

The therapeutic properties of Edible Algae for the promotion of health and support of disease : A combined Western and Eastern perspective

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Article Summary : This article is written with the aim of bringing together the very best of the current evidence we have at our fingertips about the therapeutic properties of edible algae. It is written to detail both Medical Research and concepts pertaining to The Western Allopathic Medical Model and also Traditional Chinese Medicine (TCM) , whilst touching briefly on Ayurvedic Medicine i.e. Traditional Indian Medicine. As an Integrative Medical Doctor with a British Medical Degree it is my hope we can make use of these and other wonderfully natural and adaptogenic foods. I seek to illustrate that this can support our patients alongside more conventional methods and treatments, bridging the gap between Eastern and Western Medical Practice and bringing the very best of everything we have together to enhance patient care and well being.

Introduction

Algae, in particular Spirulina and Chlorella have been prescribed by doctors and herbalists in China and Japan for centuries, and used intuitively by tribes in parts of Africa, America, Mexico and elsewhere for thousands of years . More recently Russian doctors have advocated the therapeutic use of edible blue green algae¹ to help patients recover from radiation exposure, including the effects of the nuclear disaster at Chernobyl. Since the 1930's chlorophyll, found in its most concentrated natural source in algae, has been used topically to promote the healing of ulcers, including those which have become gangrenous.

More recently NASA scientists have started researching algae use for astronauts during space missions due to its unique concentration² and bioavailability³ of life sustaining nutrients⁴. Blue- green algae is in fact fully assimilated in about 90 seconds with the expense of very little energy.⁵

¹ AFA (*Alphanizomenon flos- aquae*) and Spirulina are classified as the edible species of blue green algae.

² Edible algae are recognised as complete foods providing the correct balance of protein, carbohydrate, vitamins and minerals needed to sustain an individual.

³ Bioavailability is a measure of how much of a food we can actually absorb into the bloodstream. The nutrients in many complex foods are recognised as much less bioavailable than those found in algae which have been show to be between 95-98% bioavailable. In terms of protein Spirulina has been shown to provide 85% bioavailability whilst beef 20 % bioavailability. (Beach, R 'Modern Miracle Men' , 74th Congress , 2nd session US Senate Document , no. 264 June 1936, US Government Printing Office, Washington, DC, 1941 p1.) Most importantly this is even the case even if your absorption system i.e. your digestive system is not functioning normally and effectively, a common factor for many patients with an illness or disease from both a Holistic and Traditional Chinese Medical perspective.

⁴ These findings were published in The Journal of the National Cancer Institute.

⁵ Typically 60-70% of our daily energy is used in digestive processing. When we are able to make this process more efficient by the consumption of foods with high bioavailability and assimilability we find ourselves with so much more energy to channel elsewhere.

Algae are by nature some of the most 'adaptogenic' foods on the planet. It is interesting to note that they were the first known life form on earth and have survived and 'adapted' for over four billion years, whilst many others have become extinct.

Thus we can see through the law of similar, i.e. '*like cures like*', those who consume adaptogenic foods regularly enjoy heightened sensitivity and perception of both their internal and external environment. In turn this allows for wonderful opportunities on all levels of biological functioning for a heightened cooperation, versatility and, by definition, adaptability to one's environment.

Adaptability and cooperation is hypothesised by a number of current eminent biologists like Prof Bruce Lipton PhD⁶, to be the single most important factor which influences longevity providing for a healthy and happy life. Following on from this concept the colour green and consumption of green foods has long been associated in TCM⁷ with the concept of adaptability, reducing and sedating excesses, whilst strengthening weaknesses. Chlorophyll rich foods are often reported as facilitating humans to see things from a different view point/ perspective thus enabling a change in one's path forward.

Algae and cereal grasses, like wheatgrass and barley grass have the unique ability both to purify and cleanse; whilst simultaneously nourishing and rebuilding tissues. Perhaps this characteristic alone explains the central role these amazing foods play. It is of fundamental importance in clinical practice and everyday usage to fully understand both of these groups of qualities which algae possess so as to best advise on their consumption.

In general TCM algae is recognised as having a sweet and salty flavour thus acting specifically on The Spleen and Kidneys and also as a tonic of the Blood, Qi⁸ and Jing⁹ acting throughout the meridian system¹⁰/ the body. Algae has many different active constituents perhaps the most well known of which is chlorophyll. Again this has many

⁶ Prof Bruce Lipton PhD is a former medical school professor and research scientist. I strongly recommend his work in particular *The Biology of Belief* and *The Wisdom of Our Cells* which apply the concepts of quantum physics to cellular biology illustrating beautifully the connection between our internal and external environment and our biological functioning.

⁷ Traditional Chinese Medicine.

⁸ The English translation of this word is energy or life force.

⁹ Jing is defined as the source of kidney vitality which determines one's vitality, resistance to disease and longevity.

¹⁰ TCM recognises a number of channels called meridians which connect the internal organs and facilitate the movement of Qi/ energy around the body.

properties which I examined in my earlier article *The Amazing Healing Powers of Chlorophyll*¹¹. Perhaps of particular note is its remarkable ability to build Blood.^{12 13}

Algae, is one of the most alkalising of all natural foods on our planet, providing an abundant supply of many alkalising minerals and compounds¹⁴. This explains its incredibly useful role in the development and maintenance of a more alkaline internal environment and thus its potential in the treatment of diseases and illness including cancer, and their development in the first instance.¹⁵

We will now look in more detail at the individual energetic qualities of the different species of algae and how they support the cyclical rhythms and patterns of life beautifully encouraging the perpetual processes of excretion, regeneration and rejuvenation which are so essential for the free flow of our Qi /energy.

A focus on *Alphanizomenon floz- aquae* (AFA)

AFA is composed of 3-6 % chlorophyll making it the most concentrated of all chlorophyll food sources on our planet, including the other edible algae. It is understood and accepted that the higher the chlorophyll content of a food the more cooling, cleansing and detoxifying its action. This explains AFA's exceptional cleansing and purifying properties.

