Intergovernmental Institution for the use of Micro-algae Spirulina Against Malnutrition
Permanent Observer to the United Nations Economic and Social Council

IIMSAM US Senate-Congress

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Introduction

Each day around forty thousand children die because of malnutrition. Malnutrition is a medical emergency that contributes to at least 6 million deaths in children under five each year. Malnutrition disempowers and affects the life of around 854 million people in a drastic way.

Nations General Assembly Resolution 62/164 paragraph # 3
The right to food states:

>Considers it intolerable that more than 6 million children die every year from hunger-related illness before their fifth birthay, that there about 854 million undernourished people in the world<

The World Health Organization estimates there are 178 million children that are malnourished across the globe, and at any given moment, 20 million suffering from the most severe form.

What is severe acute malnutrition?
A life threatening condition requiring urgent treatment, characterised by severe wasting (emaciation) and/or the presence of nutritional oedema (an accumulation of fluids in the tissues, often giving a bloated appearance to the feet and face).

How is malnutrition identified?
Malnutrition is identified by a weight for height indicator within a given population, or by a measurement of a child's mid-upper arm circumference (MUAC), or by the presence of oedema. If dietary deficiencies are persistent, children will stop growing and become stunted (low height for one's age). This is referred to as chronic malnutrition. If they experience weight loss or 'wasting' (low weight for one's height), they are described as suffering from acute malnutrition.

According to the United Nations World Health Organisation (1996) the real challenge today is malnutrition- the deficiency of micro-nutrients (essential amino acids, minerals and vitamins) that no longer allows the body to ensure growth and maintain its vital functions.

Malnutrition severely diminishes the human capital of a country and its multifarious impacts hinder the universal achievement of the United Nations Millennium Development Goals. Developing countries are especially vulnerable to this easily avoidable catastrophe.

Intergovernmental Institution for the use of Micro-algae Spirulina Against Malnutrition (IIMSAM) strives to counter malnutrition globally through the use of micro-algae Spirulina- a cost effective natural resource abundant in essential proteins, minerals and vitamins. A small dose 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.

IIMSAM aspires to make Spirulina a key-driver to eradicate malnutrition, achieve food security and bridge the health divide.

IIMSAM

The Multilateral Treaties that constitute the Intergovernmental Institution for the use of Micro-algae Spirulina against Malnutrition, IIMSAM, are recognized in the UN Treaty Series 37542/43. IIMSAM was granted a Consultative Observer Status with the United Nations Economic and Social Council (ECOSOC), in keeping with Resolution number E/2003/212, dated 5th March 2003.

IIMSAM works to promote the use of Spirulina against acute malnutrition and to make Spirulina a key-driver to achieve global food security and bridge the health divide with special focus on the Developing and the Least Developed Countries.

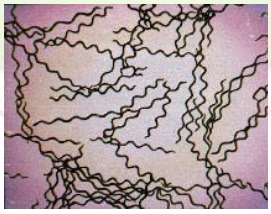
Italian Republic is the recognized host of the Treaties and Member States of Treaties that constitute IIMSAM include: ***Benin, Burundi, Cameroon, Democratic Republic of Congo, Equatorial Guinea, Gambia, Guinea, Madagascar, Sao Tome and Principe, and Somalia***, in accordance with the Article 102 of the Charter of the United Nations.

An increasing number of countries are supporting the mandate of IIMSAM and are most welcome to join our collaborative initiative to counter malnutrition through Spirulina.

Malnutrition Hotspots

The map shows the severe wasting estimates based on WHO standards for 36 countries identified by stunting prevalence 20% and covering 90% of 178 million globally estimated stunted children. Data from The Lancet Under nutrition series, article one, web table 4.

Spirulina



Spirulina Platensis is an edible micro algae that occurs naturally in tropical and subtropical lakes with high pH and high concentrations of carbonate and bicarbonate. The strands of Spirulina are free-floating filamentous cyanobacteria characterized by cylindrical, multicellular trichomes in an open left-hand helix.

