

**CHLORELLA – THE MOST
EXCITING NUTRITIONAL
DISCOVERY ON PLANET EARTH**

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Preface

I have carried out research on several plant extracts as part of my work in Ph.D dissertation, and also advocated on the benefits of consuming plenty of greens in diet in several talks that I have delivered in the past. I am also an ardent fan of magazines and books on nutrition and health, and the wonders of nature to mankind. Since I came across this miraculous plant, Chlorella, my interest and enthusiasm on this organism increased tremendously, and I was in constant search on a safe and effective manner in which I could obtain the benefits of Chlorella. Finally, I came to know about heterotrophic tank cultivated Chlorella manufactured by Nihon Chlorella Co. Ltd. and gathered more information on this organism, and also the health benefits provided by it. Eventually, I started consuming Chlorella, and found several improvements in my well-being and felt more energetic. I use Chlorella as my source of phytochemicals, minerals and vitamins, and I strongly believe and recommend the consumption of this product to friends, family members and anyone who wants to get healthier. I don't have any affiliate relationships with any of the suppliers, thus, the information provided is entirely unbiased. I hope that this write-up will serve as a complete guide and useful source of information to all individuals out there who would like to try and benefit from this miraculous gift of nature.

Introduction

In or near the bodies of water on our planet, there are 25,000 species of algae which are elementary plants without roots, stems, branches and leaves. Algae usually contain chlorophyll and green algae are the simplest green living organisms. Chlorella is a unique single-celled fresh water micro alga with grass-like odor. Its characteristic emerald-green colour and pleasant grass odor is due to its high content of chlorophyll, in fact the highest compared to any known plant. The name “chlorella” was derived from the Latin words ‘chlor’ for green and ‘ella’ for small. It has a size of 2 – 8 microns which makes it possible to be observed only under a microscope. It is roughly equal in size as human red blood cell but differs in shape where Chlorella is spherical whereas the human red blood cell is disc-shaped. Chlorella reproduces at a very fast rate, renewing into four new cells in every 17 – 24 hours. This remarkable ability of reproduction shows that it is very high in ‘qi’ or vital energy.

History

Chlorella has been on earth since the Pre-Cambrian period for more than 2.5 billion years. However, it was only discovered by a Dutch microbiologist, Martinus W. Beijerinck in 1890. After the World War II, most of the research on this organism was shifted to America with studies carried out at the Stanford Research Institute, and the Carnegie Institute. In 1951, the Rockefeller Foundation in collaboration with the Japanese Government and Dr. Hiroshi Tamiya developed the technology to grow, harvest and process Chlorella on a large commercial-feasible scale. The great success of this Japanese project attracted the attention of the American and Russian space programs that studied the possibility of using Chlorella as an ideal food for long-term space travel and colonization. This was followed by the possibilities of Chlorella as being used as a promoter of good health by the Japanese scientists in the 1960s due to the fact that it contained an array of vitamins and minerals together with many other health supporting nutrients. In 1963, the “spray-dry process” for drying Chlorella cells without diminishing the nutrients within was successfully introduced by Mr. Kaminaka. This was followed by the development of the “Dyno-mill” and “Jet-spray” procedures to break down the Chlorella cell wall while preserving the nutritional value of the cells. The results obtained were promising where a digestibility rate of over 80% was produced compared to only 47% digestibility for the whole unbroken cell. The “Dyno-mill” method was known to pulverize the cell wall and liberate the contents whereas the “Jet-spray” method was to crack the cell wall while preserving the nutrients within. Today, Chlorella is one of the most scientifically researched algae in the human history with many publications from medical institutions, research institutions and universities. As far as human’s health is concerned, not a single negative aspect of this organism has been reported. Chlorella is the second top selling health food supplement in Japan with over 30% of the Japanese population taking it as one of their principal health supplement. Researchers in the past decade have focused on efforts to discover the nutritional benefits of Chlorella and the liquid extract of this organism called Chlorella growth factor (CGF), to combat health problems such as malignant brain tumor, ulcerative colitis, osteoarthritis, fibromyalgia, non-insulin dependant diabetes mellitus and other health problems. Chlorella has also

been found to boost the immune system, reducing the intensities of many chronic health problems, and reducing the side effects of medications. Its detoxifying, nourishing and revitalizing properties enables the body's natural defences and repair systems to function more efficiently. Thus, the body is able to deal with health problems naturally at the root instead of masking the symptoms.

The Structure of Chlorella

Each Chlorella cell is a complete and well-defined unit with a distinctive nucleus enclosed in an envelope. There are organelles outside the nucleus which are all together enclosed in a well protected thick fibrous cell wall. Like other chlorophyll containing plants, in perfect growing conditions, Chlorella converts inorganic chemical elements to organic matter by using sunlight through photosynthesis. Being the simplest, Chlorella forms the first link in the Earth's food chain. It is a natural, pure, whole food rich in high-quality protein, chlorophyll, dietary fiber, vitamins, minerals, enzymes, nucleic acids and phytonutrients that are beneficial to the human body. Medical researchers have shown that Chlorella have the ability to

- improve the immune system
- detoxify and heal the body
- improve digestion and elimination
- enhance growth and tissue repair, and maintenance
- protect against degenerative and chronic health problems
- slow down the ageing process

Sources of Commercial Production of Chlorella

a) Outdoor Cultivation of Chlorella

In the sunlight, Chlorella keeps on growing rapidly using carbon dioxide, water, inorganic fertilizers in proper amounts, proper temperature, and stirring of the water to keep an even density of chemical components and to prevent settling of the algae. However, it can even grow in the absence of light, if organic carbon sources such as acetic acid or glucose are supplied together with oxygen. In mass cultivation of Chlorella, light and carbon dioxide, though boundless available in nature, cannot be freely controlled and used for efficient Chlorella production. As a result of this discovery, acetic acid came to be used partially as a carbon source. The outdoor cultivation method entails a number of problems. Since it is low in productivity, it incurs rather high production cost, and has a fatal quality defect caused by the intrusion of miscellaneous substances, and contamination due to microbes.

b) Heterotrophic Tank Cultivation of Chlorella

The pure cultivation method was developed to resolve all the problems encountered in the outdoor cultivation, and realize mass production of high-quality Chlorella. Developed in 1964 by the Central Research Laboratory of Yakult Honsha Co., this new method was brought into actual operation by Nihon Chlorella Co., and is currently used in the mass production of Chlorella. Several improvements were observed after the heterotrophic tank cultivation was introduced. Firstly, the Chlorella cultivated through the heterotrophic tank under strict sterile control from inoculation to harvesting, was found to be totally free of any contaminants or microbes. Thus, it is 100% safe for consumption. Secondly, heterotrophic tank cultivation produced high quality Chlorella, and finally, it ensures a high level of production throughout the year because Chlorella can be grown at a high rate under optimal weather control. Moreover, heterotrophic culture produces higher cell densities (Running *et al.*, 1994) in readily available large scale growth vessels, which markedly reduces the harvesting efforts. Table 1a and 1b show the various differences between heterotrophic (outdoor) tank cultivated and outdoor cultivated Chlorella.

