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Preliminary Studies on the Iodine Content of some Marine Algae from Coastal Areas of Jaffna Peninsula

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Abstract: The iodine content of twenty seven species of marine algae collected from different coastal regions of the Jaffna Peninsula was determined. Of the species analysed, *Gracilaria opuntia* (1277 ppm), *Gracilaria crassa* (889 ppm) and *Turbinaria ornata* (810 ppm) have relatively high iodine contents. The iodine content of *Gracilaria opuntia* is comparable with the amount of iodine present in caliche deposits (1500 ppm) in northern Chile which is the principal source of iodine.

1. Introduction

Iodine is considered[9] as one of the essential elements for the proper functioning of the hormones of human and animal thyroid glands. In many parts of the world simple goitre develops because of deficiency of iodine in water or food supply. An iodine deficient goitrous mother may give birth to a cretinous baby[9] because the foetus requires an adequate secretion of thyroxine during the later stages of pregnancy. Thyroxine is formed[9] by the reaction of tyrosine with iodine.

To prevent simple goitre a dietary iodine intake of 100 - 200 μg daily[9] is required. In places where manioc is used as a part of the diet the daily intake of iodine should be greater than the normal requirement. It is believed that cyanide in the manioc is converted to thiocyanate in the body which apparently displaces iodide from the reaction site. All iodine is converted to iodide in the gut.[9] Normally iodine is supplied from water.

In some places iodine content of water may not be enough to meet daily requirement of iodine. Seaweeds are good sources to meet dietary requirements of iodine. Goitre disease caused by iodine deficiency is less prevalent in countries where marine algae form a part of the diet.[1,7]

The iodine has wide and varied uses and is of high demand. Attempts are being made by various workers and companies to extract iodine from various natural sources. Caliche deposits in northern Chile are the principal sources for the production of iodine.[1] In Japan, Norway, France and Russia, iodine is extracted in small amounts from seaweeds.[6,8] Valuable data on the iodine content of marine algae occurring in different parts of the world are available.[3,5] But information on the iodine contents of the species of algae from Sri Lankan coastal area is not available. Therefore as an initial study, the amounts of iodine present in twenty seven species of green, brown and red algae collected from Jaffna coastal areas were estimated.

2. Experimental Methods and Materials

The localities and habitats of the algae studied are given in Table 1. The freshly collected seaweed samples were washed free from extraneous matter and air dried at room temperature under fans. The air dried samples (30 - 50 g), weighed accurately, were dried in an oven at 110°C to constant weight and the moisture contents determined. The oven dried samples were ground and the iodine contents were estimated by the alcoholic potash method[2] as follows:

Accurately weighed powdered samples (5 - 10 g) were refluxed with alcoholic potash (10%, 30 - 60 ml) for 24 hours, evaporated and ashed at 500°C. The water extract of the ash was acidified, oxidised with bromide and titrated with standard sodium-thiosulphate.

3. Results and Discussion

The results of analysis (carried out in triplicate) are given in Table 2. This table also gives the corresponding values for unwashed samples for a few species.

The above results show that of those species investigated, *Gracilaria opuntia*, *Gracilaria crassa* and *Turbinaria ornata* have reasonable amounts of iodine. To prevent simple goitre a dietary iodine intake of 100 - 200μ g daily is sufficient. Therefore a vegetarian can easily get the required amount of iodine from properly processed marine algae.

The most important natural source, caliche deposits, found in Northern Chile which exports iodine to all parts of the world contains 0.15% (1500 ppm) of iodine[1], *Gracilaria opuntia* has comparable amount of iodine (1277 ppm), *Gracilaria crassa* (889 ppm) and *Turbinaria ornata* (810 ppm) also have fairly large amounts of iodine. These three species would prove to be of commercial value.

Out of the three areas investigated marine algae from Mandaitivu coastal area have more iodine. It is significant that the sea water from this area has more iodine compared to the other two areas (Table 3). The iodine contents of *Ulva lactuca*, *Codium* species and *Sargassum* species are nearly the same as those reported[3] for the same species from the Gujarat coast of India (Table 4).

4. Conclusion

The amount of iodine present in certain species (e.g. *Gracilaria opuntia*, *Gracilaria crassa*, *Turbinaria ornata*) of marine algae from coastal areas in the Jaffna Peninsula is comparable with the most important natural source, caliche deposits. These seaweeds could be exploited for the commercial extraction of iodine. Several other species have reasonable amounts of iodine and these could be used in the manufacture of fortified cattle feed and for preparation of high iodine food items for human consumption.