An abundant source of nutrition viz. essential proteins, vitamins and minerals required by the human body; Spirulina had traditionally been used by the Kanem Empire in Chad, the Aztecs and other Mesoamericans civilizations. The modern scientific community started exploring the potential of Spirulina in the 1960s.

Spirulina cultivates where there is an availability of water and sun in plenty. Most cultivated Spirulina is produced in open-channel raceway ponds, with paddle-

wheels used to agitate the water. It is cultivated in closed photo-bioreactors in controlled environments in places that lack either water or sun.

Spirulina has competitive advantages in terms of cost of production when compared with other sources of protein. An average protein content of over 60 % along with other essential nutrients required by the healthy functioning of human body makes it a potent tool to deliver nutrition to the peoples of the world.

Along with nutritional and other benefits, Spirulina can be safely administered in crises situation where other substitutes fail as being micro-algae that lacks a cell wall; Spirulina can be easily assimilated in human body.

The United Nations World Food Conference in 1974 lauded Spirulina as possibly *the best food for the future*.

Today, Spirulina is produced in over 22 countries including the US that has the world's largest Spirulina farm Earthrise in Irvine, California; and is used in over 77 countries.

Advantages of Spirulina

- Spirulina does not need fertile land for cultivation and therefore conserves fertile land and soil. It has over 60 % protein that is higher than any other food besides benefits of rapid growth (20 days after the pond is inoculated by the Spirulina culture) and higher yield

- Spirulina requires less energy input per kilo than soy, corn, or bovine protein. As cheap energy sources are depleted, costs of energy dependent foods will rise up with energy prices

- Spirulina uses less water per kilo of protein than other foods as the water is recycled back to the ponds after harvesting

- Spirulina is a big oxygen producer that is even more efficient than trees and forests to absorb Carbon dioxide and release Oxygen

- Production of bio-fuel from Spirulina is so effective that it can reach up to 100,000 gallons of algae oil per acre, compared to about 30 gallons per acre from corn and 50 gallons from soybeans.

- Spirulina production uses non-fertile land and brackish water and is a potent remedy to deforestation to cultivate food. As people eat lower on the food chain, the pressures to destroy wilderness can be halted and help re-green our planet.

- No externalized hidden costs in terms of depletion of fresh water, fertile top soil and forests, pollution from pesticides, herbicides, and toxins. No long term medical costs from unhealthy foods with chemical additives.

Spirulina- a safe food

Spirulina has been declared safe for human consumption that can even be administered to children without any risks.

For UN WHO Spirulina represents a very interesting and suitable food for multiple reasons, rich in protein and iron; and is able to be administered to children without any risks. We at WHO consider it a very safe food.

-United Nations World Health Organisation, Geneva Switzerland June 8th, 1993

AARP Magazine, the world's highest circulation magazine produced by the American Association of Retired People rates Spirulina as '**No. 1 food that can add years to your life.**' Sep-Oct 2006 issue

*Spirulina has been proposed by both **NASA** and the **European Space Agency** as one of the primary foods to be cultivated during long-term space missions. It is an excellent, compact space food for astronauts (1 kg. of Spirulina is equivalent to 1000 kgs. of assorted vegetables).*

The **US National Aeronautics and Space Administration (NASA)** considered Spirulina platensis as edible algae for Space craft crew in a Closed Ecological Life Support System, CELSS, and (pub. 1st October 1988)

It also explored the nutritional quality of Spirulina that could be manipulated by growth conditions esp. protein content up to 70%. These results support the feasibility of considering Spirulina as a subsystem in CELSS because of the ease with which its nutrient content can be manipulated. (Pub. 1st March 1990)

The oxygen production by Spirulina culture was also explored (pub. 1st August 1993)

Spirulina produced by the corporations in the US meets the **US Food and Drug Administration (FDA)** approval.

Scientific Studies on Spirulina

The strongest evidence comes from well designed and controlled clinical trials, which are one type of human research study.