AFA is also an excellent source of protein, 60 % by weight, containing a complete array of amino acids.(The significance of this is discussed further in the section *focus on Spirulina.*)

In TCM AFA is recognised as a cooling, bitter food which penetrates the heart- mind function. Of all of the algae it is recognised as the most active in this context. The Chinese believe that bitter foods focus the mind and build the blood, and that ' *it is the heart that houses the mind* ' and' *the blood which carries the thoughts*'. Thus AFA is often described as helping those who enjoy it to find a better sense of inner harmony and balance in

¹¹ Please visit my website www.drkatejames.com if you would like to read and download this article

¹² Chlorophyll, often referred to as, ' the blood of plants' is almost structurally identical to haem, a substance which sits in the middle of each of our haemoglobin molecules. It is found in its most concentrated natural supply in algae and cereal grasses like wheatgrass and barley grass. Haemoglobin is the protein pigment found in red blood cells which allows them to transport oxygen to our cells. Thus an abundant cellular supply is essential for optimal oxygenation of our tissues. All our bodies need to do to use the chlorophyll to build haem is to exchange its central magnesium atom or piece for an iron one. This helps to explain why consuming foods rich in chlorophyll is so effective in the support of blood conditions and those which are directly linked to poor tissue oxygenation i.e. cancer. For more about Chlorophyll including a more in depth look the evidence for its blood building properties and therapeutic role in the treatment of anaemia please see my article entitled *The Amazing Healing Powers of Chlorophyll*.

¹³ Of further note is the actual bioavailability of iron in Blue -green algae. Thus Blue-green algae provides both a plentiful supply of Chlorophyll and iron: The building blocks of our blood.(From The Review of Natural Products by Facts and Comparisons. St Louis, MO : Wolters Kluwer Co., 1999.)

¹⁴ These include calcium, magnesium , potassium and many other trace minerals and their related compounds. For a complete nutritional breakdown of AFA please see ref 26

¹⁵ For an evidenced based scientific explanation and exploration of these concepts please see my previous articles '*Understanding Cancer Better*' and '*A little more about pH*'

many aspects of their body functioning. In TCM there is a great interdependence between the free flow of qi/energy in the physical body and the strength of mind/ blood. In essence they are both a manifestation of the other. This helps us to understand the profound changes in many aspects of both mental functioning and also physical function when such foods are integrated into the diet.

In the context of psychological and cognitive activity AFA's effects can manifest in a number of ways. These include: better concentration, improved mental focus and clarity, increased mental stamina, a deepened sense of relaxation, and improved sleep quality. It is also recognised as a facilitator of meditation and prayer.¹⁶ These characteristics and qualities can further be explained by the actions of phycocyanin, a pigment found in abundance in both AFA and Spirulina and the amino acid, (protein building block) Phenylethylamine, (PEA) found only in AFA.

Phycocyanin is known to facilitate the drawing together of amino acids¹⁷, the building blocks of neurotransmitters. It is our neurotransmitters that allow our brain cells to communicate to each other. PEA is well recognised in its support of depression having the ability to help elevate mood. It is also documented as playing an important role in the neurological imbalances characterised by Attention Deficit Disorder and some learning difficulties.¹⁸ Further it is PEA which is released when we are deeply absorbed in a pastime like drawing, writing or reading and also when we experience feelings of love and joy. It is naturally found in concentrated amounts in various other foods like chocolate, red wine and some types of cheese.

AFA's psychoactive characteristics help to illustrate AFA's particularly valuable role in the support of those working through all forms of addiction, disordered patterns of eating (including anorexia or bulimia and/ or body dysmorphic disorder and or obesity), as well as depression and anxiety. In my practice I also feel that these qualities of AFA are integral in the support of those with cancer, at all stages of the condition including end stage palliative disease.

In TCM AFA is classified as having a drying quality and is thus able to counteract internal forms of dampness. Cancer is one of these, being classified as a '*damp condition*.'¹⁹ In particular this explains its exceptionally therapeutic role in the of supporting of cancer patients, as well as those wanting to minimise their risk of developing the condition. It is interesting to note that the other species of algae do not have the same drying quality.

AFA works on the kidneys with a mild diuretic/ cleansing action and is particularly noted as able to overcome liver stagnancy. Here we have a substance able to support the liver and facilitate cleansing via the kidneys. Again an understanding of its functioning in a TCM context helps us understand the crucial role AFA has to play in supporting cancer patients.

¹⁶ Healing With Whole Foods by Paul Pitchford 3rd ed p 235

¹⁷ Healing With Whole Foods by Paul Pitchford 3rd ed p231

¹⁸ Primordial Food AFA: A Wild Blue- Green Alga with Unique Health Properties by Christian Drapeau, MSc. 2003

¹⁹ Healing With Whole Foods by Paul Pitchford 3rd ed p410 . You may also be interested in my article *Cancer explained: A Traditional Chinese Medical Perspective*.

The evidence: Recent AFA scientific trials

In my original AFA article entitled ‘*My favourite of all AFA*’ I have discussed some of the important immunological properties of AFA and their potential role in supporting and preventing cancer naturally. Below I have summarised some of the recent scientific trials which detail this evidence.

