PROVITAMIN "A" IN SEAWEEDS OF LAKE REZAYEH.

F. Plattner (*)

The continuous increase of world population makes it imperative to look out for additional sources of food supply. Studies on the possible usefulness of various materials have thus been extended even to hitherto neglected or despised natural products like -- to mention a few only -- Chlorella, water fleas, seaweeds. A representative of this latter group happens to grow in such considerble quantities in the Lake of Rezayeh that it seemed worth while to investigate some of its nutritional potentialities.

This seaweed, the only aquatic metaphyte that has adapted itself to the extraordinary salinity of the lake, is Enteromorpha intestinalis, an algal organism belonging to the family of the Ulvaceae; for simplicity's sake it will be called "Ulva" on the following pages.

Ulva grows in dense flat colonies on stony or sandy ground in the littoral zone of the lake wherever the water is shallow. From elevated points the plants can be seen under water as a continuous dark green band some meters wide, parallel to the coast line. Towards the pelagic region of the lake their growth is limited at a depth of two meters approximately, not sufficient sunlight for chlorophylle formation penetrating into deeper waters. Strong waves of the surf tear lots of the plants off the ground whereafter they float in the upper layers of the water; drifting before the winds by and by they may be distributed over nearly the whole surface of the lake. Whenever there is a "fertil year", that is to say when the concentration of the water is relatively low during the warm season (around or even below 20 p.c. weight by weight) they may become so numerous that the whole lake looks like a vegetable soup. Tests made at random and computations on their base for the whole water body led to the result that up to 200.000 tons wet weight of Ulva may populate the lake in such years. In periods of high salinity (up to 28p. c., like in summer 1339) they do not abound, but even under such untoward conditions for life they are quite numerous at times.

Washed onto the beach by storms they will start to dry superficially, forming flat cakes not unlike drying cow dung, while their interior, still moist, will decay causing a good deal of the bad odour that can be sensed along some muddy parts of the coast.

The nutritional possibilities of the Ulvaceae in general have not been studied exhaustively thus far.

This mostly may be due to the fact that their use as a food, though they can be eaten after boiling and seasoning, is inferior to many other algae from the point of view of energy supply, and to many land-grown vegetables and fruits from the point of view of taste. Their calorific value certainly is not higher than that of the average of other more ubiquitous green vegetables. But as will be shown hereafter they catch up well with some of the plant products that are known to contain more than average quantities of the vitamin-A-precursor Carotene.

Samples of Ulva were taken in a bay of one of the uninhabitated islands of the Rezayeh Lake in the month of Tir 1339 (June 1960). At that time the salt concentration of the water already had risen to 25 p.c. weight by weight approximately. The plants were put into a plastic bottle that was filled up with lake water so that very little air only could come in contact with them. After transportation into the laboratory they were kept in the deep-freeze compartment of a refrigeratore (-10 to - 20 centigrades).

The quantitative determinations of provitamin A (carotene) were carried out in principle according to the Method of Official Agricultural Chemists on wet samples of Ulva that had been cautiously rinsed with an amount of distilled water just enough to get rid of most of the adhering salt brine; a thorough washing had to be avoided because the ulvaceans are loosing considerable quantities of their water soluble phycocyanin when treated with an abundance of distilled water. When all the water had been filtered off through a piece of cloth (not applying any additional pressure) the samples were weighed.

10 to 30 grms of the wet material were saponified on a boiling water bath by 75 ml of a saturated alcoholic KOH solution, refluxing for 20 to 30 minutes. After cooling the suspension was shaken with 100 ml petroleum benzin. The supernatant was decanted into a separatory funnel and the residue 5 more times re-extracted with 25 ml portions of petroleum benzin. The combined extracts were shaken with 100 ml distilled water, the thus separated KOH-alcohol-water solution was

*) Prof. of Physiology. Tabriz University

3 times extracted by 30 ml portions of petroleum benzin in respective separatory funnels. After combining all petroleum benzin extracts into one separatory funnel washings with distilled water were continued until the water gave no more coloration with phenolphthalein; this usually occurred after 3 washings. In order to get rid of the Xanthophyll, present in the petroleum benzin solution, repeated washings had to be performed with 90 p.c. methanol solutions; up to 13 portions of 25 ml each may be required until all yellow coloration disappears in the methanol. The remaining petroleum benzin extract containing the carotene then was washed twice with 50 ml water to remove the methanol, and afterwards filtered through a layer of anhydrous sodium sulfate to get rid of all water. Adjusted to a suitable volume by petroleum benzin the colour absorption was determined by the aid of a photoelectric colorimeter and compaird with that of a potassium bichromate solution (200 mg/1) whose colour, according to a standardizing experiment, was equivalent to 5.6 microgrammes beta-Carotene per 5 ml petroleum benzin extract.

The results of 5 extraction experiments showed concentrations between 1.7 and 3.8 milligrammes carotene per 100 gms wet weight of Ulva, the average being 2.7 mgrms/100; As is well known, beta-carotene has been adopted as the International Standard of vitamin A activity, one I.U. being the activity of 0.6 microgrammes of the pure cristalline compound. According to this the 2.7 mgrs/100 found in Enteromorpha intestinalis ("Ulva") would correspond to 4500 I.U. of vitamin A per 100 grms fresh plant. The procedure represented here does not, however, measure pure beta-carotene, but it measures "crude caroten", a mixture of carotenoids in which beta-carotene usually predominates. It has become common practice to assume that the yellow pigment in the petroleum benzin extract that absorbs light at 4200 angstroem, i.e. what we call "crude carotene", has a vitamin A activity of 1 I.U. per microgr. approximately in many plant foods. In adopting this way of calculating we would come to the reduced value of 2700 I.U. per 100 grs. ulva. On the other hand there can be no doubt some of the plant's vitamin A activity has been lost during the transportation of the specimens from the lake to the laboratory, so that it is a fair inference to estimate the vitamin A activity of ulva being 3000 I.U. per 100 grm. approximately.

The following table (extracted from the recent literature gives the vitamin A activities of some common vegetables and fruits in confrontation to our findings on Ulva:

100 gms fresh material contain vitamin A (I.U.):

Potatoes	40
Cauliflower	90
Cabbage	100
Cucumber	200
Garden Lettuce	540
Green Beans	700
Tomatoes	1100
U l v a	3000
Melon	3400
Spinage	6-10. 000
Carrottes	6-12. 000

As Ulve ranges in the group of plant foods with high vitamin A activity, near to melon, and as it is edible, it could be considered as a possible source of vitamin A, at least so in case of local emergencies.

Summary

Colorimetric estimation of Carotene in Enteromorpha intestinalis, a seaweed of the family of Ulvaceans abounding in the Lake of Rezayeh, has proved a vitamin activity of this plant corresponding to 3000 International Units of vitamin A approximately.

Résumé

Dosage de carotène dans Enteromorpha intestinalis, une plante de la famille des ulvacéens qui abonde dans le Lac de Rezayeh, a prouvé l'existence d'une activité vitaminique de cette plante correspondante à 3000 U. I. de vitamine A environ.

References.

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