Belarus- 5 gms of Spirulina when given to children for 20 days reduced urine radioactivity by 50 %. (1993)

Used amongst children and adolescents affected by Chernobyl catastrophe to detoxify and strengthen the immune system (1999)

Burkina Faso- Nutritional rehabilitation of HIV-infected and HIV- negative undernourished children through utilising 10 gm of Spirulina for 3 months by IIMSAM's Expert Facilitator from Italy, Dr. Salvatore Musumeci (2005)

China- 1.5 gm of Spirulina used to fortify food for children 2 to 6 years old recovered them from bad appetite, night sweats, diarrhoea and constipation. (1987)

Spirulina found to be more effective than zinc sulphate tablets to cure zinc deficiency in children when given for a period of 3 months (1994)

Democratic Republic of Congo- Spirulina showed effectiveness to counter protein energy malnutrition (PEM) amongst children in a tropical environment (1990)

Germany- Spirulina showed positive effects in clinical and bio-chemical evaluations in the treatment of obesity (1986)

India- In the first human study evaluating the chemo-preventive potential of Spirulina, 1 gm Spirulina when given for 12 months showed significant regression of lesions in the cases of oral carcinogenesis. (1995)

Spirulina is an excellent source of Vitamin A to increase serum retinol levels amongst preschool children as it has higher beta carotene than any other plant source (1991)

Under a project sponsored by the government of India, 1 gm of Spirulina when consumed for at least 150 days by rural preschool children significantly decreased the instances of 'Bitot's Spot' (1993)

Japan- In the cases of hypo-chronic anaemia when 4 gm of Spirulina was consumed for 30 days by women patients under clinical administration, led to a significant increase in the levels of haemoglobin (1978)

In Tokai University, 4.2 gm of Spirulina when consumed for 8 weeks by men resulted in lowering of cholesterol including serum cholesterol, triglycerides and LDL levels (1988)

Macedonia- Institute for Medical, Experimental and Applied Physiology, Faculty of Medicine, Skopje used Spirulina for 2 months to correct the changes in blood composition of athletes both men and women aged 18-22 years old, after excessive training especially erythrocytes and the level of haemoglobin.

The clinical symptoms such as exhaustion, muscle fatigue and somnolence disappeared after the correction of the iron deficit. Addition of Spirulina improves the prevention of non-anaemic iron deficiency in athletes especially females. Improvement of the iron reserves is a simple dietary modification that can optimize athlete's health and physical capacity. (1998)

Romania- Spirulina was used as an adjuvant nutritive factor in treating nutritional deficiencies such as weight loss in conjunction with gastric resection, tubercular infection, chronic pancreatitis and gastritis, rheumatoid arthritis, anaemia and diabetes mellitus. With Spirulina the patients gained weight and their protein grams improved. (1984)

Russia- 5 gm of Spirulina within 6 weeks of consumption by children living in highly radioactive areas normalised the levels of immunoglobin E (IgE) leading to reduction in allergies. (1994)

Food Fortification Against Malnutrition

Malnutrition is defined as the deficiency of micronutrients, including vitamins, minerals and essential amino acids, which no longer allow the body to ensure growth and maintain its vital functions.

The recent food price crisis has aggravated the chronic crisis of child malnutrition. Malnutrition accounts for 11% of the global burden of disease yet this is a crisis that the international community has neglected.

If a child is malnourished within the first two years of its life, the child can suffer lifelong physical and mental impairment. A person suffering from malnutrition is at a much greater risk of death due to occurrences such as pneumonia, diarrhoea, malaria, measles, complications in birth, and infection.

The Lancet Malnutrition Series article 5 states: "Annual funding for basic nutrition programming amounts to at most $US 250-300 million per year. Even if this amount were perfectly targeted to the children under two living in the 20 countries that account for 80% of stunting, this would amount to $2 per child

whereas effective large scale community nutrition programs are estimated to cost $5-10/child." This costing does not even include the provision of food. No community education-based nutrition programs have been shown to be effective in food insecure regions.