AFA is recognised as having an ability to increase both the production and release of a particular type of white blood cell called Natural Killer cells (NK cells), which are the body’s first line of defence against rogue cancer cells and viruses. These cells work to detect and destroy abnormal cellular material or viruses engulfing them. A crossover placebo-controlled, randomised, double-blinded study was published in 2000 in The Journal of American Nutraceutical Association illustrating these effects. **The dosage used was 1.5 g daily**, (just 3 capsules of E3AFA²⁰). I have copied below the conclusion of the paper:

“Consumption of AFA leads to rapid changes in immune cell trafficking, but not direct activation of lymphocytes. Thus, AFA increases the immune surveillance without directly stimulating the immune system.”²¹

Recent research conducted at The Royal Victoria Hospital in Montreal Canada by Dr. G Jensen et al concluded:

“ Eating Aphanizomenon flos-aquae triggers the movement of 40% of the circulating NK cells from the blood to the tissues where their main function is to perform immune surveillance and eliminate cancerous and virally-infected cells. Further research may prove that eating a small amount of AFA every day could assist in the prevention of cancer and viral infections. No other substance is known to trigger such a movement of NK cells in the body.”²²

Thus, in conclusion, blue green algae facilitates the movement of Natural Killer Cells to where they are needed to help our bodies to engulf cells and viruses more efficiently. It is of note that in longer term users, (i.e. those who take AFA for longer than a few weeks duration) these positive immunological effects become stronger.²³

²⁰ E3AFA is harvested by a company called E3Live and is of exceptionally good potency. It is one of a number of different companies which harvest and supply AFA.

²¹ Jensen G., et al. Consumption of Alphanizomenon flos-aquae has rapid effects on the circulation and function of immune cells in humans. A novel approach to nutritional mobilisation of the immune system. Journal of the American Nutraceutical Association. January, 2000; 2 (3) 50-8

²² Manoukian R., et al. Effects of the blue-green algae Alphanizomenon flos-aquae (L.) Ralphi on human natural killer cells. Phytochemicals: Examining the health benefits and pharmaceutical properties of natural antioxidants and phytochemicals. IBC Library Series 1911, ch. 3.1, March 1998, 233-41

²³ Manoukian R., et al. Effects of the blue-green algae Alphanizomenon flos-aquae (L.) Ralphi on human natural killer cells. Phytochemicals: Examining the health benefits and pharmaceutical properties of natural antioxidants and phytochemicals. IBC Library Series 1911, ch. 3.1, March 1998, 233-41

The study also concluded that AFA stimulated both the activity and motility of other types of immune cells including T- cells and B-cells and slightly increased the phagocytic²⁴ activity of Polymorphonulceocytes (PMN's)

T- cells and B- cells work together with a number of other cells like NK cells and PMN's to make up our immune defenses. It is vital to understand that many cells lines work to support another and in essence are by definition ' *one system* ' which protects the body . B- cells are described as our *innate immune system* whilst T-cells our *Specific immune system*. In summary it is T-cells which work with B- cells to perform our most sophisticated immune processes, i.e. the recognition of unique invaders called antigens, and the production and facilitation of unique proteins to destroy them. These so called antibodies work to target invaders using a special lock and key mechanism .

Whilst NK cells are the body's first line of defence against cancer cells many different types of immune cells and mediators are involved in the recognition of and destruction of them. Interestingly a T-cell mediated process, i.e. *Specific immunity*, is the mechanism by which many drugs, including the newer forms of chemotherapy, work (e.g. Herceptin.)

In another study a water based extract of AFA containing high concentrations of phycocyanin, its blue pigment known to have anti inflammatory and antioxidant properties, was found to inhibit in vitro growth of one out of four tumour cell lines, indicating that at least some tumour cell types may be directly sensitive to killing by phycocyanin.^{25 26}

AFA's ability to enhance the release and migration of stem cells from the bone marrow and act in an anti-inflammatory capacity, through Cox-2 inhibition, are also discussed in my original AFA article ' *My favourite of all AFA* '.

Stem cells are the cells from which embryos develop and are in abundance during very early life. In the adult organism stem cells are rarely found in the bone marrow and very rarely elsewhere. They have the potential to develop into any type of tissue i.e. blood, bone, muscle, heart and so forth. Thus they are able to facilitate complete regeneration and repair of any living tissue. This extract was taken from Primordial Food the original text describing the original research conducted on stem cells:

“ AFA is the only natural compound to date which has been recently shown to stimulate stem cell release and migration. Based on this information a patent has been filed regarding the use of AFA for the treatment of Parkinson's disease, Alzheimer's disease, diabetes, multiple sclerosis, cardiac arrest recovery and regeneration. ”²⁷

²⁴ 'Phagocytic' means the ability to engulf and absorb allowing certain types of white blood cell to perform their function of taking in harmful material and destroying it.

²⁵ Bioregulatory and Therapeutic Effects of Blue Green Algae: Kumar K.; Lakshmanan A.; Kannaiyan S; Indian Journal of Microbiology 2003, vol, 43, no1, pp. 9-16.

²⁶ Phycocyanin is also found in Spirulina

²⁷ Primordial Food AFA: A Wild Blue- Green Alga with Unique Health Properties by Christian Drapeau, MSc. 2003

In further preliminary research conducted last year an ethanol extract of AFA- cellular concentrate was shown to increase stem cell proliferative action when incubated with adult bone marrow cells or human CD34+ haematopoietic progenitors in culture.²⁸ These properties of AFA are in particular very exciting, although it is too early to say what the 'real significance' of these findings are.

Research into the properties of AFA remains ongoing at a number of scientific institutions including McGill University, Boston University, The University of New Mexico, The Royal Victoria Hospital in Montreal, The Research Institute of Oncology in Belarus, Russia, Sloan Kettering Cancer Centre and The American National Cancer Institute.

AFA can be taken in both a live liquid and dried form, and as a single food or in a chlorophyll rich blend preparation. It makes up approximately 5 % by weight of Dr. Schulze's Superfood²⁹ which is one of a number of blends available in the UK and internationally. Many people who enjoy AFA choose to take it both singly and in a combination blend.

Two to four tablets i.e. 1-2 g (AFA) give a 'standard' daily dosage³⁰ however those people with more specialised requirements often need more. As people enjoy and adapt to this food they often choose to take more enjoying the many benefits it brings to their health and well being.

