Spirulina

Properties & History

Craft Production

By J. Bilbao

The Micro Algae Spirulina Platensis is a Super Food that covers all the deficiencies that we have in our diet. In the following pages we will see everything related to spirulina such as: artisanal production, characteristics, properties and history of this wonderful miniature algae that grows in fresh water.

What is The Unicelular Micro Algae Spirulina Platensis

The Unicellular Micro-Algae Spirulina Platensis is a blue-green algae, seen under a microscope, it appears in the form of a cylindrical spring in the form of a spiral.

This Micro-Algae is as old as the earth and grows naturally in alkaline lakes from hot regions of the earth.

Measuring no more than 0.2 to 0.3 mm long, it is barely visible to the naked eye, but colors the water in the water green (spinach green).

The water in that she develops, living by photosynthesis like other plants. To develop, it needs water, light, heat, and the essential elements for plant life: carbon, sulfur, phosphorus, potassium, iron, magnesium.

Since ancient times, the riverside men of the lakes where this algae develops naturally (aquatic birds contribute with their droppings, the essential food for the development of the algae and with their movements the agitation of the water) what they have done of Spirulina, a dietary supplement in your daily regimen.

The Unicellular Micro-Algae Spirulina Platensis contains unicellular photosynthetic organisms and lacks a defined nucleus or other specialized cell structures.

Blue-green algae contain the same kind of chlorophyll as higher plants, but it is not found in the chloroplasts, but is distributed throughout the cell. In many species, other pigments mask the chlorophyll and impart a bluish or reddish color to the cells.

In shallow tropical waters, the mats of these algae form curved formations called stromatolites, whose fossils have been found in rocks formed during the Precambrian, more than 3,000 million years ago. This suggests the important role that these organisms played in changing the primitive atmosphere, rich in carbon dioxide, for the oxygenated mixture that exists today.

There is a lot of controversy about whether they are algae or bacteria. They are considered algae because they photosynthesize oxygen, are 5 to 10 times larger than bacteria, and also have special nonbacterial structures such as filaments.

They are considered bacteria because their cellular organization is prokaryotic, they are cells without organelles.

With regard to nutrition, it must be said that they are photoautotrophs (they can be facultative heterotrophs in the dark) and that they fix nitrogen, unlike eukaryotes and bacteria, when the amount of oxygen is low.

With regard to their distribution, they are found throughout the world, they can be seen with the naked eye as gelatinous masses and especially in fresh water and moist soils. They can form stromatolites, that is, formations of calcium carbonate.

History of Unicellular Micro-Alga Spirulina Platensis

Historically the Aztecs consumed Spirulina as food, they named it ¨tecuitlatl¨. This custom disappeared over time. Biologists and anthropologists maintain that in pre-Hispanic times the inhabitants of Mexico ate "tamales" made with sea weed and fresh water .

Humanity learned of the existence of Spirulina again, when in the 1960s the technicians of the French Petroleum Institute were looking for the precious fuel in the center of Africa. It is an arid, poor region, where nothing indicates that there is any type of food that is easy to obtain. However, the natives of Kanem (Chad, Africa) seemed healthy and robust, which was studied by French and Belgian ethnologists who in late 1962 discovered that the natives had been harvesting and consuming algae since ancient times. The women of the tribe collect the Spirulina in wicker baskets, they let the water drain into clay pitchers and what remains in the baskets is left to dry in the sun. The final product is a paste with the

which a sauce is made by adding beef fat, fried onions, peppers, wild grasses and beef tongue which is destined to accompany the millet meatballs.

This alga has also been used in Kenya, Ethiopia, Egypt, Zambia and Peru. In Mexico, since 1967 its cultivation began in the bodies of water that remain from the old Lake Texcoco and 30 tons of algae per hectare per year have been obtained.

Still today, an ethnic group from Chad harvests it by foaming certain brackish ponds. The green puree collected in this way is dried in the sun, then sold in the form of cookies, under the name "dihé". In this way, they add a nutritional supplement in the preparation of the sauces that usually accompany porridge or cereal balls (millet) or cassava.

