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STUDIES ON PHARMACEUTICAL AND COMMERCIAL SIGNIFICANCE AMINO ACIDS FROM MARINE GREEN ALGAL SPECIES OF CAULERPACEAE

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ABSTRACT

Generally seaweeds are green, brown, and red marine algae, which are useful and essential natural resource for food and feed to human and animal welfare respectively. Thus, some of the representatives species of *Caulepa* from Chlorophyta were investigated the quality and quantity of industrially, commercially and pharmaceutical significance amino acids. In this present study, the five marine green algal species of *Caulerpa* were used for amino acids. The seaweeds are namely *Caulerpa chemnitzia, Caulerpa veravalensis, Caulerpa peltata, Caulerpa cupressoides* and *Caulerpa scalpelliformis.* These macroalgal seaweeds showed differentiation in quality and quantity of amino acids. The highest percentage of glutamic acid in *Caulerpa chemnitzia* (11.76%) and *Caulerpa scalpelliformis* (10.61%), Lysine in *Caulerpa peltata* (15.93%), *Caulerpa cupressoides* (14.98%) and *Caulerpa veravalensis* (11.44%) were recorded. Among the 20 amino acids, cysteine, glycine and proline were not detected in *Caulerpa cupressoides*, and serine was not found in *Caulerpa scalpelliformis*. The lowest percentage of methionine, tyrosine, valine and alanine were recorded in all the five species. Seaweeds are having minerals, vitamins, polyunsaturated fatty acids as well as phycocolloids, partial substitution of costly protein sources in animal feeds with seaweed protein may improve food and feed quality for human and animals respectively.

KEYWORDS: Kootapuli, Idinthakarai, Kuthankuli, Seaweeds, Amino acid, *Caulerpa*, Caulerpaceae.

INTRODUCTION

Marine macroalgae commonly referred to seaweeds are categorized by their pigmentation, morphology, anatomy, and nutritional composition as red (Rhodophyta), brown (Phaeophyta) and green seaweeds (Chlorophyta).[1] Seaweeds are valuable sources of protein, fiber, vitamins, polyunsaturated fatty acids and trace elements, as well as important bioactive compounds.[2] Seaweeds are generally macroscopic algae and are used in many ways. They are harvested for food, fodder, fertilizer, medicine and chiefly for economically important phycocolloids.[3] The nutritional property of seaweeds from some regions of the world and Indian coast has been well documented.[4-5] About 250 marine macro algal species have been commercially utilized worldwide and 150 species are favorably consumed, as human food.[6] Therefore, they have been known as being beneficial for human and animal welfare.[7] However, the nutrient compositions of seaweeds are different depending on species, habitats, maturity and environmental conditions.[8]

Generally, green and red seaweeds contain higher protein contents (10–30% dry weight) than brown seaweeds (5–15% dry weight). Proteins are composed of various amino acids and their nutritional quality can be evaluated against the recommended amino acid pattern.[9-10]

Red seaweed (*Gracilaria* species), green seaweed (*Enteromorpha, Caulerpa* and *Ulva* species) and brown seaweed (*Sargassum* species) have been abundant in the coastal region of south east coast of India. However, the utilization of seaweeds is still under-utilized because in India the knowledge about their nutritional composition is still limited. Therefore the present study aimed to determine essential biochemical amino acid contents of *Caulepa* species which were collected from Kootapuli [N 08°08’44.2’’E 077°36’02.5’’], Idinthakarai [N 08°10’32.3’’E 077°44’31.3’’] and Kuthankuli (N 08°12’49.0’’E 077°46’58.4’’), Tirunelveli district, Tamil Nadu, India in rainy and summer seasons in order to gain extensive information about their nutritional value. Climate and sea conditions may have fluctuations in nutrient composition of seaweeds.[11-12]

MATERIALS AND METHODS

Collection of seaweeds

The green seaweeds *Caulerpa chemnitzia, Caulerpa veravalensis, Caulerpa peltata, Caulerpa cupressoides* and *Caulerpa scalpelliformis* were collected from Kootapuli, Idinthakarai and Kuthankuli, Tirunelveli district, Tamil Nadu, India. Seaweed samples were picked by hand and then washed with seawater to remove the foreign particles, sand particles

and epiphytes. Then it was held in an ice box containing slush ice and instantly transported to the laboratory and washed thoroughly using tap water to remove the salt on the surface of the sample. Then the seaweeds were spread on blotting paper to remove excess water. Samples were dried in oven at 37°C, till constant weight and obtained and ground in an electric mixer.[13] The powdered samples were then stored in refrigerator.