It is difficult to make exact comparisons between the potency of live liquid and dried AFA . Choosing which form to take really depends on your individual needs.³¹

(If you are considering using AFA and take the medication Warfarin please read the section on using algae wisely and safely and in particular read footnote 60.)

A focus on Spirulina

Due to its lower chlorophyll content, 0.7-1.1% Spirulina is classified as more gentle and tonifying than other algae species being less cooling and cleansing.

²⁸ Shytle, R., et al. Effects of blue-green algae extracts on the proliferation of human adult stem cells in vitro: A preliminary study. Med Sci Monit 2010; 16(1): BR 1-5.

²⁹ Dr. Schulze's Superfood is a dried combination blend of approximately 90-95% : AFA, Spirulina, Chlorella, wheatgrass and barley grass, with approximately 5-10%: dulse, spinach leaf , acerola cherry, beet tops, palm fruit, rose hips. lemon and orange peel added. It is one of a number of different blends of chlorophyll rich foods available in the UK and internationally.

³⁰ As algae is a food supplement there is no recognised recommended daily amount. Thus the notion of a standard daily dosage is difficult to quantify and I find in my practice can vary greatly depending in an individual's needs . I have taken these dosages from Healing With Wholefoods by Paul Pitchford 3rd ed and feel they are a useful guide.

³¹ For a comparison of the composition of liquid and dried AFA please visit http://www.e3live.com/research/nutrition_profile.html

Spirulina is noted for its tonification of the body's Yin fluids. The Yin fluids³² include all the fluids and secretions in the body thus Spirulina is considered by many to be the most useful of the algae in the context of enriching and building the blood. This is of particular importance in the treatment of anaemia,³³ (please also see footnote 12) and the support of cancer patients.

Interestingly Spirulina has been found to inhibit HIV replication in human T-cells, peripheral blood mononuclear cells and Langerhans cells found in both the lymphatic system and various organs³⁴ and is widely accepted as having many immune strengthening properties.

Many edible algae share many common characteristics. Like AFA it also helps to support and promote mental focus due largely to its phycocyanin content. They also both provide an excellent source of complete predigested protein. In Spirulina this is called biliprotein. Together with its plentiful supply of live enzymes this makes algae particularly nourishing and sustaining for those with compromised or weakened digestive function.³⁵ Spirulina is 68% protein by weight and being less concentrated in its actions than AFA it can also be generally enjoyed in larger quantities thus allowing for the easier consumption of a larger amount of plant protein. People who eat it regularly in their diet frequently describe the requirement and craving for much less animal protein.

Spirulina can also play an important role in supporting weight loss and the maintenance of a healthy weight. This is in part because of its excellence as a protein source but can also be explained by several other factors. It is recognised as an excellent source of the compounds needed to build thyroxin, a key hormone in the body, which controls and regulates metabolism and body weight. Further, it supplies many easily assimilable minerals like chromium and magnesium which are fundamental in the control of blood sugar and many other homeostatic functions. The characteristics explained above make algae an excellent food choice for supporting those with diabetes and blood sugar imbalances.³⁶ It is also worth noting that some of its carbohydrate has also been pre-metabolised with some remaining as glycogen thus giving those who consume it both a short term and longer term steady supply of energy.

It is also recognised for its strengthening action throughout the body acting particularly strongly on the liver, kidneys and arteries. The mucopolysaccharides found in the cell walls of Spirulina are complex sugars which can strengthen heart muscle and protect the cardiovascular system against vascular disease. A 2008 randomised, double-blind,

³² For more information on the concept of Yin please see my previous article entitled *Building Our Yin*.

³³ Please see my article entitled '*The amazing Healing Powers of Chlorophyll*' for a full discussion of the role of Chlorophyll rich foods in the treatment of anaemia.

³⁴ Ayeahunie, S. et³⁴ The mucopolysaccharides found in the cell walls of Spirulina are complex sugars which can strengthen heart muscle and protect the cardiovascular system against vascular disease. al. " Inhibition of HIV-1 Replication by an Aqueous Extract of Spirulina platensis. JAIDS: Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology. 18,1, May 1998:7-12.

³⁵ This almost always includes anyone with a serious or chronic illness.

³⁶ Readily available protein and trace minerals are vital to achieve stabilisation of blood sugar in those with diabetes and impaired glucose tolerance, including those with Syndrome X and some forms of Polycystic Ovary Syndrome.

placebo-controlled intervention study involving geriatric patients determined that Spirulina helped to significantly reduce the LDL (Low Density Lipoprotein) to HDL (High Density Lipoprotein) ratio after four months of supplementation.³⁷ This is considered as one of the variables which can contribute to cardiovascular risk and is conventionally treated with a Cholesterol lowering diet and/ or the use of medications.

Spirulina is usually taken in a dried form and can be taken as a single food or in a chlorophyll rich blend preparation. It makes up approximately 30 % by weight of Dr. Schulze's Superfood³⁸ which is one of a number of blends available in the UK and internationally. A 10g dose of Spirulina once or twice a day provides an ample amount for most people. Those with more specialised needs often need more. Again, as people enjoy and adapt to this food they often choose to take more enjoying the many benefits it brings to their health and well being.

(If you are considering using Spirulina and take the medication Warfarin please read the section on using algae wisely and safely and in particular read footnote 60.)

A focus on Chlorella

Chlorella is classified as a green algae which is the least cooling, most tonifying and most gently cleansing of all the edible algae.

Many of its most notable qualities are associated with its tough outer cell wall. These include its ability to bind with heavy metals, pesticides and other such carcinogens like PCB's (polychlorobiphenyls) and so gently and safely allowing the body to excrete them.³⁹ This also helps to explain the crucial role of Chlorella in removing the residues of chemotherapy from the body, many forms of which contain heavy metals e.g. Cisplatin and Carboplatin.

³⁷ Park, H.; Lee, Y.; Ryu, H.; Kim, M.; Chung, H.; Kim, W. (2008). A randomised double-blind, placebo-controlled study to establish the effects of Spirulina in elderly Koreans. *Annals of nutrition and metabolism* 52 (4): 322-328.

