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Algal Health Supplement: A Panacea for Malnutrition

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Abstract

Spirulina- a cyanobacteria has been used from centuries by different populations and only rediscovered in recent years. Once classified as the blue green algae, it does not strictly speaking belong to the algae, even through for convenience it continues to be referred too in that way. It grows naturally in the alkaline waters of lakes in warm regions. Its impressive protein content and its rapid growth in entirely mineral environments have attracted the attention of both researcher and industrialists' alike. Spirulina may be called a super food because it contains remarkable concentration of nutrient known in any food, plant, grain or herb. It is composed of 60 percent highly digestible vegetable protein, has extremely high concentrations of beta carotene, vitamin B12, iron and trace minerals. It has a balanced spectrum of amino acids; several recent studies have demonstrated the immune enhancing and cancer preventive properties of spirulina. So study was conducted in Patna district on supplementation. The effect of cereal supplementation with spirulina has been estimated in rat because our human body never be an experimental body, so for lab testing we were utilizing animals for that rat is much more suitable. Ultimately by study it may be concluded that spirulina based algal supplement is beneficial for our malnourished population because rich in protein, iron & essential nutritients. So by incorporating innovation in approaches and application, to generate a better value through enrichment of traditional diet. An optimum mix of tradition with modernity through food fortification by Spirulina would be the key to achieve food security and bridge the health divide. This is the reason that in real sense discovery of spirulina is a potent food source for the future.

Keywords: Alga, Spirulina, Health benefits, Supplementation, Bio fortification, Nutritional Security.

Introduction

Malnutrition is a global problem and much bigger than hunger and imposes enormous costs on societies in terms of ill health, lives lost reduced economic productivity and poor quality of life. Therefore for overcoming malnutrition Spirulina is the best future food supplement. Spirulina is one of the foods that environmentalists say could show mankind the way out of the global food crisis. It can grow in brackish water and poor soil. Also it provides more nutrients per acre area than most conventional crops. In the future, bio fortification holds promise as a sustainable approach to improve micronutrient adequacy in the diets of entire households in developing countries.

Some research summarizes new developments in food –based approaches, their advantages and limitations and examines some of the efficacy studies and programmes utilizing food–based strategies to alleviate micronutrient deficiencies (Rosalind S Gibson2008).The poor quality of the habitual diet and the lack of dietary diversity in much of the developing world contribute to deficiencies of micro & macronutrients (Shetty Prakash 2009).

The aim of this paper is to give an overall view of the nutritional properties and health benefits of spirulina. By these properties it helps in eradication of hunger and malnutrition from our state or nation. This research definitely gives a different path for nutritional security by using Spirulina as future food supplements.

The Potential of Spirulina

Referring here a review on spirulina (2011), stated that "it appears today that spirulina shows a significant potential for fighting chronic malnutrition and for development. In a report on spirulina, the FAO(2008) made two recommendations in that regard, and which are fully referenced in the review. "International organization(s) working with spirulina should

consider preparing a practical guide to small-scale spirulina production. This small-scale production should be orientated towards: (i) providing nutritional supplements for widespread use in rural and urban communities where the staple diet is poor or inadequate; (ii) allowing diversification from traditional crops in cases where land or water resources are limited."

"There is a role for both national governments – as well as intergovernmental organizations – to re-evaluate the potential of spirulina to fulfil both their own food security needs as well as a tool for their overseas development" The first recommendation is widely followed today, since the international organizations working with spirulina continue their efforts for development and humanitarian promotion. In recent years, considerable progress has been achieved in this domain in many countries and on different aspects (technique, organization, education, operation, studies).

The United Nations World Health Organisation (WHO) found Spirulina to be an interesting food for multiple reasons, rich in protein, iron and essential nutrients; and able to be administered to children without any risk. Scientific studies have explored its uses to counter a wide array of pathologies successfully that range from night blindness to cancer; and the micro-algae has exhibited a significant potential to be a panacea in many cases such as in the victims of radiation sickness in Belarus or patients or Bitot's spot in Chennai.

Present forms of food aid by various agencies focus on fighting hunger rather than treating malnutrition especially in the context of the needs of young children that are most at risk. The access to food aid by people that suffer because of malnutrition is also limited because of the limited reach of the programmes. How shall the international bodies and national governments meet with their obligation towards the peoples of the world in the mis-match of processes and efficiency? The answer is, by incorporating innovation in approaches and application, to generate a better value through enrichment of traditional diet. An optimum mix of tradition with modernity through food fortification by Spirulina would be the key to achieve food security and bridge the health divide.

It is now absolutely imperative that these international organizations take a clear stance on the use of spirulina in the fight against malnutrition. Finally, there are many different ways to incorporate spirulina into food nowadays. In India, for instance, spirulina biscuits and sweets have been locally developed by Antenna Technologies and are particularly enjoyed by thousands of children (Heierli, 2007). The creation of new food products that incorporate spirulina certainly represents the best solution.

Nutritional attributes and health benefits of Spirulina

In many ways, spirulina may be called a super food. It contains the remarkable concentration of nutrients known in any food, plant, grain, or herb. It's composed of 60 percent highly digestible vegetable protein and has extremely high concentrations of beta carotene - Vitamin B-12, iron and trace minerals. It has a balanced spectrum of amino acids.

Several recent studies have demonstrated the immune enhancing and cancer preventive properties of spirulina. Scientists around the world have been confirming spirulina's cholesterol lowering benefits and its ability to lower blood pressure. Studies with men in Japan and India showed that several grams of spirulina daily can reduce serum Low Density Lipoprotein (LDL) and raise High Density Lipoprotein (HDL). Spirulina has a high protein concentration (60%-70% of it's a dry weight). It is useful in human nutrition, due to the high quality and quantity of its protein. Quality of protein is judged by a) NPU (Net Protein Utilization) and b) PER (Protein Efficiency Ratio).