Extraction of crude amino acids

The powdered samples of each specimen weighing 100 grams were transferred into 250ml of Erlenmeyer conical flasks containing 150 ml of 95% methanol for extraction for 5 days under dark condition in room temperature. The extraction was repeated at least thrice until the extracts were colourless. The extracts were combined and kept each extraction type separately were centrifuged at 12000 rpm for 10 minutes. The supernatants were concentrated using flash evaporator at 45^0C under reduced pressure. The concentrated extracts were stored at 0^0C till further study.[14]

Samples for detecting amino acids using HPLC

In a test tube, 1 mg crude amino acid extracts prepared from seaweeds and 1 ml of β-mercaptoethanol was added and mixed thoroughly, allowed to stand for 5 minutes at room temperature. Then 0.5 ml of ice cold methanol was added and mixed thoroughly using the vortex mixture for 5 minutes and allowed the tubes to stand for 15 minutes in an ice bucket. Then the mixture was centrifuged at 5000 rpm for 15 minutes and the supernatant was collected and immediately processed by HPLC analysis.[15] All determinations were performed in triplicate, and the data are shown in terms of mean ± standard deviation (SD).

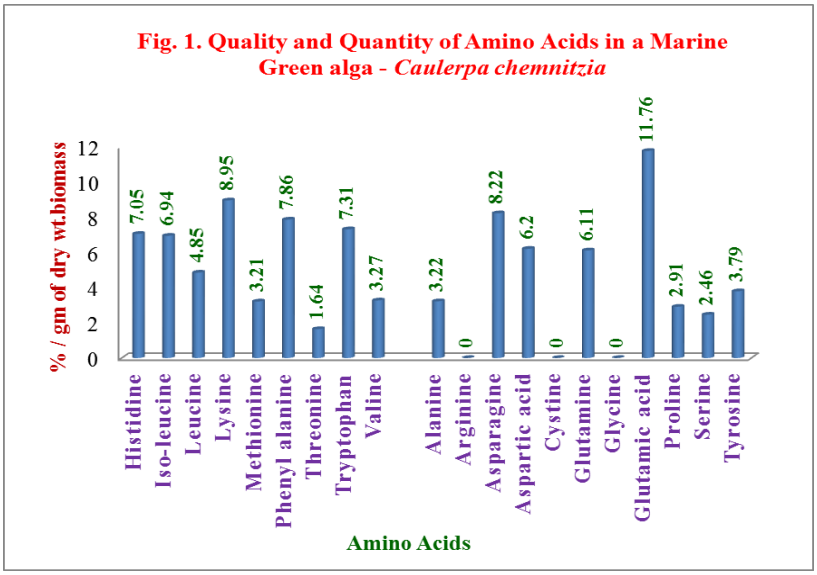
RESULTS AND DISCUSSION

Totally five seaweeds were collected from Thirunelvelli district, coastal regions, south east coast of India, and estimated their nutritive properties viz., amino acids. Proteins have crucial functions in all the biological processes such as enzymatic catalysis, transport, storage and mechanical sustentation control. Amino acids have been detected in the protein hydrolysate of the selected seaweeds. These amino acids may occur as combined or in a free state.[16-18] The distribution pattern of these amino acids reveals some pronounced differences among the species of *Caulerpa*.