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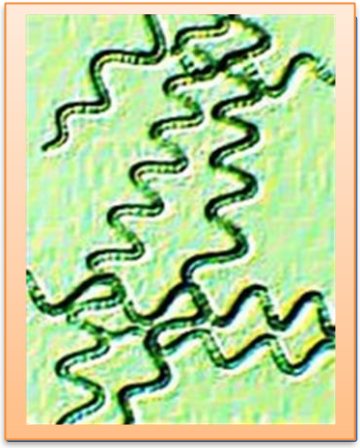


Features **of Unicellular** Micro-Algae

Spirulina Platensis

Spirulina Platensis contains 70% protein, against 8% wheat, 7% rice and 2% potato. It is very easy to digest because it lacks cellulose, its essential unsaturated fatty acids are a factor of known importance in the prevention and improvement of cardiovascular diseases.

Its amino acid composition indicates that Spirulina has a structure similar to that of an egg yolk. It also has 24% carbohydrates, as well as pigments, minerals and vitamins A, B1, B2, B6, C, E and the exceptional vitamin H among others.

It is one of the most protein natural sources (70% of its weight). Its proteins are complete and of high biological value: it has 21 of the 23 amino acids (all the essential ones) in an almost ideal proportion,

highlighting tryptophan (antidepressant par excellence) and phenylalanine (gives a feeling of satiety) as those with the highest concentration. At the lipid level, it is rich in polyunsaturated fatty acids (linoleic, linolenic and gamma-linolenic). Among carbohydrates, the presence of a rare natural sugar (Rhamnose) stands out, which favors

the metabolism of glucose and has a favorable effect on diabetes.

In terms of vitamins, in addition to A, E and H, it stands out for being the richest natural source of B12 (ideal to complement strict vegetarian diets, since one gram per day covers the daily needs of said vitamin). As for minerals, it is especially rich in iron (five times more than liver), but it also contains calcium, phosphorus, magnesium, potassium, sodium, manganese, selenium, chromium and zinc, among others.

It is also well endowed with chlorophyll, carotenoids, nucleic acids and mucilage. Its unicellular structure (plasma membranes) devoid of cellulose, facilitates the rapid assimilation of its nutrients, especially at the protein level, even in people with digestive and absorption difficulties.

Medicinal Propiedades of Unicellular Micro-Algae Spirulina Platensis

The 100% natural Unicellular Micro-Algae Spirulina Platensis is a dietary supplement that, consumed regularly, provides excellent health benefits to the human body.

It is a Natural Invigorator for the elderly and convalescents, prevents states of malnutrition, increases the bioavailability of iron, corrects anemia, activates the immune system, reduces the risk of cancer and early aging, helps lower cholesterol levels, treats juvenile acne, helps regulate blood sugar levels, It is a coadjuvant in slimming diets and promotes the multiplication of intestinal lactobacillus.

Spirulina Platensis is an important source of vitamins (b- Carotene, B complex and vitamin E), pigments and enzymes with antioxidant properties.

The fatty acids present in Spirulina Platensis help prevent and improve cardiovascular diseases such as arteriosclerosis, cholesterol, blood pressure and are essential in human nutrition.

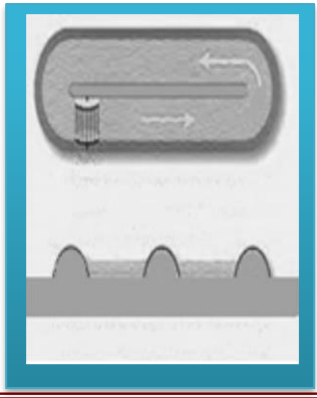
Spirulina Platensis is also indicated for people who practice sports, its continuous consumption in people who practice any type of physical exercise, produces greater strength in the body, maintaining the body

for a longer period of time without feelings of exhaustion and lengthening the time of resistibility. in great efforts, the recovery after a great effort is much faster than usual consuming Spirulina on a regular basis.