In the 2006 publication "**Ending Child Hunger and Malnutrition Initiative**", WFP and UNICEF estimate the cost of effectively addressing malnutrition at US$ 80/family, or US$ 8 billion for 100 million families. This estimate includes not only health promotion interventions such as clean water and breastfeeding, but also supplementary and therapeutic feeding.

Malnutrition is an issue of food quality as much as quantity. Rapidly growing children have specific nutritional needs and thus specific nutritional and food aid interventions are needed. In terms of food aid, more of the same will not be enough. It is important that both food aid and nutrition programming include interventions that assure the nutrient security of young children in order to avoid malnutrition in the first place.

Earlier intervention such as through Soya flour failed as it is an inappropriate food for young children. It contains poor quality protein and far too many anti-nutrient factors that inhibit absorption of essential minerals such as zinc. This is a deadly double standard driven by minimum cost rather than the imperative to meet minimum nutritional standards.

Therefore, it is imperative that food fortification through Spirulina be included in the global food security agenda at the earliest to deliver to the peoples of the world adequate nutrition required by the human body.
A little Spirulina when added to traditional diets not only encounters malnutrition effectively and efficiently; but also initiates a multi-tiered empowerment process that leads towards building of lasting capacities and capabilities.

Spirulina is an ideal medium for food fortification to eradicate malnutrition because

- **Holistic Nutrition as a Food Supplement**
- **Cost Effective**
- **Easily assimilated in Human Body**
- **Safely administered to Children**
- **Environment Friendly**

- **Easy to Transport**
- **Long Shelf Life**
- **Ideal Empowerment Tool for Developing Countries**

The UN Millennium Development Goals

Spirulina by countering and eradicating malnutrition plays a significant role in the achievement of the United Nations Millennium Development Goals.

United Nations Millennium Development Goals

Goal 1: Eradicate extreme poverty and hunger Malnutrition erodes human capital, reduces resilience to shocks and reduces productivity (impaired physical and mental capacity).

Goal 2: Achieve universal primary education Malnutrition reduces mental capacity and school performance. Malnourished children are less likely to enrol in school, and more likely to enrol later.

Goal 3: Promote gender equality and empower women Better nourished girls are more likely to stay in school and to have more control over future choices.

Goal 4: Reduce child mortality Malnutrition is directly or indirectly associated with more than half of all child mortality.

Goal 5: Improve maternal health Malnutrition, in particular iron deficiency and vitamin A deficiency, increases the risk of maternal mortality.

Goal 6: Combat HIV/AIDS, TB, malaria, and other diseases Malnutrition hastens the onset of AIDS among HIV positive people, and generally increases susceptibility to infectious diseases.

Goal 7: Ensure environment sustainability Spirulina is much more efficient than forests to absorb carbon dioxide and release oxygen therefore playing a significant role in the CCS (Carbon Capture and Storage)