³⁸ Dr. Schulze's Superfood is a dried combination blend of approximately 90-95% : AFA, Spirulina, Chlorella, wheatgrass and barley grass, with approximately 5-10%: dulse, spinach leaf, acerola cherry, beet tops, palm fruit, rose hips, lemon and orange peel added. It is one of a number of different blends of chlorophyll rich foods available in the UK and internationally.

³⁹ Healing with Whole Foods by Paul Pitchford 3rd ed. p232

Chlorella has also been identified as able to stimulate T-cell⁴⁰ and Natural Killer cell activity together with facilitating interferon production.⁴¹ The latter two properties are mediated by complex polysaccharides found in its cell wall. Interferon is a substance produced by cells which plays many different protective roles in an organism. These include inhibiting the proliferation of cancer cells, helping to fight viral infections and supporting the body in destroying parasites and bacteria. Furthermore, Interferon is also able to augment Natural Killer Cell activity. Further studies have also identified it as an immunomodulator with antitumour properties⁴² and antiviral activities⁴³. It has been suggested that the remarkable protective properties of Chlorella's cell wall help to strengthen the body's cell walls against toxins and invading bacteria, viruses, protozoa and fungi as they incorporate its properties and qualities through the law of similar 'like cures like.'

Chlorella also contains CGF, Chlorella Growth Factor, derived from Chlorella's RNA/DNA⁴⁴. This makes up 13 % of its weight in comparison to 4.5% of Spirulina's.⁴⁵ In real terms this means it is viewed as a superior source of the building blocks for genetic nuclear repair and protein production both of which are key in facilitating cellular repair and regeneration. This becomes particularly important as we age, and is a key factor in protecting our cells from any form of daily environmental damage or that which ensues from the global, non specific⁴⁶ effects of radiotherapy and most older types of chemotherapy treatment.

⁴⁰ Oral administration of Chlorella augments concomitant antitumour immunity. Tanaka K et al. Immunopharmacol Immunotoxicol. 1990; 12(2): 277-91. This study specifically detailed a T-cell mediated antitumour effect of Chlorella in mice.

⁴¹ Kojima, M. et al. A Chlorella polysaccharide as a factor for stimulating RES activity. Journal of the Reticuloendothelial Society 14: pp 192-208, 1973.

Kojima, M et al. A new Chlorella polysaccharide and its accelerating effect on the phagocytic activity of the reticuloendothelial system. Paper delivered at: Symposium II: Phagocytic Activity of RES, Dept. of Pathology, Fukushima Medical College, Fukushima City, Japan.

White, R. and Barber, G. An acidic polysaccharide from the cell wall of Chlorella. Research at: Dept. of Biochemistry, Ohio State University . 484 W.12 Ave., Columbia , OH 43210.

Komiyama, K. et al. An acidic polysaccharide Chlon A from Chlorella. Antitumour activity and immunological response. Research at: The Kitasato Institute, Japan.

⁴² J Ethanopharmacol. 1988 Dec; 24 (2-3): 135-46 Immunomodulation by a unicellular green algae (Chlorella pyrenoidosa) in tumour-bearing mice. Miyazawa Y et al.

⁴³ Canadian Medical Association Journal , July 22, 2003; 169 (2). Safety and immunoenhancing effect of a Chlorella- derived dietary supplement in healthy adults undergoing influenza vaccination: randomised, double-blind, placebo controlled trial .S Halperin et al.

⁴⁴ DNA and RNA are abbreviations of Deoxyribonucleic and Ribonucleic acid. These are the carriers of a cell's blue print and genetic code.

⁴⁵ ⁴⁵ In traditional classification systems it is documented as the most evolved algae of those discussed because of its RNA/ DNA content and the existence of the organism's true nucleus.

⁴⁶ Most chemotherapy used in the UK and all radiotherapy treatment can be classed as non specific/ global. This is because it destroys all rapidly dividing cells in a non selective way, thus many healthy cells are killed. This accounts for their very diverse unwanted side effects which are typically difficult to treat with conventional treatment.

CGF is also recognised as strengthening immunity by improving the activity of many different immune cells including T- and B- cells and macrophages.⁴⁷ Macrophages, the name of which is derived from Greek meaning, 'big eater,' are cells which function in a very similar way to Natural Killer Cells, destroying cancer cells and cellular debris. Chlorella has also been shown to be effective in reducing cholesterol in the body and preventing atherosclerosis.⁴⁸ In keeping with the other species of edible algae it is a wonderful food for those with diabetes and blood sugar imbalances, having a protein content of 55 % by weight.

All three of the algae discussed are recognised as promoting peristalsis, (gut contraction) and thus reduce gut transit time.⁴⁹ This gives them a particularly therapeutic role in those with constipation. ⁵⁰Algae also help to prevent the reabsorption of any toxins whilst they move through our colons for excretion, forming stable compounds with toxins to ensure safe excretion. This is key to minimising our body's toxic load.

The high chlorophyll content of algae and their various other properties help to cleanse and purify the bowel, acting as a constant 'watchman' for bacteria, viruses, protozoa and fungi which can cause imbalances and disease through opportunistic colonisation. Thus algae can serve an important role in helping the bowel maintain a healthy gut flora and sense of equilibrium.

Chlorella is usually taken in a dried form and can be taken as a single food or in a chlorophyll rich blend preparation. It makes up approximately 60 % by weight of Dr. Schulze's Superfood⁵¹ which is one of a number of blends available in the UK and internationally. A 2-3 g dose of Chlorella daily provides an ample amount for most people. Those with more specialised needs often need more. Again, as people enjoy and

⁴⁷Hamada, M. et al. Immune responsiveness of tumour-bearing host and trial modulation.