Spirulina Platensis grown in macro-pools with advanced ecological bio-technology, has a rich content of essential nutrients, providing more than 50 macro and micronutrients, cellular antioxidants, natural pigments such as chlorophyll, carotenoids and phycocyanin, essential amino acids, proteins, fatty acids essential fats, and precursor cofactor nutrients of essential Prostaglandins E-1 and E-3, which are essential bioregulatory hormones of the nervous, cardiovascular, immune, anti-inflammatory, hormonal, sexual, hair, skin, nails, reproductive, metabolism and balanced levels of blood sugar, PGE-1 and PGE-3 necessary "in-situ" and in milli-seconds, for the proper functioning and maintenance of the natural protection of our cells and vital organs.

Other Benefits of the Unicellular Micro Algae Spirulina Platensis

- Slimming (taken before meals with water).
- Restorative (taken during meals).
- Ideal complement for de-intoxication and fasting regimens.
- Contribution of co-factor nutrients (macro, micro-nutrients, Gamma-Linolenic Acid (GLA) and others.
- Acts as a bio-activator of melanin and good skin color, protector of free radicals; supply of essential nutrients such as Glucose Tolerance Factor for the control of blood glucose levels and for insulin to work more effectively.



Unicellular Micro-Alga Spirulina Platensis Cultivation

The Spirulina grows in natural alkaline lakes. The Spirulina farm is part of a new era of organic farming. The key component in the production of Spirulina is sunlight and attention is paid to temperature measurement

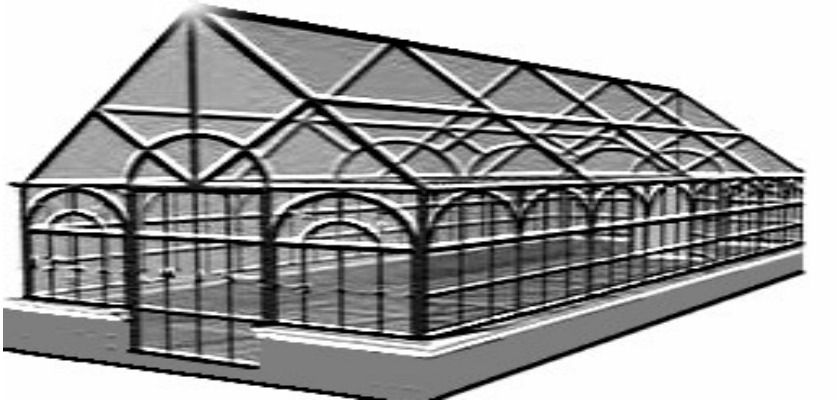
and oxygen levels. Because pesticides and herbicides would kill many microscopic life forms in a pond, algae scientists have learned how to balance pond ecology without using these harmful substances. This form of aquaculture represents one of the necessary solutions to produce food while restoring the planet.

For the cultivation of Spirulina, a pond with rounded corners must be available, to facilitate the agitation and cleaning of the corners. The ponds can have a larger or smaller surface depending on the needs of Spirulina that you want to produce, it is essential to take into account the need to periodically shake the pond. To facilitate its drainage, the bottom of the pond should have a hole and a slight slope. The surface agitation of the ponds can be done by hand with a broom once every two hours or it can be done mechanically with a small electric motor that moves the broom every two hours. In addition, the bottom of the pond should be shaken once a day. Likewise, the water must be oxygenated permanently, this is done with small air pumps and diffusers placed at the bottom of the pond symmetrically so that the water can be oxygenated equally throughout the entire surface of the pond, (Same as is done in fish tanks). The temperature of the culture medium is the most important climatic factor, which will directly affect the speed of growth and the quality of the Spirulina. Below 20°C, growth is practically nil, the optimum temperature for development being around 37°C. Lighting is essential for growth, but it should not be maintained

continuously 24 hours a day. Full sun is not ideal: partial shade is best. It is also very important that the culture medium registers a high ambient temperature without relying solely on the entry of sunlight. The rain and the wind are beneficial, but it is necessary to control that the water does not overflow the pond and that it does not fill with dust and leaves. The water used in the culture medium must be sweet, clean and very hard (Alkaline) and must be purified by means of a filter to eliminate possible contamination. This liquid will provide the trace elements and calcium that Spirulina needs, in addition to the carbon and salts that must be available to add later and thus convert the water to brackish. In climates that are not so hot, Spirulina can also be produced using glass or plastic greenhouses that are self-sustaining or that generate their own energy, photovoltaic, or any other renewable energy so that its cultivation is profitable. The average amount of Spirulina that is obtained per Ha. of pond and year in optimal production conditions, is approximately 30 tons.