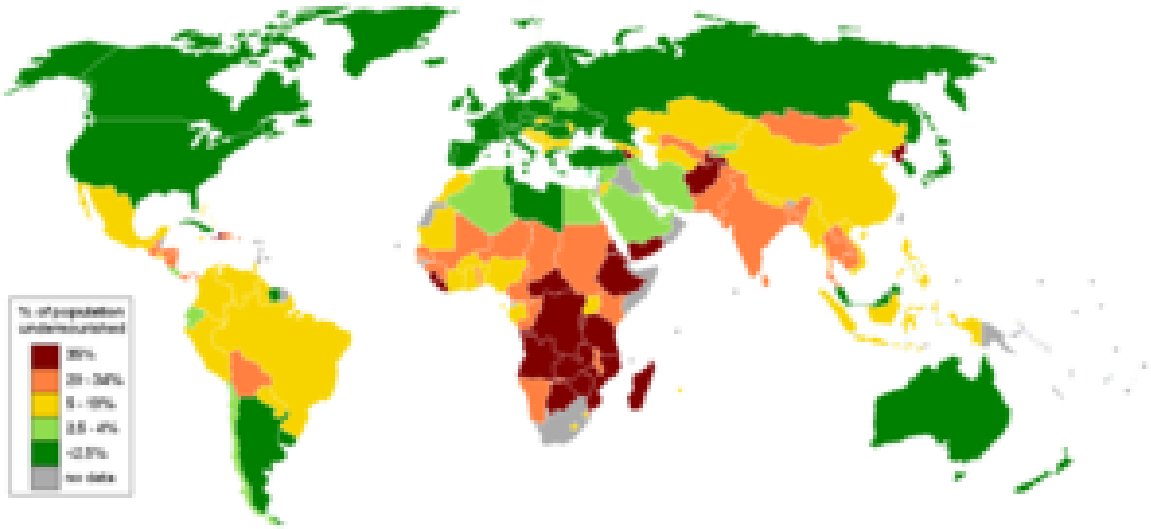
Goal 8: Global Partnership for Development

Conclusion

To fulfil its mandate to realise a world free of hunger and malnutrition, Intergovernmental Institution for the use of Micro-algae, IIMSAM, firmly believes in a global partnership for development with various stakeholders to make Spirulina a key-driver to eradicate malnutrition, achieve food security and bridge the health divide.

Food fortification through Spirulina is a potent medium not only to eradicate malnutrition and save precious lives but also towards enriching human capital, build capacities and capabilities along with the achievement of the United Nations Millennium Development Goals especially in the context of the Developing and the Least Developed Countries.

Appendix 1



Percentage of population affected by malnutrition by country
Source –United Nations FAO

Appendix 2

Nutritional Profile of Spirulina

Protein	**about 60% (51 to 71)**
Carbohydrate	**about 14%**
Lipids	**about 6%**

Amino Acids (essentials)	Spirulina grams	Egg Protein per 100 grams of	FAO Standard proteins
Isoleucine	**6.4**	**5.8**	**4.0**
Leucine	**10.4**	**9.0 <**	**7.0**
Lysine	**4.5**	**6.7**	**5.5**
Methionine	**2.2**	**3.0**	**5.5***
Phenylalanine	**5.4**	**5.3**	**6.0**
Threonine	**5.4**	**5.3**	**4.0**
Tryptophane	**1.5**	**1.8**	**1.0**
Valine	**7.5**	**7.2**	**5.0**

* includes cystine

Table from Busson, F., Spirulina Platensis (Gom) Geitler et. Spirulina geitleri, J.Dr Toni, Cynophycées Alimentaires, Armée Française, Service de Santé, Parc de Pharo, Marseill,1971.

Carbohydrates	Per 100 grams
Ramnose	**9.0**
Glucane	**1.5**
Phosphorolated Cyclitols	**2.5**
Glucosamine Muramic acid	**2.0**
Glycogen	**0.5**
Scialic acid and others	**0.5**

Lipids (Principal Ones)	mg/Kg
Palmitic acid (saturated fatty acid)	16-,500 to 21,141
Linoleic acid (unsaturated FA)	10,920 to 13,784
Gamma linoleic acid (omega 6)	8,750 to 11,970
Alpha linolenic acid (omega 3)	699 to 7,000
Chlorophyll-a	6,100 to 7,600
Beta sitosterol	30 to 97
Beta carotene	average 1,700

Vitamins	mg/Kg
Biotin	0.4
Cyanocobalmin (B12)	0.45 (analogs not included)
Delta-calcium Panthothenate	11.0
Folic acid	0.5
Inositol	350
Nicotinic acid (PP)	118
Pyridoxine (B6)	3
Riboflavine (B2)	40
Thiamin (B1)	55
Tocopherol (E)	190
Ascorbic acid (C)	90

Carbohydrates, Lipids, and Vitamins; Source- SOSA TEXCOCO, Mexico