Table 1a: Comparison of components between heterotrophic (indoor) and outdoor Chlorella [Adapted from Nihon Chlorella Co.Ltd]

Component	Indoor Chlorella (mg/100g)	Outdoor Chlorella (mg/100g)
Chlorophyll	2,800 – 3,600	1,000 – 3,000
Carotene	70 -120	5 – 50
Vitamin C	30 – 60	8 – 91
Calcium	80 – 1,200	80 – 170
Iron	40 – 50	70 – 200
Extract	17,000 – 21, 000	14,000 – 26,000
Digestibility	82%	82%

Table 1b: Comparison of characteristics between heterotrophic (indoor) and outdoor Chlorella [Adapted from Nihon Chlorella Co.Ltd]

Characteristic	Indoor Chlorella	Outdoor Chlorella
Safety	Safe	Questionable
Phytochemical (carotenoids, chlorophyll)	High and stable	Unstable
Productivity	High	Low

Nutritional Profile

Chlorella is rich in amino acids, complex carbohydrates, vitamins, minerals, fats (85% unsaturated fats), RNA (up to 10%), DNA (up to 3%), chlorophyll, an array of phytonutrients and carotenoids, enzymes (including pepsin for digestion), polysaccharides and the unique CGF (Table 2 & Table 3).

Table 2: Macronutrients in Chlorella

Nutrient	Mass per 100g
Ash	5 -7g
Carbohydrate	10 – 20g
Chlorophyll	3 – 7g
Energy	411 kcal
Fat	5 -15g
Fiber	1 – 6g
Moisture	3 – 6g
Protein	60 – 69g

Table 3: Ash composition of Chlorella

Mineral	mg per 100g
Iron	53
Calcium	94
Potassium	1360
Magnesium	264
Sodium	50
Phosphorus	1680

It is known to have the highest amount of chlorophyll compared to all other green algae and plants. The chlorophyll content in Chlorella can reach as high as 7% of its total weight, and it contains 5 – 10 times more chlorophyll than spirulina, and 10 times more than alfafa. Due to its high chlorophyll content, it is also known as the “Supreme Whole Food Concentrate”. It is a complete protein where it contains all the eight essential amino acids needed by the body with the other non-essential amino acids (Table 4 & Table 5). The protein found in Chlorella is far more superior than the one found in meat due to the fact that the amino acids it provides can be easily assimilated by the body that are needed to carry out various functions in the human body. Its protein content is higher than many different food sources (Table 6).

Table 4: Essential amino acids in Chlorella

Amino acids	mg per 100g
Isoleucine	2230
Leucine	5070
Lysine	4900
Methionine	1300
Phenylalanine	2910
Threonine	2800
Tryptophan	1180
Valine	3230

Table 5: Non-essential amino acids in Chlorella

Amino acids	mg per 100g
Alanine	4550
Arginine	3670
Aspartic acid	5210
Cysteine	790
Histidine	1200
Glutamic acid	6670
Glycine	3360
Proline	2810
Serine	2370
Tyrosine	2400

Table 6: Comparison of protein content

Source	Mass per 100g
Chlorella	60 - 69g
Spirulina	70g
Soy	32g
Wheat	13g
Chicken	24g
Fish	18 – 29g
Beef	24 – 27g
Eggs	13g
Rice	3g
Potatoes	3g

It is known to contain the full spectrum of B-complex vitamins where it contains twice the amount of folic acid compared to raw beef liver, and more vitamin B12 (normally lacking in vegetarians) than raw beef liver. It is also one of the richest natural sources of vitamin B3 (niacin) and rich in vitamin A that acts as an antioxidant to scavenge the free radicals in the human body in order to prevent cancer and slow down the ageing process. Chlorella has one of the highest amounts of beta-carotene among all green products (Table 7 & Table 8)

Table 7: Vitamins in Chlorella

Vitamin	Mass per 100g
Alpha-carotene	24.0mg
Beta-carotene	86.0mg
Vitamin B1 (Thiamin)	2.32mg
Vitamin B2 (Riboflavin)	5.02mg
Vitamin B3 (Niacin)	24.5mg
Vitamin B5 (Pantothenic acid)	1.92mg
Vitamin B6 (Pyridoxine)	2.52mg
Folic acid	560µg
Vitamin B12	8µg
Biotin	230µg
Choline	180µg
Inositol	281µg
Vitamin C	70mg
Vitamin D	37700 IU
Vitamin E	14.5mg
Vitamin K	506µg

Table 8: Comparison between Chlorella and different vegetables (per 100g)

	Chlorella	Spinach (Raw)	Pumpkin (Raw)
Moisture (g)	4.2	90.4	88.9
Protein (g)	63.1	3.3	1.3
Fat (g)	11.3	0.2	0.1
Vegetable Fiber (g)	14.3	0.8	1.0
Sugar (g)	0.3	3.6	7.9
Iron (mg)	52.7	3.7	0.4
Calcium (mg)	94	55	17
Potassium (mg)	1360	740	330
Phosphorus (mg)	1680	60	35
Sodium (mg)	50	21	1
Carotene (mg)	110	3.1	0.62
Vitamin B1 (mg)	2.32	0.13	0.07
Vitamin B2 (mg)	5.02	0.23	0.06
Vitamin C (mg)	70	65	15

The organic minerals found in Chlorella are easily absorbed and utilized by the human body. It is high in potassium, magnesium, calcium and iron which are needed for healthy heart functions , blood formation and circulation. The levels of zinc, selenium and iodine are sufficient for healthy immune functions. In addition, it is a rich and unique source of other nutrients such as fatty acids, lutein and xantophyll (Table 9 & Table 10)

Table 9: Fatty acids and phytonutrients in Chlorella

Nutrient	mg per 100g
Unsaturated fatty acids	1377
Saturated fatty acids	256
RNA	2950
DNA	280
Lutein	503
Xantophyll	138
GLA	6
Coenzyme Q9	14
Total carotenoids	718

Table 10: Fatty acid composition of Chlorella

Fatty acid	Composition ratio (%)
Myristic acid	0.9
Palmitic acid	16.1
Palmitoleic acid	6.6
Palmitolinoleic acid	19.8
Palmitolinolenic acid	6.1
Stearic acid	3.2
Oleic acid	1.9
Linoleic acid	36.7
Linolenic acid	8.7

Chlorella Growth Factor (CGF)

CGF is a unique group of substances only present in the nucleus of Chlorella making up to 18% of its total weight. It is very rich in nucleic acids (RNA and DNA) plus other substances such as amino acids, peptides, vitamins, minerals, polysaccharides, glycoproteins, and beta-glucans. It was first extracted by electrophoresis using hot water in the early 1950's by Dr. Fujimaki of the People's Scientific Centre in Tokyo, Japan who named it as 'Chlorella Growth Factor' because it promoted healthy growth in young children and young animals. In actual fact, this is the group of substances that is responsible for Chlorella's own rapid growth and reproduction. CGF is 100% water-soluble and is responsible for the remarkable ability of Chlorella to heal and rejuvenate the human body, repairing damaged cells and tissues, and stimulating the growth of new and healthy cells which makes this organism as one of the most powerful whole foods. In addition, CGF also has the ability to slow down the ageing process due to its high content of nucleic acids.

