

**HEALTH BENEFITS OF *SPIROGYRA*; A BIOCHEMICAL AND NUTRITIVE ASSAY**

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**ABSTRACT**

In India food scarcity and malnutrition is the major problem, which increases the death rate in an alarming rate. Alternative supplements of diet are important to overcome the food crisis all over the world. As *Spirogyra* is nutrient rich algae, it can be considered to be a better alternative to all other established food sources, which are rare in production and availability, at present. The nutritive assay of *Spirogyra* has shown its potentiality in providing all the required nutrients, especially carbohydrates and protein, thereby, experimentally proving and suggesting that, these algae can be used as a staple and nutrient rich food.

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**INTRODUCTION**

The World Bank estimates that India is one of the highest ranking countries in the world for the number of people suffering from malnutrition [The World bank 2009]. Deficiencies in nutrition inflict long term damage to both individuals and society. Nutrition deficient individuals are more likely to have infectious diseases such as pneumonia and tuberculosis [WHO 2012]. Here arises the concept that it is important to find alternative food sources to recover India from food crisis.

Scientific researches have proven that algal resources can be better adopted as food source in various ways. Algal aquaculture worldwide is estimated to be a \$5-6 US per year industry [Gary and Masao 2001]. Only a particular strain of algae is appropriate for this purpose. *Spirogyra* is a macroscopic filamentous alga that is rich in pigments, dietary proteins and minerals. Nutraceutical components are much higher in it. Thus, the species of *Spirogyra* is a potential health food in human diets and may be of use to the food industry as a source of ingredients with high nutritional value. *S. varians* can provide a dietary alternative due to its nutritional value and its commercial value can be enhanced by improving the quality and expanding the range of freshwater macro algae based products [Sawitree *etal* 2015]. The main objective of current work is to monitor the health benefits of the green algae, *Spirogyra*, and to suggest the use of this algal resource as an alternative food source, so as to overcome the current and future food insecurity.

**MATERIALS AND METHODS**

**Plant collection**

Fresh colonies of *Spirogyra* (Plate.1) has collected from a fresh water pond. Taxonomical identification of the algae was confirmed at the Department of Botany, Nirmala College for Women, Coimbatore, Tamil Nadu, India. The colonies are then gently washed with distilled water and spread on newspaper to remove the excess water. Then shade dried at room temperature. Dried materials were powdered with the aid of an electric blender. The powdered plant stored in an air tight container for further analysis.



**Morphology of *Spirogyra* colony**



**Microscopic view of *Spirogyra* filaments**

**Plate 1 External Morphology of *Spirogyra* Colony**

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**Biochemical analysis**

Biochemical analysis for the total carbohydrate, starch, protein and amino acids were carried out by following standard methods (Table 1) (Fig 1 and Fig 2). Determination of total carbohydrate was obtained by Anthrone method. Starch content was estimated by following Anthrone reagent test. Protein content has been tested by using Lowry’s method and then the total free amino acids were estimated by Ninhydrin reagent test [Sadasiyam and Manickam 2008]. The values of biochemical composition of *Spirogyra* were then compared with the RDA value (Table 2) (Fig 3).

**Nutritional assay**

Vitamin and Mineral content for 100 gm sample has been estimated and monitored.

**RESULTS**

**Biochemical composition**

Biochemical analysis has shown that *Spirogyra* is rich in essential macronutrients. Carbohydrates are important components of storage and structural materials in all organisms and *Spirogyra* exhibit a less amount of carbohydrate estimate, 0.5357 mg/100 gm of the sample. The main storage form of carbohydrate, ie, starch is also present in a higher proportion, 0.48159 mg/100 gm. These results have been proven that *Spirogyra* can be used as the staple food for both children as well as adults. Tests that have been conducted for protein and amino acid content shows that the sample contains a considerable range of protein (0.1811 mg/100 gm) and amino acids (0.0254 mg/100 gm).

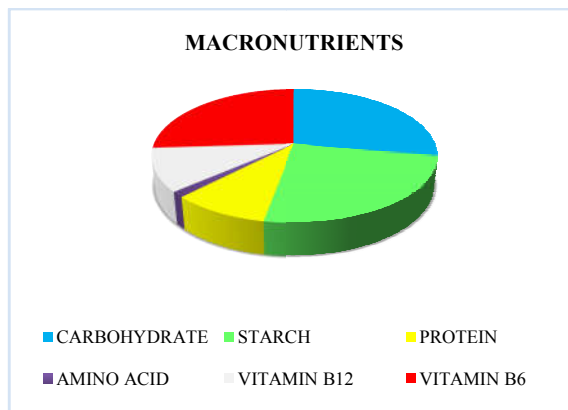
**Nutritional assay**

Analysis for vitamins shows that, dried algal powder contains two metabolically active forms of vitamins such as Vitamin B<sub>6</sub> and Vitamin B<sub>12</sub>. Vitamin B<sub>6</sub> is involved in many aspects of macronutrient metabolism, neurotransmitter synthesis, histamine synthesis, hemoglobin synthesis and gene expression [Combs and G F 2008]. *Spirogyra* contains 0.20 mg of Vitamin B<sub>6</sub> per 100 gm of sample. Vitamin B<sub>12</sub> is an especially important Vitamin for maintaining healthy nerve cells, and helps in the production of DNA and RNA and red blood cells [Yamada and Kazuhiro 2013]. The current study reveals that the sample contains about 0.50 mg of Vitamin B<sub>12</sub> per 100 gm of sample. These observations reveal the potentiality of *Spirogyra* as a better vitamin supply.