Konishi, F et al. Antitumour effect induced by hot water extract of Chlorella: Resistance to meth-a tumour growth mediated by CE-induced polymorphonuclear leukocytes. Cancer Immunology Immunotherapy. Publisher Springer-Verlag, 1985.

Vermeil, O. et al. Anti-tumoural vaccination by peritoneal injection of micro-vegetable(yeasts and unicellular algae.)Archives Medicales de L'Oest-Tome 14(10): pp 423-426.

Tanka, K. et al. Augmentation of antitumour resistance by a strain of unicellular algae Chlorella. Cancer Immunology Immunotherapy. Publisher Springer-Verlag, 1984.

⁴⁸ Hashimoto, S. et al. Effects of soybean phospholipid . Chlorella phospholipid and clofibrate on collagen and elastin synthesis in the aorta and on the serum and lipid contents in rats. In Scientific Research Digest on Chlorella Hokkaido, Japan: Medicinal Plant Institute of Hokkaido, 089-37, Japan , 1987,pp 481-487.

Sano , T. and Tanaka, Y. Effect of dried powdered Chlorella on experimental atherosclerosis ad alimentary hypercholesterolaemia in cholesterol-fed rabbits. Artery 14(2):pp 76-84,1987.

⁴⁹ It is worth noting that when consuming a natural tribal diet of mainly beans, rice, vegetables and fruits *normal* gut transit time is 6-8 hours.

⁵⁰ It is widely accepted in Naturopathic/ Holistic Medical Practice that constipation is one of the most detrimental consequence of a typical, modern Western Diet. This is because the transit time of matter excreted by our systems is markedly increased.

⁵¹ Dr. Schulze's Superfood is a dried combination blend of approximately 90-95% : AFA, Spirulina, Chlorella, wheatgrass and barley grass, with approximately 5-10%: dulse, spinach leaf , acerola cherry, beet tops, palm fruit, rose hips. lemon and orange peel added. It is one of a number of different blends of chlorophyll rich foods available in the UK and internationally.

adapt to this food they often choose to take more enjoying the many benefits it brings to their health and well being.

(If you are considering using Chlorella and take the medication Warfarin please read the section on using algae wisely and safely and in particular read footnote 60.)

Comparisons between algae and cereal grasses⁵²

In general terms AFA is the most potent detoxifier of the algae due to its higher chlorophyll content and is considered the most active in terms of its action on the heart and the mind. In particular I have found it to be excellent for balancing creativity and boosting concentration in adults and children alike.⁵³ It is also considered to be the most useful in treating dampness, which, when combined with its Natural Killer Cell properties, makes AFA a potentially important agent in the natural support of cancer patients and for those working towards the prevention of cancer in the first instance.

Spirulina works more gently in terms of its cleansing action and is considered more tonifying and building in some respects than AFA. Chlorella is considered particularly strengthening for both the tissues and immune system. Thus they are both excellent for supporting all stages of life from time spent in utero⁵⁴ to our older years.

The cereal grasses wheatgrass and barley grass like AFA are considered more cooling and more quickly cleansing of toxins from the tissues than Spirulina and Chlorella. They are also noted to play a particularly important role in supporting inflammatory conditions of the tissues e.g. gastrointestinal inflammation following chemotherapy and radiotherapy treatment.

Using algae wisely and safely

It is vital to appreciate that one must only consume species of algae recognised as edible and free from contamination i.e. AFA, Spirulina and Chlorella.

In terms of the amounts of algae an individual may need it varies greatly. It is of note that as algae is classified as a food there is no official recommended daily amount, thus the notion of a standard daily dose could be interpreted as being false. I have taken the

⁵² Cereal grasses is used in this context as an umbrella term for wheatgrass and barley grass

⁵³ This has been reinforced by research exploring AFA as being used as a natural support for Attention Deficit Disorder and Alzheimer's Disease. Please see Jarratt, C., et al, The Children and Algae Report, The Centre for Family Wellness, Harvard, MA, 1997.

⁵⁴ AFA is considered best taken prior to conception for approximately 12 months to allow the body to adapt. Spirulina and sometimes Chlorella are in some cases advised for first time use during a pregnancy. (Healing With Whole Foods by Paul Pitchford 3rd ed.) For women wanting to use algae during or shortly before conception it is best to consult a Holistic Doctor of Practitioner for advice and guidance.

dosages detailed in this article from *Healing With Wholefoods* by Paul Pitchford (3rd ed) and feel they are a useful guideline, however in my practice we choose to use quite varying amounts of algae depending on an individual's needs and their balance of excesses and deficiencies. I advise people it is always best practice to seek the guidance of a Holistic Doctor or Practitioner if considering dosages exceeding *the standard* referred to in this article. I also always encourage them to do their own research and reading about these foods so they feel fully able to make informed choices that best suit their individual needs.

Because of the rebalancing and immunomodulatory functions of algae I feel it is best practice for anyone with specific medical needs or conditions, including those with cancer, in particular those on chemotherapy or radiotherapy treatment , to take algae with some guidance from a Holistic Doctor or Practitioner.

A group which requires very special support and guidance from a Holistic Doctor is those with autoimmune diseases⁵⁵. These include multiple sclerosis, systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), Inflammatory Bowel Diseases like Crohn's Disease and Ulcerative Colitis, Idiopathic Thrombocytic Purpura, Autoimmune Haemolytic Anaemia, Sarcoidosis and Thyroiditis.⁵⁶ (Please note the list of autoimmune conditions listed above is not exhaustive so if you are unsure it is best to check with a Holistic Doctor or your General Practitioner.) People with autoimmune diseases often have complex needs and requirements, particularly if their condition is undergoing a period of instability, and are often much more sensitive to adaptogens than the general population; particularly those which work strongly on the immune system, as algae does .

It is also important for patients on immunosuppressive drugs to seek the specialist advice of a Holistic Doctor if they would like to use algae.⁵⁷ These patients include those who have had a previous organ or bone marrow transplant ,those with autoimmune diseases, and those on dexamethasone or prednisolone. For a fuller list of such immunosuppressive

⁵⁵ In general terms this group of medical conditions involve the immune system becoming ' over active' and is characterised by a person's immune system attacking their own tissues.