- Inhibitory effects of sterols isolated from *Chlorella vulgaris* on 12-0-tetradecanoylphorbol-13-acetate-induced inflammation and tumor promotion in mouse skin. Biol Pharm Bull 1996 Apr;19(4):573-6

Chlorella as a Food

Chlorella is a whole food because each cell of this organism is a self-sufficient organism containing all the life forces within. It contains phytonutrients and co-factors in a balance amount that is beneficial for the overall restoration and maintenance of health. Its high content of vitamins, minerals, protein, amino acids and other vital nutrient enables it to supply a wide range of nutrients that the human body needs. Chlorella is regarded as a functional food in countries like Japan due to the fact that it contains all the essential nutrients needed by the human body and can carry out many therapeutic functions in the body. This is made possible because the nutrients in Chlorella interact with the body's system in such a way as to promote the body's ability to heal, balance and revitalize. Chlorella is able to provide vital nutritional support that is lacking in the modern diet consumed by many individuals today where with its rich nutrient content it can help fill the gap in the nutritional requirements of people. Furthermore, the vitamins and minerals in Chlorella are bio-chelated which means that they are naturally incorporated in amino acids, making it easier for the human's body to absorb and assimilate.

- Microalgae as food and supplement.

Crit Rev Food Sci Nutr 1991;30(6):555-73.

Health Benefits of Chlorella

The health benefits of Chlorella are mainly due to its four important properties;

- high content of chlorophyll
- Chlorella growth factor (CGF)
- high fiber cell wall, and
- high content of nutrients

Chlorella has been reported to be helpful for various health problems such as hypertension, arteriosclerosis, hypercholesterolemia, cardiac problems, constipation, bowel toxicity, dermatitis, allergies, arthritis, diabetes mellitus, fibromyalgia, Epstein-Barr virus infection, candidiasis and others. Besides that, it has also been found to enhance the ability of the immune system, slow down the ageing process, stimulate growth, reduce the risk of cancer, enhance the healing process, rejuvenate and vitalize the body, and others.

Chlorella and Detoxification

Chlorella has been used extensively in Japan for detoxification purposes where it is considered as a first class detoxifying agent, capable of binding and removing alcohol from the liver, and heavy metals (cadmium and mercury), certain pesticides, herbicides and polychlorbiphenyls (PCBs) from the tissues of the human's body. In fact, chlorella is a key detoxifying agent used during the removal of dental amalgam fillings that contain mercury. Furthermore, studies on animals have shown the effectiveness of Chlorella in removing chlorinated hydrocarbon insecticide from the tissues. Due to its high percentage of chlorophyll, Chlorella is able to cleanse the bowels and purify the blood, and it has been found to have a positive effect on the function of the liver and kidney. Thus, this will keep the bloodstream free of wastes and substantially increase an individual's resistance to common cold and flu. The detoxification capability of Chlorella is due to its unique cell wall and the material associated with it. The cell walls of Chlorella have been shown to have three layers of which the thicker middle layer contains cellulose microfibrils, and the outer layer a polymerized carotenoid material. The extremely tough outer cell wall of Chlorella binds to heavy metals, pesticides, herbicides, and toxins, and removes them from the body. The cleansing of blood, bowel and liver begins after Chlorella has been consumed regularly for three months or more, depending on the amount taken, and the health condition of the individual. Large doses of Chlorella has found to be able to facilitate the faecal excretion of mercury where once the intestinal level of mercury has been lowered, mercury from other body tissues will migrate to the intestine for elimination. Below are some studies carried out in which the detoxifying ability of Chlorella was shown;-

- In a research carried out in the United States, poisonous hydrocarbon chlordecone was administered to animals which were then fed Chlorella. The Chlorella interrupted the recirculation of the chlordecone and eliminated it from the animal's bodies. The researchers concluded that Chlorella was potentially effective as a detoxifier for not only chlordecone but for compounds with similar properties, such as dioxin and PCBs.

- A paper in *Experientia* (1950) reported that guinea pigs on a diet rich in chlorophyll showed increased resistance to lethal X-rays; the U.S. Army repeated the experiment, with the same results.
- A Japanese study of heavy metal poisoning with cadmium revealed that when 8 grams of *Chlorella* were administered to the test animals daily, cadmium excretion increased threefold in the stool and sevenfold in the urine.
- In a study in which a culture of brewer's yeast was given a lethal dose of four highly toxic substances, mercury, copper, cadmium and PCB, it was found that when *Chlorella* extract was added to a mixture of these poisons, the brewer's yeast remained alive.
- In a study carried out by Dr T. Nagano at Shizuoka College of Pharmacy in Japan, rats were given *Chlorella* that contained cadmium to determine whether the cadmium would be absorbed from the *Chlorella* into the rats. In rats given only cadmium (without *Chlorella*), growth retardation was noted, while no problem with growth was seen in those given *Chlorella* containing cadmium. Blood levels of cadmium were determined and demonstrated that the cadmium that was bound to the *Chlorella* was not absorbed into the rats' bodies.
- In another study, *Chlorella* was used to detoxify people suffering from PCB (polychlorobiphenyl) exposure. Dr Ueda of the Kitakyushu City Institute for Environmental Pollution Research gave 30 patients who suffered from PCB exposure daily doses of 4-6 grams of *Chlorella* for one year. Almost all improved being less tired, with better digestion and normal bowel movements.
- Dr S Pore of the School of Medicine, West Virginia University did a study in which *Chlorella* given to rats speeded up the detoxification of this toxin, decreasing the half-life of the toxin from 40 days to 19 days.

Detoxification of chlordecone poisoned rats with *chlorella* and *chlorella* derived sporopollenin.

Drug Chem Toxicol. 1984;7(1):57-71.

Chlorella Enhances Immune System

Chlorella is known to be an excellent immune system booster. CGF is well recognized as biological response modifier in the Japanese scientific community. CGF has the ability to increase the “colony forming units” (CFU), and it also enhances the production of gamma-interferon, tumor necrosis factor (TNF) and interleukins (IL) in the body. Gamma-interferon, is a protein produced by immune cells that activates the NK cells that target tumor cells and protects the body from infections. TNF kills tumor cells and inhibits the growth of parasites and viruses whereas ILs are messengers among the leukocytes that help in the fight against tumors and viruses. Chlorella stimulates the activity of T-cells and macrophages by increasing interferon levels, thus, enhancing, the immune system’s ability to combat pathogens and foreign proteins. It thus appears that the cell wall of Chlorella has the ability to fight cancer cells through interferon production induced from the complex polysaccharides. Chlorella’s unique cell wall is one of the important factors that sets it apart from other green foods. Furthermore, Chlorella’s rich source of beta-carotene, carotenoids, zinc, selenium, amino acids, calcium and nucleic sugars such as mannose, rhamnose, arabinose, galactose, and xylose also helps in the building of a strong and healthy immune system. Several studies have shown the ability of Chlorella in enhancing the immune system.