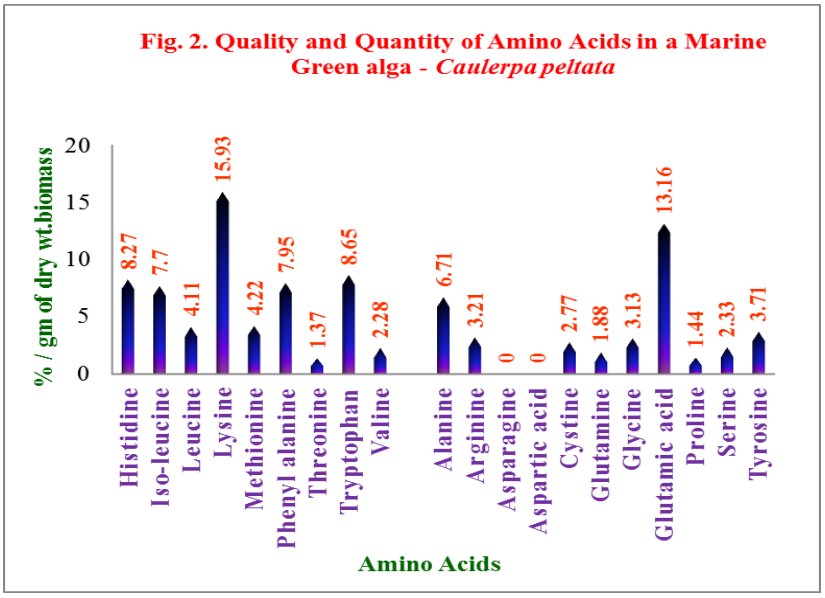
Lysine and tryptophan were the highest amount 15.93% in *Caulerpa peltata* and 13.68 % in *the C. scalpelliformis* respectively. Glutamic acid was higher amount 13.16%, 12.43%,

11.76% and 10.61% in *C.peltata*, *C. cupressoides*, *C. chemnitzia* and *C. scalpelliformis* respectively. *Caulerpa chemnitzia* has detected 18 amino acids from the analyzed 20 amino acids.

Nine essential amino acids were presented in *Caulerpa chemnitzia.* Among the nine essential amino acids lysine and methionine were 8.95% and 3.21% respectively. The remaining seven amino acids range from 3.27% to 7.86% / gram of dry weight of the algal biomass. Nonessential amino acids, eight have been detected from the analyzed 11 non-essential amino acids in *C. chemnitzia,* in which, glutamic acid has the highest 11.76% and serine has 2.46% as a lower content of amino acids and the remaining six amino acids such as asparagine, aspartic acid, glutamine, tyrosine, alanine and proline have 8.22%, 6.2%, 6.11%, 3.79%, 3.22% and 2.915% respectively [‘’Fig. 1’’].