⁵⁶ The Natural Medicines Comprehensive Database 2008 p217 advises, ' avoid the use of algae or use with caution.' Alternatively see the NMCD 2010 on-line . However another view point is these foods are by definition adaptogenic and are always able to bring the body back towards balance and health. I have used algae with a number of patients with autoimmune diseases and observed much improvement in their condition. I used a very careful and gentle approach with these patients particular during the initial balancing phase of their usage.

⁵⁷ There is theoretical evidence that algae may work against the effects of medicines which suppress the immune system None of this evidence comes from any human trials or case studies rather is based on *the interpretation* of in vitro and animal studies. Natural Medicines Comprehensive Database 2008 p217 and p361 advises, ' be cautious with this combination. (i.e. algae and immunosuppressant drugs)". I feel the usage of algae depends on a number of factors including the context and purpose of the immunosuppressant therapy and its length of duration. One of the recognised side effects of immunosuppressive medication is the development of lymphoma and other forms of cancer as a consequence of a down regulation in the immune system. It is interesting to consider how the role of supplementation with algae may offer great protective benefit to some patients receiving longer term immunosuppressive therapy.

drugs please see the footnote 48 .⁵⁸It is always wise, if unsure about the classification of your medication, to check with a Holistic Doctor or your General Practitioner.

In summary- for those with more complex medical needs, who want to use algae, again I would advise that consulting a Holistic Doctor is essential.

There is no evidence of any specific interactions between algae and cereal grasses like wheatgrass and barely grass and any Prescription Medicines, Herbs or other Dietary Supplements.⁵⁹ **I consider it best practice for patients taking the medication Warfarin not to use AFA, Spirulina, Chlorella or Cereal grasses without seeking the advice and guidance of a Holistic Doctor or their own GP⁶⁰.** In any event these patients almost always have complex medical needs.

Simultaneous use of Warfarin and chlorophyll rich foods is considered much less problematic with some of the dried Chlorophyll combination blend powders. This is because some producers carefully ensure the total amount of vitamin K is relatively low by choosing a specific weightage of ingredients. It always best to seek the advice of the producers of these blends, contained under their product information and / or that of your Doctor.

It is worth noting that those with disturbed bowel function i.e. Inflammatory Bowel Diseases like Crohn's or Ulcerative Colitis, those with an artificially shortened bowel and those with other bowel conditions like Diverticular Disease would be best advised to seek the advice and guidance of a Holistic Doctor or Practitioner before starting to consume algae or cereal grasses. This is particularly important because Chlorella and blue-green algae have been reported as causing a change in bowel function in some individuals particularly during the initial weeks of using.⁶¹ It has also been suggested that Chlorella might cause pathogenic colonisation of the bowel.⁶² It is of note that this inference has been drawn from a single human reported case of Chlorella infection cited in a 1983 paper. When we

⁵⁸ These drugs include azathioprine, basiliximab, cyclosporine, daclizumab, muromonab-CD3, Orthoclone, mycophenolate, tacrolimus, sirolimus, prednisolone, dexamethasone or other corticosteroid treatment. Please note this list is not exhaustive.

⁵⁹ Natural Medicines Comprehensive Database 2010

⁶⁰ Like leafy vegetables and brassicas Chlorella, Spirulina, Cereal grasses and to a much lesser extent AFA all contain significant amounts of Vitamin K. These amounts can vary depending on the environment in which the algae or grasses are grown. Chlorella and Cereal grasses usually contain the highest amounts. Theoretically this might decrease the anticoagulant activity and effectiveness of Warfarin. Please see The Natural Medicines Comprehensive Database 2008 p362 or alternatively see The NMCD 2010 on-line for further information. It is not impossible for patients on Warfarin to enjoy healthful amounts of these foods however it requires a very careful strategy to ensure that as these foods are increased the dosage of Warfarin may be increased as is needed. This is also the case if a patient is wanting to significantly increase leafy green foods in their diet. This step ensures the efficacy of the patient's Warfarin continues.

⁶¹ Please see Natural Medicines Comprehensive Database 2008 p 361. Or NMCD on -line 2010. It is worth noting that Halperin et al in their randomised, double-blind, placebo controlled trial on healthy adults noted Chlorella to be, 'well tolerated.' Out of 82 healthy participants receiving Chlorella for approximately 6 weeks only one withdrew from the trial due to side effects of nausea and abdominal discomfort. Canadian Medical Association Journal, July 22, 2003; 169 (2). Safety and immunoenhancing effect of a Chlorella-derived dietary supplement in healthy adults undergoing influenza vaccination. S Halperin et al.

⁶² Natural Medicines Comprehensive Database 2008 p361 or alternatively The NMCD on -line 2010

examine the original evidence that fact the role Chlorella had to play in this colonisation is far from certain.⁶³

Due to the cleansing and rejuvenating action of algae on the bowel I feel that it is best practice for some form of probiotic supplement, possibly in the form of yoghurt with live cultures, to be taken when integrating algae into the diet, particularly during the initial weeks of consumption.

Chlorella, which naturally contains iodine, should also be avoided by those with an allergy to iodine as it could theoretically cause a reaction ⁶⁴.

Spirulina, which is a source of phenylalanine must be avoided by people with the rare genetic metabolic disorder Phenylketonuria.

It is important to remember that in particular those with a cold constitution, who are naturally very thin and/or suffer from a predisposition to dryness and/ or feeling generally ungrounded often need much smaller amounts of the Blue -green algae AFA to balance them⁶⁵.

In summary if you are unsure about incorporating algae into your diet, and wanting to get the most optimal support for you as an individual it is always best to consult a Holistic doctor or Practitioner with experience in supporting patients with these foods and with the same or similar medical conditions.