- Augmentation of antitumor resistance by a strain of unicellular green algae, *Chlorella vulgaris*.

Cancer Immunol Immunother. 1984;17(2):90-4.

- Antitumor effect induced by a hot water extract of *Chlorella vulgaris* (CE): resistance to Meth-A tumor growth mediated by CE-induced polymorphonuclear leukocytes. Cancer Immunol Immunother. 1985;19(2):73-8.

- Augmentation of host defense by a unicellular green alga, *Chlorella vulgaris*, to *Escherichia coli* infection.

Infect Immun. 1986 Aug;53(2):267-71.

- The radioprotective effects of aqueous extract from chlorococcal freshwater algae (*Chlorella kessleri*) in mice and rats.
Strahlenther Onkol. 1989 Nov;165(11):813-6.
- Augmentation of the resistance against *Escherichia coli* by oral administration of a hot water extract of *Chlorella vulgaris* in rats.
Int J Immunopharmacol 1989;11(8):971-6
- Enhanced resistance against *Escherichia coli* infection by subcutaneous administration of the hot-water extract of *Chlorella vulgaris* in cyclophosphamide-treated mice.
Cancer Immunol Immunother 1990;32(1):1-7
- Accelerated restoration of the leukocyte number and augmented resistance against *Escherichia coli* in cyclophosphamide-treated rats orally administered with a hot water extract of *Chlorella vulgaris*.
Int J Immunopharmacol. 1990;12(8):883-91.
- Oral administration of *Chlorella vulgaris* augments concomitant antitumor immunity.
Immunopharmacol Immunotoxicol. 1990;12(2):277-91.
- Effect of *Chlorella vulgaris* extracts on murine cytomegalovirus infections.
Nat Immun Cell Growth Regul. 1990;9(2):121-8.
- Augmentation of the resistance against *Listeria monocytogenes* by oral administration of a hot water extract of *Chlorella vulgaris* in mice.
Immunopharmacol Immunotoxicol. 1994 May;16(2):191-202.
- Hot water extracts of *Chlorella vulgaris* reduce opportunistic infection with *Listeria monocytogenes* in C57BL/6 mice infected with LP-BM5 murine leukemia viruses.
Int J Immunopharmacol. 1995 Jun;17(6):505-12.
- Protective effect of an acidic glycoprotein obtained from culture of *Chlorella vulgaris* against myelosuppression by 5-fluorouracil.
Cancer Immunol Immunother. 1996 Jun;42(5):268-74.
- A novel glycoprotein obtained from *Chlorella vulgaris* strain CK22 shows antimetastatic immunopotentiality.
Cancer Immunol Immunother. 1998 Feb;45(6):313-20.

- The effects of *Chlorella vulgaris* in the protection of mice infected with *Listeria monocytogenes*. Role of natural killer cells.
Immunopharmacol Immunotoxicol. 1999 Aug;21(3):609-19.
- Effects of the green algae *Chlorella vulgaris* on the response of the host hematopoietic system to intraperitoneal ehrlich ascites tumor transplantation in mice.
Immunopharmacol Immunotoxicol. 2001 Feb;23(1):119-32.
- Safety and immunoenhancing effect of Chlorella-derived dietary supplement in healthy adults undergoing influenza vaccination: randomized, double-blind, placebo-controlled trial.
CMAJ. 2003 Jul 22;169(2):111-7.
- Attenuating effect of chlorella supplementation on oxidative stress and NFkappaB activation in peritoneal macrophages and liver of C57BL/6 mice fed on an atherogenic diet.
Biosci Biotechnol Biochem. 2003 Oct;67(10):2083-90.

Chlorella Boosts Brain Power

Chlorella is a memory-boosting super-food, and is often called the “Brain Food”. It contains the vital nutrients that the brain needs to maintain memory. The human’s brain has the highest concentration of RNA in the body which is vital for memory and learning. However, the brain cells have limited capacity to make nucleosides and nucleotides which are needed to synthesize RNA. This limited capacity declines slowly as an individual ages which may be a contributing factor in age-related memory loss. Thus, supplementing our diet with natural sources of nucleosides and nucleotides can provide the building blocks that are needed for maintaining healthy brains. This need can be provided by Chlorella which is a very rich source of nucleosides and nucleotides. Besides that, Chlorella is also an excellent natural source of the “brain-boosting” nutrient, phosphatidylserine (PS) which is a major component of the cell membrane in all of the cells in the human body. Interestingly, the human brain cells are also particularly high in PS. PS is a brain nutrient because it rejuvenates the brain cells and revitalizes the cell membranes by improving their integrity. Several studies have shown that PS supplementation is able to improve memory and learning abilities. Supplementation with PS also lightens depression and may delay memory loss associated with Alzheimer’s disease. Chlorella also has a rich natural source of antioxidants, beta-carotene and chlorophyll that are needed to neutralize the damage of the free radicals produced by the human body cells. It has been shown that chlorophyll is a powerful antioxidant source that protects the mitochondria from free radical damage. Several researchers have demonstrated that people with higher levels of beta-carotene and vitamin C in their blood performed better on memory tests. Furthermore, animal studies have shown that CGF has the ability to significantly suppress the overflow of stress hormone, corticosteroids levels in the blood. Another Swiss study found that the blood mercury levels were higher in Alzheimer’s disease patients. The high fiber cell wall of Chlorella cells has been proven to be very effective in removing heavy metals such as mercury from the body. Several studies have shown the benefits of Chlorella in improving the brain’s health.

- *Chlorella vulgaris* culture supernatant (CVS) reduces psychological stress-induced apoptosis in thymocytes of mice.

Int J Immunopharmacol. 2000 Nov;22(11):877-85.

- Therapeutic potentials of unicellular green alga *Chlorella* in advanced glycation end product (AGE)-related disorders.

Med Hypotheses. 2005;65(5):953-5.

Chlorella Improves Heart Health

Several studies have demonstrated that supplementation with Chlorella and hot water extract of CGF can help to improve hypertension and to lower blood serum cholesterol better than medications, besides improving the quality of lives of those involved. This may be due to the fact that Chlorella improves the elasticity and pliability of the arteries, thus, helping to normalize blood pressure. Research has shown that long-term use of Chlorella helps to lower LDL levels. Chlorella's rich content of chlorophyll, phospholipids and carotenoids help combat free radicals and reduce oxidative damages that can lead to arterial lesions and plaque build-up associated with arteriosclerosis. Furthermore, Chlorella has been proven to be an excellent detoxifier of cadmium, a heavy metal found in cigarettes. Researchers have shown that cadmium and other heavy metals can be responsible for increasing blood-clotting activity, hypertension, and arteriosclerosis. The high content of magnesium in Chlorella confers proper cardiac function, blood pressure regulation, stroke prevention, and for both muscular contraction and relaxation. The omega-3, alpha linolenic acid in Chlorella has the artery cleansing, and thus, is effective in reducing cholesterol in the body. Several studies have proven the role played by Chlorella in improving the cardiac function.

- Effects of Chlorella on serum cholesterol levels in rats.