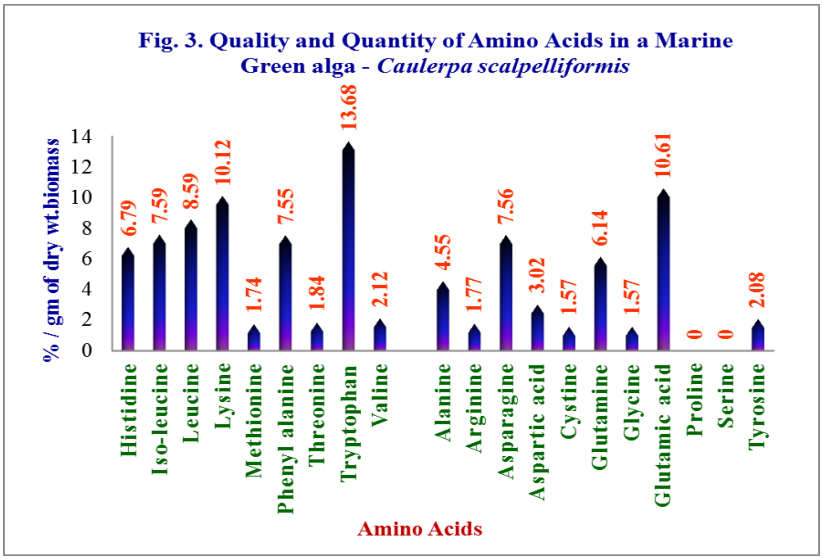


Caulerpa peltata has detected 18 amino acids from the analyzed 20 amino acids. *C. peltata* has nine essential amino acids in which, lysine has the highest amount of amino acid (15.93%) and the lowest (1.37%) in threonine, the remaining seven essential amino acids range from 2.28% to 8.65% / gram of dry weight of the algal biomass. Non-essential amino acids nine have been detected from the analyzed 11 non-essential amino acids in *C. peltata,* in which, glutamic acid has the highest 13.16% and proline has 1.44% as a lowest content of non-essential amino acids and the remaining seven non- essential amino acids such as alanine, tyrosine, arginine, glycine, cysteine, serine and glutamine have 6.71%, 3.71%, 3.21%, 3.13%, 2.77%, 2.33% and 1.88% respectively [‘’Fig. 2’’].

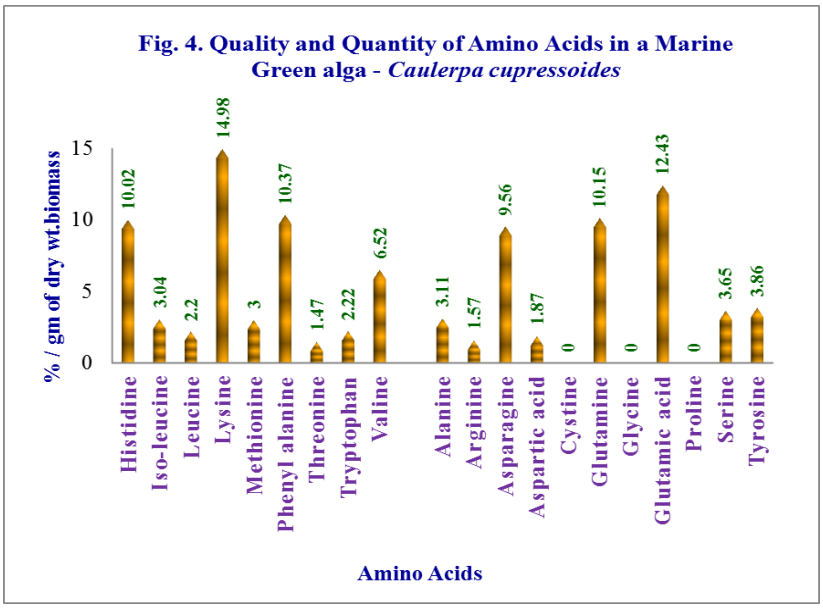


Caulerpa scalpelliformis has detected 18 amino acids from the analyzed 20 amino acids. *C. scalpelliformis* has nine essential amino acids in which, tryptophan has the highest amount of essential amino acid (13.68%) and the lowest (1.74%) in methionine, the remaining seven essential amino acids range from 10.12% to 1.84% / gram of dry weight of the algal biomass. Nine non-essential amino acids have been detected from the analyzed 11 non-essential amino acids in *C. scalpelliformis*, in which, glutamic acid has the highest 10.61% and cysteine and glycine have 1.57% as a lowest content of non-essential amino acids, and the remaining six non- essential amino acids such as asparagine, glutamine, alanine, aspartic acid, tyrosine, and arginine have 7.56%, 6.14%, 4.55%, 3.02%, 2.08% and 1.77% respectively [‘’Fig.3’’].

Caulerpa cupressoides has detected 17 amino acids from the analyzed 20 amino acids. *C. cupressoides* has nine essential amino acids in which, lysine has the highest amount of essential amino acid (14.98%) and the lowest (1.47%) in threonine, the remaining seven essential amino acids range from 2.2% to 10.37% / gram of dry weight of the algal biomass.