⁶³ Jones et al reported a case of Chlorella infection in a 30 year old lady who developed a persistent infection of a healing operative wound on the dorsum of her right foot after *possible* contamination by river water while canoeing. Microscopic analysis was consistent with green algal infection although far from conclusive: *'The organisms in tissue did not stain with fluorescent antibody conjugates specific for the two known pathogenic Prototheca species. In some organisms, electron microscopy revealed membranous cytoplasmic profiles considered to be remnants of degenerated chloroplasts. These findings are consistent with the presence of a green algal infection.'* (In particular it is worth noting that Chloroplasts are in fact found in all plant cells.) Jones JW Green algal infection in a human . American Journal of Clinical Pathology, 1983 80 : 102-7

⁶⁴ Natural Medicines Database on-line 2010 search under Chlorella

⁶⁵ In Ayurvedic Medicine these people would be referred to as having high vata. If a person describes an ensuing decline in mental focus or describes feeling increasingly spacey it may be that AFA needs to be used differently or supplemented with other green foods and food groups to balance them. In practice this probably applies constitutionally to about 5 % of the population. Further if we find we feel transiently spacey and unable to focus i.e. during the menstrual period AFA can sometimes make this more noticeable and sometimes this is a message our body needs a little less. Although in fact the reverse can be true and AFA can indeed balance and improve these sensations as discussed earlier . Ultimately the outcome depends on the underlying cause in the context of an individual's constitution and it is always important to employ a dynamic approach. Of particular note is remembering the exact approach that suits an individual at one time in their life does not always suit them at another. It is always best to seek the advice of a Holistic Doctor or Practitioner to make sure you are using it correctly for your own constitutional type and circumstances.

In Conclusion

We can see how, by enjoying a variety of algae in our diets, we can benefit from immunological support across many aspects of our immune system function and many more aspects of our biological and energetic functioning. This is vital in the context of supporting cancer when our immune systems are in particular need and can very easily become depleted and compromised particularly with the use of old style chemotherapeutic agents⁶⁶.

We can also appreciate from examining the research how algae can actually support the body through chemotherapy; Khan et al concluded that Spirulina helped to prevent heart damage caused by chemotherapy using Doxorubicin, without interfering with its antitumour activity,⁶⁷ whilst Randall et al noted that in patients treated for brain tumours cellular components and functions of the immune system remained at near-normal levels and that participants were less adversely affected by chemotherapy and other immunosuppressive medications like steroids.⁶⁸

I have reviewed individual research studies conducted on various algae species but I could find no research papers exploring the therapeutic use of different algae species simultaneously. I hope one day we will have such studies to help us better understand their synergistic potential and efficacy.

I would ask everyone who reads this article to find good reason not to incorporate one, or ideally a combination of these wonderful foods into their daily diets! Some of you will need guidance and support, others may feel happy to experiment independently.

I suggest a 6-7 times weekly dose of AFA and either a chlorophyll rich blend combination or fresh cereal grass juice for almost all. It is always good for us to have a day off from the green foods each week or every couple of weeks to allow the body a day to rest from their cleansing effects. This is especially true in the initial stage of usage. After time we find we are able to use them much more intuitively, being guided by our bodies in relation to a suitable dose and regime. The beauty of these foods is they guide us towards having more or less and keep working even when we take a short break.⁶⁹

⁶⁶ As previously discussed in footnote 36 older types of chemotherapeutic agents and radiotherapy which still form the basis for the majority of cancer treatment in the UK act in a non selective /global way destroying all rapidly dividing cells in the body many of which are needed to maintain healthy functioning. This accounts for their very diverse unwanted side effects which are typically difficult to treat with conventional treatment.

⁶⁷ Khan, M., et al. Protective effect of Spirulina against doxorubicin-induced cardiotoxicity. *Phytotherapy Research*. 2005 December;19(12):1030-7.

⁶⁸ Dietary Chlorella for patients with malignant glioma: Effects on immunocompetence, quality of life, and survival. Randall E. Merchant, Charles D. Rice, Harold F. Young. *Phytotherapy Research* Volume 4. Issue 6 p220-231. December 1990.

⁶⁹ These are some of the common characteristics of adaptogenic foods.

I sit here writing this article nine months pregnant with our fourth child who is already blessed to have enjoyed this amazing group of foods way before its conception. My family and I have eaten these wonderful foods for nearly five years now and in more recent times many many of my patients too. I have watched my daughter Grace, now aged 6 move over 5 years clear beyond her diagnosis of Leukaemia. Her chemotherapy treatment finished almost 3 years ago now however her holistic dietary support continues: She has taken AFA, Spirulina, Chlorella, wheatgrass and barely grass, amongst others, like the rest of us, for almost 5 years now. These foods, together with her conventional treatment, acupuncture and other aspects of her holistic support have helped her grow into the healthy, happy child she is today. I feel I have more than I could ever articulate for which to thank the green foods!

On a final note I wonder if writing this may have turned out quite the same and flowed so freely without the amazing assistance of AFA, Spirulina, Chlorella, wheatgrass and barely grass? I hope this article has inspired you to explore or continue your consumption of these wonderful green foods, seizing opportunities to create your own individual *microclimate* for perpetual evolution and adaption... laying the perfect foundations for optimal health and well being.

For further information you may also like to read my related articles :

My favourite of all AFA: (available at my Practice Website www.drkatejames.com)

The Amazing Healing Powers of Chlorophyll: (available at my Practice Website www.drkatejames.com)

Cancer Explained: A Traditional Chinese Medical Perspective: (available on personal request)

Understanding Cancer Better: (available on personal request)

A little more about pH: (available on personal request)

I recommend edible algae simply because I believe in it. I have no interest in any company who supplies it and do not make a profit on the sales generated.

If you have any questions or queries in relation to this article I would love to hear from you. Please feel free to contact me at drkatejames@doctors.org.uk

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