Taiwan Yi Xue Hui Za Zhi. 1981 Sep;80(9):929-33. Chinese.

- Effect of dried, powdered *Chlorella vulgaris* on experimental atherosclerosis and alimentary hypercholesterolemia in cholesterol-fed rabbits.

Artery. 1987;14(2):76-84.

- Effect of lipophilic extract of *Chlorella vulgaris* on alimentary hyperlipidemia in cholesterol-fed rats.

Artery. 1988;15(4):217-24.

- Hypocholesterolemic effect of indigestible fraction of *Chlorella regularis* in cholesterol-fed rats.

J Nutr Sci Vitaminol (Tokyo). 2001 Dec;47(6):373-7.

- A hot water extract of *Chlorella pyrenoidosa* reduces body weight and serum lipids in ovariectomized rats.

Phytother Res. 2004 Feb;18(2):164-8.

- Preventing dyslipidemia by *Chlorella pyrenoidosa* in rats and hamsters after chronic high fat diet treatment.

Life Sci. 2005 May 13;76(26):3001-13.

Chlorella Lowers the Risks of Cancer

Generally, people who develop cancer have lower levels of vitamin A and beta-carotene in their blood. Several scientific studies have shown that vitamin A and beta-carotene improve the ability of the immune system, and help in the prevention and treatment of cancer. The synergistic effect of beta-carotene and vitamin E also helps in the elimination of early stage cancer. Chlorella is rich in the antioxidant beta-carotene, a precursor of vitamin A. Studies in the Harvard University suggest that the extracts from algae such as Chlorella were more effective than beta-carotene alone in exhibiting anti-cancer activity. This is due to the fact that Chlorella contains a range of carotenoids that is superior as compared to the single synthetic beta-carotene. A study carried out by Dr. Randall Merchant showed that dietary supplementation with *Chlorella pyrenoidosa* produces positive results in patients with cancer or suffering from certain common chronic illnesses. According to *Herbal Medicine, Healing Cancer* by Dr. Donald R. Yance, Jr., a Virginia-based study treated 15 glioblastoma patients with powdered and liquid chlorella combined at times with standard chemotherapy and/or radiation therapy. Although glioblastoma patients normally display a two-year survival rate of 10 percent, the 15 chlorella-treated patients exhibited a survival rate of 40 percent. Several studies in China showed that natural carotenoids such as those found in Chlorella, benefited people with pre-cancerous cells in the stomach where these cells reverted to normal cells as compared to synthetic beta-carotene which was unable to carry out the similar activity. Besides carotenoids, Chlorella also contains the antioxidants such as vitamin C, vitamin E and the trace element selenium. Studies have revealed that deficiency in selenium leads to liver problems and liver cancer. A study on Chlorella published in Japan (1992), showed that Chlorella has impressive effects on blood chemistry. It increased red blood cells, white blood cells, platelets, and albumin. The ability of Chlorella to increase albumin is vitally important because many cancer patients have a decreased level of albumin.

- Antioxidant and antiproliferative activities of Spirulina and Chlorella water extracts. *J Agric Food Chem.* 2005 May 18;53(10):4207-12.

- Simple assay for antitumour immunoactive glycoprotein derived from *Chlorella vulgaris* strain CK22 using ELISA.
Phytother Res. 2002 Sep;16(6):581-5.
- Effects of the green algae *Chlorella vulgaris* on the response of the host hematopoietic system to intraperitoneal ehrlich ascites tumor transplantation in mice.
Immunopharmacol Immunotoxicol. 2001 Feb;23(1):119-32.
- A novel glycoprotein obtained from *Chlorella vulgaris* strain CK22 shows antimetastatic immunopotential.
Cancer Immunol Immunother. 1998 Feb;45(6):313-20.
- A water-soluble antitumor glycoprotein from *Chlorella vulgaris*.
Planta Med. 1996 Oct;62(5):423-6.
- Chlorophyll and chlorophyllin as modifiers of genotoxic effects.
Mutat Res 1994 Dec;318(3):239-47.
- Inhibitory potential of *Chlorella vulgaris* on mouse skin papillomagenesis and xenobiotic detoxication system.
Anticancer Res 1999 May-Jun;19(3A):1887-91
- Post-exposure radioprotection by *Chlorella vulgaris* (E-25) in mice.
Indian J Exp Biol 1995 Aug;33(8):612-5
- Evaluation of radioprotective action of a mutant (E-25) form of *Chlorella vulgaris* in mice.
J Radiat Res (Tokyo) 1993 Dec;34(4):277-84

Chlorella Improves Fatigue Associated with Chemotherapy

Chlorella most important improvement is in the white blood cell count. People diagnosed with cancer suffer from the side effects of chemotherapy –fatigue. With chemotherapy, the good cells are also killed together with the bad cells which results in the suppression of the immune system leading to leucopenia. Leucopenia is an abnormal drop in the infection-fighting white blood cells called neutrophils. In animal studies carried out, it was found that mice treated with the chemotherapy drug 5-fluorouracil (5-FU) experienced accelerated recovery (20% faster) of white blood cells in bone marrow when given the protein-carbohydrate complex (CGF) isolated from Chlorella. The group of mice fed Chlorella also had higher white blood cell count and only experienced a milder form of leucopenia. Chlorella helps the body to rapidly rebuild the white blood cells to improve chemotherapy-induced fatigue. Chlorella is especially helpful when used as part of a broad based individualized nutritionally oriented physician guided program.

- Protective effect of an acidic glycoprotein obtained from culture of *Chlorella vulgaris* against myelosuppression by 5-fluorouracil.

Cancer Immunol Immunother. 1996 Jun;42(5):268-74.

Chlorella Stimulates Interferon Production

Interferon is one of our body's greatest natural defenses against cancer where the usage of agents to stimulate the activity of T-cells and macrophages is one way to fight cancer. Interferon is a natural secretion of the body and it stimulates the production of macrophages and tumor necrosis factor (TNF). Chlorella stimulates the activity of T-cells and macrophages by increasing interferon levels, thus, enhancing the immune system's ability to combat foreign invaders whether they are bacteria, viruses, chemicals or foreign proteins. The cell wall of Chlorella has the ability to fight cancer cells through interferon production induced from the complex polysaccharides. This unique property of Chlorella sets it apart from other green foods. Studies carried out at the Kitazato Institute in Japan indicated that chemical substances in Chlorella stimulated the production of interferon and T-cells. The studies also indicated that Chlorella decreased the side effects caused by chemotherapy and reduced the damage to the immune system. Similar results which indicated the anti-tumor activity of Chlorella was obtained by studies carried out in Kanazawa, Japan.