Example of a Small Spirulina Crop

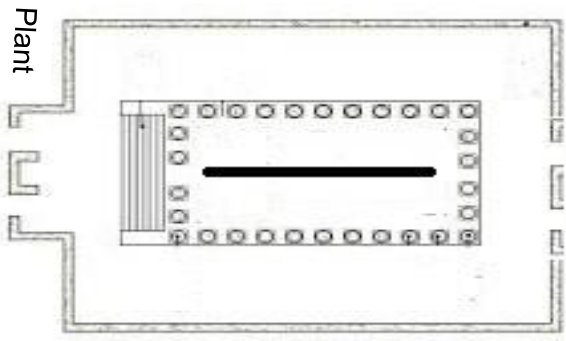
Greenhouse of 10 m x 3 m x 3 m



Firstly, we will install a small greenhouse whose dimensions are 10 meters long by 3 meters wide and 3 meters high 7m x 3m x 3m will be used for production and 3m x 3m x 3m will be used for drying room, so as not to invest too much in the installation of the same we can manufacture or an artisan structure with wood and later we will cover the structure with plastic greenhouses, we will leave two doors on the two narrow sides so that in case of need they act with vents and the interior can be cooled if it takes temperatures higher than the necessary ones. We will equip the greenhouse with a water heating installation simply by circulating hot water through metal tubes that will act as radiators. The energy source for the operation of the water boiler and the pump that will circulate the water through the installation, will be produced by a polycrystalline solar panel that produces approximately

0.25 kWh and will store the energy produced in accumulators to later be used in heating the greenhouse, mainly on cold days and at night, the system will have a thermostat so that it turns on and off automatically when the temperature of the crop requires it.

Pond de 5 x 2 x 0,40



Inside the greenhouse we are going to build a rectangular pond of 5 meters long, 2 meters wide, 0.40 meters deep, the pond has a surface area of 10 m2, and 4 m3 or 4,000 liters of water. To build the pond we will make a rectangular hole in the ground with the measurements of the pond, once the hole is made we will proceed to the waterproofing of the same, for this we will use swimming pool plastic in one piece, we will place the plastic piece and we will finish off the upper external edge of it on the surface of the ground by placing a row of bricks.

Once the pond is built, we will provide it with the necessary installations to keep the water moving, for this we will install an electric motor on the edge of the pond towards the height of 3/4 of the pond, then we will place a rotating blade of approximately 100 cm wide which will create with its rotation a current in the water in order to keep moving, remove and oxygenate the water of the pond necessary in the cultivation of Spirulina, the blade will be supported by two clamps located at the two ends of the pond at the same height, and whose bar will in turn be connected to the rotor bar of the electric motor.

Built and equipped the pond, we will proceed to the beginning of the filling of the pond, the first thing that we are going to deposit in the pond is the live strain of Spirulina, this size of culture we will deposit 50 liters of live strain of Spirulina, then we will add 100 liters of water every day for 10 days to the culture solution that we are going to prepare.

Then we will prepare and add the culture solutions that are made up of: sodium bicarbonate, coarse salt and water of

wood ash.

Sodium bicarbonate we will add 4 kilos daily for 10 days dissolved in 117 liters of water each day.

Coarse salt, we will add 1.2 kilos daily for 10 days dissolved in 23 liters of water each day.

We will add 0.8 kilos of wood ash daily for 10 days, draining the ash water through a fine cloth so that no pieces fall into the water, to

dissolve it, 35 liters of water will be added to the ash each day (The way to make the mixture.... Put the ash in a fine cloth and filter the water thrown on the ash from it).

Then we will prepare and add the nutrients that Spirulina feeds on in its cultivation, which are made up of: Urea and Iron oxide.

Urea, to prepare this nutrient we can do it by saving urine from people who do not have any treatment with antibiotics. Urea, we will add 1.6 liters per day for 10 days mixed with 46 liters of water each day.