TABLE 1. Localities and Habitats of the algae

Species	*Locality*	*Habitat*
1. Gracilaria opuntia	Mandaitivu	Muddy lagoons
2. Gracilaria edulis	Mandaitivu	Protected inshore lagoons
3. Gracilaria crassa	Mandaitivu	Lagoon, erect tree like
4. Gracilaria confervoides	Keerimalai	Calcareous reef
5. Laurencia obtusa	Mandaitivu	Lagoon, attached by small discs
6. Jania natalensis	Mandaitivu	Lagoon, attached
7. Hypnea musciformis	Mandaitivu	Protected inshore lagoon
8. Acanthophora delile	Mandaitivu	Lagoon
9. Centroceras clavulatum	Mandaitivu	Lagoon, attached
10. Gelidiella acerosa	Mandaitivu	Lagoon, erect prostrate
11. Padina pavonica	Mandaitivu	Lagoon, attached
12. Turbinaria ornata	Mandaitivu	Lagoon, attached
13. Pocockiella variegata	Nainativu	Inshore waters
14. Stoechospermum marginatum	Mandaitivu	Lagoon, attached
15. Cystophyllum muricatum	Mandaitivu	Lagoon, attached
16. Dictyota species	Mandaitivu	Lagoon, attached
17. Sargassum tenerrimum	Mandaitivu	Lagoon, attached
18. Sargassum polycystum	Mandaitivu	Lagoon, attached
19. Hormophysa triquetra	Mandaitivu	Lagoon, attached
20. Struvea anastamosans	Mandaitivu	Lagoon, attached
21. Codium species	Nainativu	Inshore waters, floating
22. Acetabularia crenulata	Casuarina	Protected inshore waters, attached.
23. Chaetomorpha species	Mandaitivu	Lagoon, floating
24. Ulva reticulata	Mandaitivu	Lagoon grows intermingled with other algae
25. Ulva lactuca	Mandaitivu	Lagoon
26. Valoniopsis pachynema	Mandaitivu	Lagoon
27. Thalasia hemprichi	Mandaitivu	Coral lagoon, rooted

TABLE 2. Iodine contents of Marine Algae

Algae	*Locality*	*Date of collection*	*Moisture in the air-dried algae (%) (washed)*	*Iodine (ppm) i.e. mg of iodine/kg air-dried algae*	
				Washed	*Unwashed*
a) Family: Rhodophyceae					
01. Gracilaria opuntia	Mandaitivu	10.12.1982	24.4	1277	
02. Gracilaria edulis	Mandaitivu	10.12.1982	3.7	318	
	Nainativu	01.01.1983	13.9	134	147
03. Gracilaria crassa	Mandaitivu	10.12.1982	13.3	889	
04. Gracilaria confervoides	Keerimalai	13.02.1983	10.1	no detectable amount	no detectable amount
05. Laurencia obtusa	Mandaitivu	10.12.1982	15.1	421	
06. Jania natalensis	Mandaitivu	10.12.1982	3.2	101	
07. Hypnea musciformis	Mandaitivu	10.12.1982	13.5	277	
08. Acanthophora delile	Mandaitivu	13.02.1983	15.9	115	
	Keerimalai	13.02.1983	10.0	110	78
09. Centroceras clavulatum	Mandaitivu	31.12.1982	16.7	249	351
	Keerimalai	13.02.1983	8.1	133	
10. Gelidiella acerosa	Mandaitivu	31.12.1982	14.1	524	401
b) Family: Phaeophyceae					
14. Padina pavonica	Mandaitivu	10.12.1982	11.1	196	
15. Turbinaria ornata	Mandaitivu	31.12.1982	19.4	810	
13. Pocockiella variegata	Nainativu	01.01.1983	13.4	533	
14. Stoechospermum marginatum	Mandaitivu	13.02.1983	13.1	58	56
15. Cystophyllum muricatum	Mandaitivu	13.02.1983	13.8	176	
16. Dictyota sp.	Mandaitivu	13.02.1983	7.1	10	
17. Sargassum tenerrimum	Mandaitivu	10.12.1982	16.0	205	
18. Sargassum polycystum	Mandaitivu	31.12.1982	17.1	180	253
19. Hormophysa triquetra	Mandaitivu	13.02.1983	13.3	62	62
c) Family: Chlorophyceae					
20. Struvea anastamosans	Mandaitivu	31.12.1982	12.2	437	
21. Codium sp.	Nainativu	01.01.1983	16.4	46	73
22. Acetabularia crenulata	Casuarina	13.02.1983	4.7	no detectable amount	no detectable amount
23. Chaetomorpha sp.	Nainativu	01.01.1983	17.3	44	80
	Keerimalai	13.02.1983	4.5	no detectable amount	no detectable amount
	Mandaitivu	10.12.1982	17.9	119	
24. Ulva reticulata	Mandaitivu	31.12.1982	20.6	259	
	Nainativu	01.01.1983	20.9	47	24
25. Ulva lactuca	Mandaitivu	10.12.1982	12.7	21	
	Casuarina	25.12.1982	16.4	101	
	Keerimalai	13.02.1983	14.8	no detectable amount	14
26. Valoniopsis pachynema	Mandaitivu	10.12.1982	2.8	30	
d) Angiosperm					
27. Thalasia hemprichi	Mandaivitu	10.12.1982	16.4	178	
	Nainativu	01.01.1983	9.2	54	26

TABLE 3. Iodine content in sea-water samples

Locality	*Date of collection*	*Iodine (mg/litre)*
Mandaitivu	10.12.1982	0.876
Mandaitivu	11.01.1983	0.738
Keerimalai	19.01.1983	0.067
Nainativu	23.01.1983	0.054

TABLE 4. Iodine contents reported[8] of some algae from the Gujarat coast of India

Species	*Iodine contents in ppm (mg/kg)*
Ulva lactuca	19.86
Ulva rigida (C.A. Agardh)	40.94
Codium dwarkense Boergesen	50.5
Sargassum cinereum (J.Agar)	206.1
Sargassum johnstonii setch and Gard	244.6
Gracilaria folifera	151.8
Myriogloea sciuru (Harv.) Kuck	1045.00

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