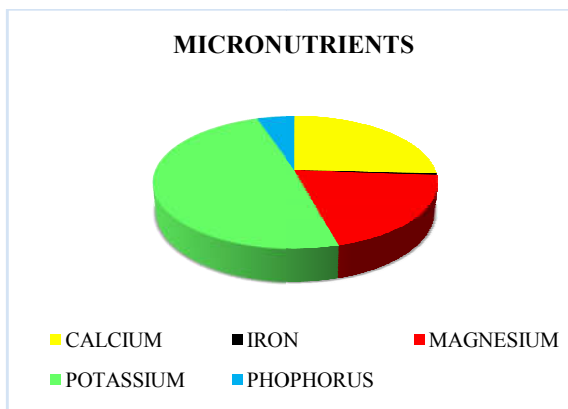
A vast range of mineral content has been found to be present in the sample. Potassium and Calcium were observed to be in a very higher amount, 1698 mg/100 gm and 890 mg/100 gm respectively. In a considerable amount, *Spirogyra* contains Magnesium (685 mg/100 gm) and Phosphorus (180 mg/100 gm). In a little concentration of 13.90 mg/100 gm Iron also present in the selected sample. All these nutrients are essential and play a vital role in human body metabolism. Calcium keeps the bones and teeth strong, phosphorus is essential for growth and repair of body cells and tissues, magnesium maintains normal nerve and muscle function, potassium is crucial to heart function and iron is essential element for blood production.

**Table 1** Biochemical Composition of *Spirogyra*

Sl.No.	Parameters	Concentration(mg/100g)
<b>Macronutrients</b>		
1	Carbohydrate	0.5357 mg
2	Starch	0.48159 mg
3	Protein	0.1811 mg
4	Amino Acid	0.0254 mg
<b>Micronutrients</b>		
5	Vitamin B12	0.20 mg
6	Vitamin B6	0.50 mg
<b>Minerals</b>		
7	Calcium	890.0 mg
8	Iron	13.90 mg
9	Magnesium	685.0 mg
10	Potassium	1698.0 mg
11	Phosphorus	180.0 mg



**Fig 1** Composition of Macronutrients



**Fig 2** Composition of Micronutrients

**Table 2** Comparison of Biochemical Values of *Spirogyra* With Rda Value

Sl. No.	PARAMETERS	OBSERVED VALUES	RDA VALUE)100gm/day
<b>MACRONUTRIENTS</b>			
1	CARBOHYDRATE	0.5357 mg	130 g
2	STARCH	0.48159 mg	5 g
3	PROTEIN	0.1811 mg	56 g
4	AMINO ACID	0.0254 mg	8.96 g
<b>MICRONUTRIENTS</b>			
5	VITAMIN B12	0.20 mg	1.3 mg
6	VITAMIN B <sub>6</sub>	0.50 mg	2.4 mg
7	CALCIUM	890.0 mg	1 mg
8	IRON	13.90 mg	8 mg
9	MAGNESIUM	685.0 mg	420 mg
10	POTASSIUM	1698.0 mg	4.7 mg
11	PHOSPHORUS	180.0 mg	700 mg

RDA (Recommended Dietary Allowance): Average daily level of intake sufficient to meet the nutrient requirements of nearly all (97%-98%) healthy people [National Institute of Health]. From Table 2 it is clear that even a 100 grams of dried mass of *Spirogyra* is rich in all the micronutrients than macronutrients. A small proportion of macronutrients are present suggest that the daily intake of this algae as an alternative supplement of conventional food sources. A considerable intake of these algal food sources can thereby impair a better change in the health condition, especially, of the children in the remote areas, affected by the malnutrition and health hazards. But large consumption per day become adverse as the high mineral intake may cause some adverse effects.

## CONCLUSION

Currently, a part of the world is suffering from food scarcity and the other part is dying by consuming highly contaminated artificial fast foods. Unfortunately both these groups are exhibiting the same problem- 'Malnutrition'. Algal food supplement is more appreciable as the resources are widely available and inexpensive. For the recent world scenario of malnutrition and health hazards it is important to commercialize the utilization of such widely available resources. Species of *Spirogyra* are rich in proteins, essential vitamins and minerals. They are receiving considerable attention for their use as a supplement to diet and as a nutraceutical. From the current study it is observed that *Spirogyra* is one of an economically important species of algae that contains a higher rate of vitamins, minerals and other macronutrients, thereby indicating the essentiality of these strains in the nutrient deficient society.

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