Chlorella and Hypertension

Chlorella may also help reduce blood pressure in some people with hypertension (high blood pressure). Vegetarians generally have a lower incidence of high blood pressure and other cardiovascular diseases, than non vegetarians. While dietary levels of sodium do not differ significantly between these two groups, a vegetarian's diet typically contains more potassium, complex carbohydrates, essential fatty acids, fiber, calcium, magnesium, and vitamin C, and less saturated fat and refined carbohydrate, all of which have a favorable influence on blood pressure. A diet high in sodium and low in potassium is associated with high blood pressure. Conversely, a diet high in potassium and low in sodium can lower blood pressure. Numerous studies have shown that sodium restriction alone does not improve blood pressure control in most people; it must be accompanied by a high potassium intake. Most Americans have a potassium-to-sodium ratio of less than 1:2, meaning they ingest more than twice as much sodium as potassium. Researchers recommend a dietary potassium-to-sodium ratio of greater than 5:1 to maintain health. The easiest way to lower sodium intake is to avoid prepared foods and table salt, and consume food high in potassium such as fruits, vegetables, whole grains, legumes, and enriching greens like chlorella (1360mg potassium per 100g), spirulina, wheat grass juice, barley grass juice, and herbal extracts. In a study carried out in Japan (1995), a significant reduction in both systolic and diastolic blood pressure was observed after 3 months in patients given 1.5g of Chlorella daily for 6 months as compared to the control group which only received health advice. Another study reported in the March 2003 issue of *Original Internist* showed that treatment with 10 grams of chlorella daily for three months significantly improved blood pressure in 25% of the patients. Several other studies have shown that consumption of Chlorella is effective in reducing hypertension without exhibiting any harmful effects on the subjects.

- Nutritional supplementation with *Chlorella pyrenoidosa* for mild to moderate hypertension.

J Med Food. 2002 Fall;5(3):141-52.

- A review of recent clinical trials of the nutritional supplement *Chlorella pyrenoidosa* in the treatment of fibromyalgia, hypertension, and ulcerative colitis.

Altern Ther Health Med. 2001 May-Jun;7(3):79-91. Review.

- Effects of chlorella alkali extract on blood pressure in SHR.

Jpn Heart J. 1978 Jul;19(4):622-3.

Chlorella Eliminates Toxin from the Body

The ability of Chlorella's cell wall in eliminating toxins such as heterocyclic amines (HCA), pesticides, organic chemicals and heavy metals from the body helps in the prevention of cancer. The CGF and chlorophyll are extremely useful in cancer prevention and treatment. Several studies have shown that CGF increases the number of immune cells in the abdominal cavity, thus, improving resistance to abdominal tumors. Chlorella's rich content of chlorophyll cleanses and protects the cells in the body from cancer. Chlorella also inhibits the activity of P450 enzyme. The P450 enzyme (cytochrome P450) produced in the liver, activates toxic molecules, including HCA's in such a way that they become sticky. These sticky toxins have a greater tendency to bind with the cells of the digestive tract, increasing the risk of colon cancer. Thus, with the presence of chlorophyll from Chlorella, HCS's and the other dangerous chemicals would be less likely to bind with the cells in the digestive tract, hence, reducing the risks of getting colon cancer.

- Effect of *Chlorella pyrenoidosa* on fecal excretion and liver accumulation of polychlorinated dibenzo-p-dioxin in mice.

Chemosphere. 2005 Apr;59(2):297-304. Epub 2005 Jan 7.

- Chlorophyll derived from Chlorella inhibits dioxin absorption from the gastrointestinal tract and accelerates dioxin excretion in rats.

Environ Health Perspect. 2001 Mar;109(3):289-94.

Chlorella is Anti-Ageing

Ageing is mainly caused by low levels of nucleic acids (RNA and DNA) that result in lower vitality, and increased susceptibility to degenerative diseases that are so common among the elderly. Thus, diets rich in nucleic acids can counter and slow down the ageing process because eating foods high in nucleic acids provide the raw materials for the production and repair of our cellular nucleic acids. Chlorella is an excellent source of nucleic acid with 2950 mg of RNA and 280 mg of DNA per 100 grams. In fact, Chlorella is one of the highest known food sources of nucleic acids. Chlorella being rich in powerful antioxidants, such as carotenoids, vitamins C and E, chlorophyll and selenium, helps in preventing premature ageing by neutralizing free radicals in the body. Besides that, Chlorella also provides the necessary nutrients in an easily absorbable form to optimize cellular nutrition so that these cells age slowly. It also can help the body attain a slightly alkaline form because it is known as the most alkaline food, and has the ability to balance the pH of the body. The youth promising secret of Chlorella is popular among the Japanese who live longer and healthier than most on earth.

- Effect of docosahexanoic acid-fortified *Chlorella vulgaris* strain CK22 on the radial maze performance in aged mice.

Biol Pharm Bull. 2002 Aug;25(8):1090-2.

Chlorella Boosts Energy and Vitality

Adequate supply of oxygen to the body cells is important in preventing tiredness. Chlorella can help replenish our oxygen supply by increasing the amount of haemoglobin in the blood. This is possible due to the high content of chlorophyll, iron and protein in Chlorella that helps in the synthesis of haemoglobin. Thus, with good supply of oxygen and adequate vital nutrients, vitality and energy can be restored. Chlorella also contains the energy giving sugars, such as mannose and rhamnose, and being a whole food, the effects of Chlorella are longer lasting.

- Effect of chlorella on rats with iron deficient anemia.

Kitasato Arch Exp Med 1991 DEC;64(4):193-204

Chlorella and Female's Health

Being an adaptogen, Chlorella normalizes body functions bringing the body back to homeostasis. Thus, it is very useful for the various health problems in women that arise from imbalances in the body. The average woman does not have enough of iron or calcium, especially after the age of forty, and Chlorella is known to be high in both of these minerals. Being a detoxifier, Chlorella can help keep the urethra free of toxins, and at the same time increase the number of white blood cells to help invasion of pathogens into the urinary system. Furthermore, its high beta-carotene content help boosts immunity. In females, the state of liver function affects the level of estradiol, which indirectly affects the levels of prostaglandins. High levels of prostaglandins are linked to higher probability of the incidence of dysmenorrhoea. According to traditional Chinese medicine, dysmenorrhoea is mainly due to the impeded flow of *qi* and blood to the uterus. The high level of *qi* in Chlorella improves the quality of blood and invigorates its circulation. From the holistic point of view, dysmenorrhoea is a sign that the body is out of balance. Chlorella with its rich nutrients brings the body back to homeostasis. Clinical trials using Chlorella in Japan have shown favourable results in overcoming some of the symptoms of menopause. Chlorella also helps women with osteoporosis due to its high contents of calcium that necessary for proper mineralization and growth of bones. Being a whole food, containing every complex chemical compounds necessary for cell growth, it is essential for healthy pregnancies.

Chlorella Improves Digestion

Several studies carried out in Japan have shown that Chlorella can help in relieving constipation. A study carried out by Saito & Okanao revealed that Chlorella stimulates peristaltic action of the intestines, thus, improving the frequency bowel movement. Furthermore, it was found that Chlorella also increased the total stool amount and improved stool consistency in constipated subjects. This is possible due to the indigestible cell wall of Chlorella which is known to be very high in fiber and aids in stimulating peristalsis.