NPU (Net Protein Utilization)

The utilization of ingested protein is determined by its digestibility, i.e. the proportion of protein nitrogen absorbed and by the amino acid composition (together with other factors, such as age, sex and the physiological status). The NPU value is determined experimentally by calculating the percentage of nitrogen retained (WHO 1973).

PER (Protein Efficiency Ration)-

This is the weight gain of an individual, divided by the weight of protein ingested. Measurements are usually made on growing rats. The PER value for spirulina determined in growing rats is estimated between 1.80 and 2.6. The sectrum of amino acids shows that the biological value of proteins in spirulina is very high, and that an optimum product could be achieved by supplementation with a good source of sulphur-containing amino acids and possibly also lysine and or histidine. For example cereals such as rice, wheat and millet or certain oilseeds such as sesame should be excellent supplements (Leonard- J & Compere-P (1967).

Vitamins, Minerals & Trace Elements

It has more than sufficient amount of vitamins, minerals and trace elements which are as shown by following Table 1and 2:-

Table-1 The vitamin content of spirulina and adult daily requirements (Jacques Falquet1998).

Vitamin	Content (mg/kg)	Daily requirements (mg) (adult 20-25 years)
B1	34-50	1.50
B2	30-46	1.80
B6	5-8	2.00
B12	1.5-2.0	0.003
Niacin	130.00	20.00
Folate	0.50	0.40
Pantothenate	4.6-25	6-10
Biotin	0.05	0.1-0.3
Vitamin C	Traces	15-30

Minerals and Trace Elements

Table-2 Typical analyses for dry Spirulina (Jourdan J.P.1996)

Minerals	Content in spirulina (mg/kg)	Required adult daily dose (mg/kg)
Calcium	1300-14,000	1200
Phosphorus	6700-9000	1000
Magnesium	2000-2900	1000
Iron	580-1800	18
Zinc	21-40	15
Copper	8-10	1.5-3
Chrome	2.8	0.5-2
Manganese	25-37	5
Sodium	4500	500
Potassium	6400-15400	3500

The minerals of particular interest in spirulina are Iron, Calcium, Phosphorus and Potassium. The very high iron content should be double stressed because iron deficiencies (anaemia) are very widespread, particularly in pregnant women and children and good sources in food are rare. As a comparison, whole cereals, which are ranked as one of the best sources of iron, contain only 150-250 mg/kg. In addition iron supplements given in the form of ferrous sulfate can pose a toxicity problem and often cause diarrhoea. Cereals meanwhile, are rich in phytic acids and phosphatic polymers, which sharply limits the bioavailability of the iron they contain. In the case of spirulina, iron bioavailability has been demonstrated both in rats and in humans.

By keeping above all qualities of spirulina in mind a study was conducted regarding cultivation and supplementation in Botany and Home science Univ. Dept. of Patna University, Patna under UGC major project..

Methodology

Firstly some strains of spirulina was selected and grown in shallow race way ponds. A method was developed properly cultivating a pure strain. A pure strain must be obtained so that the culture doesn't become contaminated by other types of microalgae that contain toxins or do not have the high nutritional content from biomass as spirulina.

Then after some spirulina were dried (either by oven-drying or by sun-drying) and powdered thoroughly. Fifty to seventy percent of the algae's dry weight comes from protein, which is significantly higher than other land plants.

Thus it was supplemented with cereals and fed to rats because, our human body never be an experimental body, so lab testing we were utilizing animals, for that rat is much more suitable.

Results & Discussion

The effect of cereal supplementation with Spirulina has been estimated in rats, which increases the Protein Efficiency Ratio (PER) of each & every cereal item and ultimately it affects our health. If practically will be used in day today life, definitely it affects the health status as well as nutritional status of we people.

A study was done under a project in Patna, during this a major nutritional gap between standard RDA & actual RDA was seen.

Table 3: Comparison of protein content of other foods with Spirulina (Henrikson 1994)

Sl. No.	Food Type	Crude Protein (%)
1.	Spirulina powder	65-70
2.	Whole Dried egg	47
3.	Skimmed powdered milk	37
4.	Whole soybean flour 36	36
5.	Peanuts 26	26
6.	Chicken	24
7.	Fish	22
8.	Beef meat	22
9.	Cereal flours	< 12
10.	Vegetables	< 5

Table 3 reveals that protein content of Spirulina is abnormally higher than the other foods & above all table shows its Vitamins & Minerals contents.

It means nature gives us nutritional power packs which are used in providing nutritional supplements for widespread in rural and urban communities where the staple diet is poor or inadequate. A small quantity of Spirulina, when mixed with traditional foods, tremendously increases its inherent nutritional value besides making the food easily digestible that can be readily assimilated by the human body. The potential of spirulina to fulfill both their own food security needs as well as a tool for their overseas development and emergency response efforts.

Conclusion

Micro algae Spirulina (Spirulina Platensis) has been a traditional food in many countries. A small quantity of Spirulina, when mixed with traditional foods, tremendously increases its inherent nutritional value besides making the food easily digestible that can be readily assimilated by the human body. Spirulina is being produced in over 22 countries and consumed in over 77 countries across the world.

WHO in 1992 declared "Spirulina is a high quality food product, rich in iron and protein, safe to consume and an excellent nutrient supplement for children". Over 200 scientific studies have demonstrated potential health benefits of Spirulina.

From above mentioned study it may be concluded that if mildly and significantly malnourished children were fed algal supplements then definitely their condition will improve, problem associated with malnutrition will overcome and ultimately nutritional security will come. Of course the nutritional value of Spirulina is said to be a recent discovery to the modern world, but in reality it a rediscovery of a future food resource.

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