVA test p<0.05% level.
SEM: Standard mean of the error

DISCUSSION

Vitamins are fundamental precursors for enzyme cofactors and are essential for various chemical and physiological activities in the human body. Marine algae include both water- and fat-soluble vitamins. These include Vitamins A, B, C and E. Many algae have vitamin auxotrophy, which is failed to synthesize an organic nutrient. The vitamin content of *C. parvula* in the current study was revealed to be a decent source of Vitamins A and E as well as Vitamin B6, Vitamin B12 and Vitamin C.

Vitamin A (Retinol) is needed by humans for the ordinary functioning of the visual system. The second primary role of Vitamin A is to protect the body's development and cellular epithelial integrity and immune function. Seaweeds are known to be a useful source of Vitamin A. Norziah and Ching [13] revealed *Gracilaria changii* Vitamin A activity. In the current study, *C. parvula* showed 0.583±0.01 µg/g dry wt. of Vitamin A.

Vitamin B1 (thiamine) is a water-soluble member of the Vitamin B complex. Its dynamic frame is a coenzyme called thiamine pyrophosphate, which is involved in changing pyruvate to acetyl coenzyme A during metabolism [14].

The content of Vitamin B1 in *C. parvula* was 3.43±0.01 µg/g dry wt. Seaweeds are generally an outstanding resource of constituents of Vitamin B such as B1, B2, and B12 [15]. The vitamin structure changes with numerous components including species, geographic zone, and seasonal and environmental parameters [16-19]. Consequently, *Padina tetrastromatica* recorded a greater quantity of Vitamin B1, which was greater than *C. parvula* [20].

Vitamin B5 (pantothenic acid)

Pantothenic acid content of *C. parvula* was 4.95±0.01 µg/g dry wt. Vitamin B5 is concerned with the oxidation of fatty acids and carbohydrates [21].

Vitamin B9 (folic acid)

Folic acid functions as a coenzyme in the form of tetrahydrofolate and is needed for ordinary cell division, particularly during pregnancy and infancy where quick development is essential. Folic acid also helps to produce red blood cells in erythropoiesis [22]. Vitamin B9 is chosen to treat the effects of aging, chronic fatigue syndrome, and anemia [18]. *C. parvula* includes 1.95±0.01 µg/g dry wt. folic acid. The marine algae *Undaria pinnatifida* include a greater quantity of folic acid than those found in the current examination [23,24].

Sea vegetables are also an immense supply of B-group vitamins (particularly B1 and B12). This could give one of the few vegetarian solutions to Vitamin B12 in the eating routine [15]. Higher plants do not require or combine cobalamin [25]. *Pyropia yezoensis* contains as much as 0.06 mg of Vitamin B12 (100 g)$^{-1}$ algal dry wt., almost identical to that observed in the liver of bovine animals [26]. Takenaka established that nourishing nori with Vitamin B12-deficient rats produced a 1.9-fold increase in hepatic levels of aggregate B12 compared to those without nori supplementation. In the present inquiry, the fullness of Vitamin B12 is irrefutable *C. parvula* (6.33±0.00 µg/g dry wt.).

It is a water-soluble vitamin and is a cofactor for enzymes connected with collagen biosynthesis; carnitine and neurotransmitters *in vitro* [27] and can suppress multiple kinds of reactive oxygen species in aqueous settings. The algae are a useful source of Vitamin C [20,28].

In the current examination, *C. parvula* showed plenty of Vitamin C (174.74±0.01 µg/g dry wt.). This contributes to the evidence that seaweeds can provide dietary intake in a balanced diet. This outcome showed that the experimental alga could be used as a complement to boost the immune system.

Vitamin E is a lipid-soluble vitamin called α-tocopherol, which plays a main role in cancer prevention and inhibition. Vitamin E has been examined for cancer such as colon cancer, pulmonary cancer, prostate cancer, and breast cancer [29]. The concentration of tocopherol in algae basically represents the equilibrium between the algae biosynthetic and accumulating ability for tocopherol and fundamentally represents the rate at which it is transformed into quinine, as it is referred to

mainly as an antioxidant to preserve the physiological lipid profile in membranes [30,31], and Panayotova and Stancheva (2013) reported Vitamin E content in *Cystoseria* [31]. The amount of Vitamin E in these marine algae was better than that enlisted in food known as wealthy α-tocopherol. In the current examination, *C. parvula* showed a Vitamin E content of 15.75±0.01 µg/g dry wt. Vitamin E is considered for antioxidant activity. Appearing to help counteract cardiovascular illnesses was α- and π-tocopherols.

CONCLUSION

Marine algae may be a natural source of vitamins. Seaweeds have an elevated amount of vitamins and are an outstanding source of vitamins. It is found that *C. parvula* is a good source of vitamins that can be used in the nutraceutical and pharmaceutical industries. The examination has consequences for where algae can obtain a vitamin that is vital to fuel marine life.

AUTHORS' CONTRIBUTIONS

All authors have contributed to the completion of this research work.

CONFLICTS OF INTEREST

Authors have none to declare.

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