Chlorella and Probiotics

Chlorella stimulates the production of beneficial bacteria in the bowel, which in turn has the probiotic effect of strengthening gut flora and resisting diseases. A study by Tadechi (1957) and his colleagues, found that Chlorella stimulates the growth of *Lactobacillus acidophilus*, an important bacteria that promotes the good health of the intestines. This can be explained by the high amounts of chlorophyll and fibrous cell walls in Chlorella that causes the beneficial lactic acid bacteria in the gut to multiply four times the usual rate, and at the same time remove the foul smell of the stools. Thus, the digestion and the assimilation of nutrients are vastly improved.

Chlorella and Enzymes

Chlorella helps improve digestion because it contains digestive enzymes such as chlorophyllase, pepsin and several others that our bodies require. Studies carried out by Dr. Randall Merchant and other researchers in Japan showed that Chlorella helps in healing and relieving symptoms of ulcerative colitis.

Chlorella Balances Acid-Alkaline in the Body

Optimum pH of 7.4 is important for the maintenance of the internal environment of our bodies. Most diseases start, live and thrive in acidic environment, and not in alkaline environment. Chlorella is an alkaline food because of its high contents of calcium, magnesium, potassium, zinc and iron. Thus, it counters the acidic foods and help raise the pH level towards the alkaline side of the scale. This, in turn, promotes increased bone mass, and vastly improves metabolic functions. The chlorophyll in Chlorella also flushes out the acidic toxins from the body via the digestive system.

Chlorella and Weight Management

Chlorella helps in weight management program by providing high levels of easily assimilated nutrients needed by the body which will in turn reduce food cravings and eating binges. It works by restoring the natural balance of the body, so that a permanent change in overall health and weight can be achieved, and by the addition of GLA to the diet. Incorporating Chlorella into a well-balanced weight-loss program will bring back the endocrine system into a state of balance, improve the effectiveness of the program, and in long run lose their desire for unnecessary junk foods or meals. Consumption of Chlorella corrects the magnesium deficiency which is known to produce intense cravings, especially for chocolates and sweets. Adequate supply of B vitamins in Chlorella, corrects the hormonal signals which leads to the body's hunger signals to quiet down. Moreover, the presence of GLA in Chlorella helps in regulating blood sugar and control insulin, which naturally leads to reduced carbohydrate binging. The effectiveness of Chlorella is due to the fact that it satisfies the appetite by providing the required energy and nutrients, and at the same time cleanses the digestive tract and stimulates the peristaltic function of the intestine.

Chlorella Stimulates Wound Healing

Chlorella helps to heal wounds and burns when applied topically. This is made possible by the high amount of chlorophyll and CGF that cleanses and accelerates healing of wounds and burns, when applied topically. Besides that, Chlorella also helps promote the healing of diabetic skin ulcers due to an increase in the production of fibroblasts that help the body to repair wounds. Consumption of Chlorella on a regular basis over a long period of time will increase the body's ability to heal itself of wounds without the need to apply it externally. Several Japanese doctors have showed that ulcers healed rapidly and wounds which were unresponsive to various medications and treatments finally healed when the patients took oral doses of Chlorella and CGF. Other studies have revealed that CGF stimulates both plant and animal cells to reproduce at a faster rate, which helps speed up healing.

- Oral administration of a unicellular green algae, *Chlorella vulgaris*, prevents stress-induced ulcer.

Planta Med 1997 Oct;63(5):465-6.

Chlorella and Children's Health

Chlorella is a useful daily dietary supplement for pregnant and breast-feeding mothers. This will ensure that the infant is constantly supplied with all the special health benefits of Chlorella. Studies carried out by Dr. Yoshio Yamaguchi showed that children that were given Chlorella exhibited greater height and weight gain as compared to children not given Chlorella. Chlorella contains high levels of arginine, an amino acid that promotes the secretion of growth hormones in the body. Furthermore, the RNA in CGF is found to stimulate the pituitary gland to secrete growth hormones, and helps in the development of brain cells. The rich nutrients in Chlorella, such as vitamins, minerals and proteins help provide better nutrition for growth and overcome deficiencies.

Chlorella Relieves Arthritis

The outer cell wall of Chlorella contains glucosamine which is useful in the renewal of cartilage, tendons and ligaments. Furthermore, the wide range of antioxidants such as chlorophyll, vitamins A, C, and E, carotenoids and selenium in Chlorella help combat arthritis by neutralizing the effect of free radicals. It also contains omega-3 fatty acid that is known to benefit in the treatment of arthritis besides alleviating morning stiffness or chronic muscles aches.

Chlorella Improves Eyesight

Chlorella is known to be a good source of lutein, a member of the carotenoids that has been found to be useful for the prevention and treatment of macular degeneration. Studies carried out by researchers in Harvard found that people with the highest consumption of lutein and zeaxanthin-rich food had a much lower risk, as much as 57%, of macular degeneration as compared to people who consumes the least amounts of these nutrients. Chlorella, being a natural whole food, contains the balanced amounts of carotenoids.

- Antioxidant and anti-cataract effects of Chlorella on rats with streptozotocin-induced diabetes.

J Nutr Sci Vitaminol (Tokyo). 2003 Oct;49(5):334-9.

Chlorella Protects the Liver

Studies carried out in the Republic of China, Japan, and Germany has revealed tremendous potential of Chlorella in preventing and reversing the various liver problems. Animal studies carried out as early as the 1950s by Dr. Hermann Fink in Germany showed promising therapeutic effect of algae on the liver. In the 1970s, studies by Chinese scientists in Taiwan showed that Chlorella could protect the liver from damaging effects of malnutrition and toxins such as ethionine even at a low (5%) supplementation level. In 1975, Japanese researchers found that supplementation with Chlorella lowered both blood and liver cholesterol.

- Protective effect of Chlorella on the hepatic damage induced by ethionine in rats.

Taiwan I Hsueh Hui Tsa Chih 1979 DEC;78(12):1010-9

Chlorella Prevents Allergies

Animal studies carried out indicated that CGF suppresses the excessive production of IgE which is excessively produced during allergic reactions, and thus, can prevent allergies. Researchers in Japan (1997) showed that supplementation with Chlorella (3 – 5 grams) alleviate atopic dermatitis in children. Besides that, Chlorella was also found to help with infantile bronchial asthma, allergies and indigestion to eggs and milk. The high levels of antioxidants in Chlorella help quench free radicals and reduce their effect on allergies.

Chlorella and Blood Sugar

Studies have shown that low levels of magnesium can increase the risks of developing Type II diabetes by as much as 30%. It is known that 80% of diabetic patients have low levels of magnesium, where many health practitioners label diabetes as a “magnesium deficiency state”. Being rich in magnesium, Chlorella can help to normalize blood sugar levels.

- Therapeutic potentials of unicellular green alga Chlorella in advanced glycation end product (AGE)-related disorders.

Med Hypotheses. 2005;65(5):953-5.

- Potential hypoglycemic effects of Chlorella in streptozotocin-induced diabetic mice.

Life Sci. 2005 Jul 15;77(9):980-90. Epub 2005 Apr 7.

- Improving glycogenesis in Streptozocin (STZ) diabetic mice after administration of green algae Chlorella.