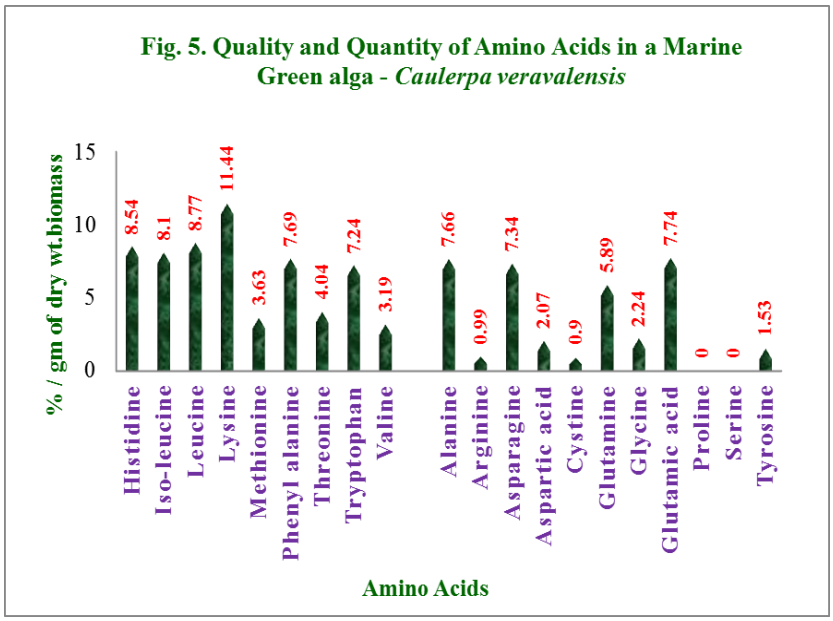


Eight non-essential amino acids have been detected from the analyzed 11 non-essential amino acids in *C. cupressoides*, in which, glutamic acid has the highest 12.43% and arginine has 1.57% as a lowest content of non-essential amino acids, and the remaining six non- essential amino acids such as glutamine, asparagine, tyrosine, serine, alanine and aspartic acid have 10.15%, 9.56%, 3.86%, 3.65%, 3.11% and 1.87% respectively [‘’Fig. 4’’].



Caulerpa veravalensis has detected 18 amino acids from the analyzed 20 amino acids. *C. veravalensis* has nine essential amino acids in which, lysine has the highest amount of essential amino acid (11.44%) and the lowest (3.19%) in valine, the remaining seven essential amino acids range from 3.63% to 8.77% / gram of dry weight of the algal biomass. Non-essential amino acids eight has been detected from the analyzed 11 in *C. veravalensis*, in

which, alanine has the highest 7.66% and cysteine has 0.99% as a lowest content of non-essential amino acids, and the remaining six non- essential amino acids such as glutamic acid, asparagine, glutamine, glycine, aspartic acid and tyrosine have 7.74%, 7.34%, 5.89%, 2.24%, 2.07% and 1.53% of non-essential amino acids respectively [''Fig.5'']. This is in agreement with the findings of higher protein content in species of Chlorophyta and the lowest in Phaeophyta.[19] Also observed maximum protein content in some of the green algal species was belonging to the genus of *Caulerpa.*



Seaweeds can be considered as promising plants of the future forming one of the important marine living resources of high nutritional value. Being plants with unique structure and biochemical composition, seaweeds could be exploited for their various properties in the form of food, energy, medicine and cosmetics and as biotechnological tools. The previous report of the amino acids quantity was dissimilar in a few species of a genus *Caulerpa.*[20]

CONCLUSION

This present study is an evident that marine macro green algal seaweeds like *Caulerpa chemnitzia, Caulerpa cupressoides, Caulerpa scalpelliformis, Caulerpa veravalensis* and *Caulerpa peltata* are rich in nutritive properties. The values obtained from amino acid contents are similar to the earlier findings [4]. The essential aminoacids lysine and tryptophan were the highest 15.93% in *Caulerpa peltata* and 13.68 % in *C. scalpelliformis* respectively. Non-essential amino acid glutamic acid was higher amount 13.16%, 12.43%, 11.76% and 10.61% in *C.peltata, C. cupressoides, C. chemnitzia* and *C. scalpelliformis* respectively. The

present findings will be commercially useful in food and feed production and in pharmaceutical industries for various drug production purposes. Lysine, cysteine, phenylalanine, arginine, iso-leucine, threonine, tryptophan and valine and seven non-essential amino acids were found to be present in all the five species of *Caulerpa*.

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