Life Sci. 2006 Feb 9;78(11):1181-6. Epub 2005 Nov 14.

Chlorella and Fibromyalgia

In a study involving fibromyalgia patients, 88% of them experienced vast improvements in their symptoms, and 45% experienced soothing comfort, after three months of high dosage of Chlorella (10 grams daily).

- Nutritional supplementation with *Chlorella pyrenoidosa* for patients with fibromyalgia syndrome: a pilot study.

Phytother Res 2000 May;14(3):167-73

- Nutritional Supplementation with *Chlorella pyrenoidosa* for Fibromyalgia Syndrome: A Double-Blind, Placebo-Controlled, Crossover Study.

Journal of Musculoskeletal Pain 2002 9(4): 37 - 54

Chlorella and Skin Health

Chlorella also helps in attaining a much younger looking skin in weeks. This is due to the fact that Chlorella is rich in nucleic acids that repair the skin and shield them from free radical damages that cause the signs of aging. Besides nucleic acids, Chlorella is also rich in lysine, the amino acid that builds collagen and promotes youthful skin. The beta-carotene and other carotenoids, vitamin E, and the fatty acids in Chlorella help in rejuvenating flagging skin, smoothening wrinkles and lightening age spots whereas the chlorophyll present cleanses the blood and bowels. Clean blood and bowels often results in healthy radiant skin. Moreover, the easily digested and assimilated nutrients in Chlorella provide optimum cellular nutrition for the renewal of healthier cells resulting in a younger, more beautiful and vibrant-looking skin.

Consumption of Chlorella

For general health maintenance, 3 – 4 grams per day of Chlorella is recommended. The dosage should be increased to 6 – 8 grams for relieve of actual health symptoms. Cancer patients have been known to consume as much as 30 grams per day. Children can take one half to one quarter of the adult dose. Chlorella has been shown to promote rapid growth in children, as well as build in them superior immune systems. Chlorella can be taken at any time of the day, but is best taken about half an hour before meal for optimum digestion. The best time to take it is in the morning before breakfast, but never just before or after drinking coffee or soft drinks since caffeine is extremely detrimental to the digestive process. When taken with meals, Chlorella helps in digestion and better assimilation of nutrients from the food. This is due to the fact that Chlorella causes the bacteria in our digestive tract such as Lactobacilli, to multiply at four times the rate of normal. It can be taken all at once or it can be taken in small doses throughout the day. It is a natural whole food, is non-toxic and may be taken in quite large amounts without any unpleasant side effects. In other words, it makes a perfectly safe nutritional supplement. To date, there have been no reports on detrimental effects on human health as result of taking Chlorella. However, if an individual has never been on health supplements, then Chlorella should be introduced slowly in the diet with a dosage of 200 mg daily, and slowly increasing it daily. Then again, people who are deficient in cellulose may not be able to tolerate Chlorella. These individuals are advised to consume Chlorella with a good enzyme supplement. Besides ingestion, Chlorella can be powdered and mixed with water into a paste and applied over a cut, scrap, rash or serious wound to help effectively heal it. After consuming Chlorella for approximately one year, an individual will notice significant healing improvements of cuts, scraps, and wounds without the need to apply it topically.

Initials Reactions on Taking Chlorella

People who take Chlorella for the first time may find that they have better digestion where their bad breath and constipation will be reduced significantly, and they may feel more energetic. Some individuals may not experience any difference at all which does not mean that they are not benefiting from Chlorella. This may be due to the fact that many benefits of Chlorella are very subtle, such as the removal of heavy metals from the body which can take up to 6 months with a dosage of 15 – 20 grams daily. However, some individuals may experience cleansing reactions such as gas, cramping, constipation or diarrhea, the first time they consume Chlorella. Individuals who have had allergies in the past may develop a sudden rash, pimples, boils, eczema or their previous allergic reaction returning upon consuming Chlorella for the first time. These reactions are usually referred to as the “healing crisis” which is due to the high fiber content and other nutritional factors of Chlorella. These reactions are normal and are similar to that experienced by individuals switching from a low-fiber junk-food diet to a high-fiber natural food diet. For these individuals, it is advisable to start off with a lower dosage (200 mg) and slowly increasing by 200 mg each day. As long as an individual is not showing an allergic reaction such as hives or throwing up, consumption of Chlorella can be safely continued. In a couple of months, the reactions should decrease, and as it decreases, the dosage can be slowly increased.

References

Bewicke, Dyana & Potter, Beverly A., Ph.D. *Chlorella: The Emerald Food*. Berkeley, CA: Ronin Publishing, 1984.

Bishkinn, Estitta, MS, CNC and Bushkin, Gary, MS, CNC. *All About Green Food Supplements*. New York: Avery Publishing Group, 1999

<http://www.chlorellafactor.com> Superfoods For Optimum Health: Chlorella and Spirulina by Mike Adams, the Consumer Wellness Research Center

<http://www.dcnutrition.com/Miscellaneous/Detail.CFM?RecordNumber=715> Chlorella - General Discussion

<http://www.neuraltherapy.com/heavyMetalDetox.doc> A Comprehensive Review of Heavy Metal Detoxification and Clinical Pearls from 30 Years of Medical Practice
Dietrich Klinghardt, MD, PhD

Jensen, Bernard, PhD. *Chlorella: Gem of the Orient*: Escondido, California: Jensen Publication, 1987.

Jensen, Bernard, PhD. *Chlorella: Jewel of the far East*. Bernard Jensen, Publisher, CA USA, 1992

Lee, William, H & Rosenbaum, Michael *Chlorella, the Sun-Powdered Supernutrient and its Beneficial Properties*: New Canaan, Connecticut: Keats Publishing, Inc 1987.

Pati, Kumar, Ph.D., *et al. Chlorella*, Health World Special Issue, CA USA 1989

Running, J.A., Huss, R.J., Olson, P.T. (1994) Heterotrophic production of ascorbic acid by microalgae. *Journal of Applied Mycology* 6: 99-104.

Sansawa, H., Inoue, K. & Shirai, T. (2002) Effect of Chlorella Tablet Ingestion on Mild Hypercholesterolemic Patients. *Nippon Shokuhin Kagaku Kogaku Kaishi* 49(6): 395-400

Steenblock, David, B.S., M.Sc., D.O. *Chlorella – Natural Medicinal Algae*. El Toro, Calif: Aging Research Institute, 1987

Tse, Paul *The Detoxification, Immunostimulation and Healing Properties of Chlorella*, World Convention of Traditional Medicine & Acupuncture, Singapore, 2000.

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Dr. Haresh holds a Bachelor of Science and M.Sc Degree in Microbiology and a Doctorate Degree in Medical Science. His interest in Wellness and Natural Medicine is very wide, having given several talks in these areas and obtained training in Pranic Healing. He is also currently having students working under his supervision, for both Bachelors and Masters degrees in various aspects of health, including development of functional food and drinks, anti-microbial properties of different plant extracts, identification of food borne pathogens using PCR, and prevalence of metabolic syndrome. He is a prominent speaker and writer on wellness and health. Presently he is an Assistant Professor, in a private university in Kuala Lumpur.