Iron oxide, to prepare the necessary amount of iron oxide, we will do it with 8 liters of vinegar and 160 rusty nails, we will mix them and let them macerate for 10 days, after 10 days the iron oxide will be ready to be used as a nutrient. Iron oxide, we will add 0.8 liters per day for 10 days mixed with 23 liters of water each day.

In a 10 m2 pond that will eventually contain 4,000 liters of water in total, we will deposit the following culture solutions and nutrients:

- Live strain of Spirulina or cultivation seed. 50 liters + 100 liters of water per day x 10 days
- Sodium bicarbonate …….. 4 kilos + 117 liters of water per day x 10 days
- Coarse salt..... 1.2 kilos + 23 liters of water per day x 10 days
- Wood ash powder .... 0.8 kilos + 35 liters of water per day x 10

days

- Urea …..1.6 liters + 46 liters of water per day x 10 days
- Iron oxide ….0.8 liters + 35 liters of water per day x 10 days

To make the mixture of the daily solution to be poured into the pond, we will use a plastic tank with a capacity of 500 liters, open at the top and with an outlet tap towards the pond to pour the mixture into it when it is ready.

Since the harvest will begin on the tenth day and it will be done every day, it will be necessary to do daily maintenance by pouring the solution with the nutrients in so that the crop continues to develop in optimal conditions. Thus, after harvesting each day, we will leave around 350 liters of water in the tank to make the daily mixture of the solution plus the nutrients, it will be exactly in the same proportion each day, as we have done in the past. 10 first days, 4 kilos of sodium bicarbonate, 1.2 kilos of coarse salt, 0.8 kilos of wood ash powder, 1.6 liters of urea and 0.8 liters of iron oxide. We will mix well all the components in the water that we have left in the tank and we will proceed to pour it into the pond again. This maintenance must be done daily after harvesting.

Collection of Spirulina: After 10 days we can start to collect the spirulina, for them we will extract the water from the pond by means of a water extractor pump, and we will pour the water into the tank that we have previously used to prepare the culture solution, before pouring the water we will filter it through a pin of 180-thread white cloth, in that cloth we will deposit the

amount of spirulina that the water contains, when the water is extracted, the blade that moves the water in the pond will be in motion so that there is the maximum amount of spirulina in suspension in the water, each day we will extract a quantity of water equal to the total amount that the pond has and returning it to it through the tank to which we are pouring it.

We will take the harvested spirulina to the drying room that we have created in one of the greenhouse parts, there we will spread it out in slotted trays covered with fabric, we will spread it on the fabric of the tray creating a very thin layer on it, finally the tray will be exposed to the sun inside the drying room until its humidity is at 5/6%.

The harvest will be carried out daily using the same technique described above.

With this technique, in a small production of the dimensions described, it is possible to produce up to 1 gram per liter of dry spirulina every 10 days, this would give us a quantity of 12 kilos of dry spirulina per month.

If you want to go to a larger crop, you only have to extrapolate the crop

needs to the dimensions of the production you want to carry out, that is, proportionally increase the amounts of each component according to the total amount of water that is going be used in the production pond.

Technical Sheet of the Unicellular Micro Algae Spirulina Platensis

Physical Properties	
Appearance	Fine Powder
Color	Green Bluish
Smell and Taste,	Strong resembles marine plants. Without flavor
Density	0.5 grams per liter
Particle size	9 to 25 microns

Chemical Composition		
Nutritional Value: Total Organic Nitrogen %	10.85 min	13.35 max
Nutritional Value: Total Protein Nitrogen %	9.60 min	11.36 max
Nutritional Value: Crude Protein (%N'6.25)	60 min	71 max
Nutritional Value: Net Useful Protein %	53 min	61 max
Nutritional Value: Digestibility %	83 min	84 max
Residual Moisture %	4 min	7 max
Ashes %	6.40 min	9 max
Protein %	60 min	71 max
Crude Fiber %	0.10 min	0.90 max
Xanthophylls g/kg of Product	1.40 min	1.80 max
Beta-Carotene g/kg of Product	1.50 min	1.90 max
Chlorophyll g/kg of Product	6.10 min	7.60 max
Minerals: Calcium mg/kg of Product	1045 min	1315 max
Minerals: Phosphorus mg/kg of Product	7617 min	8942 max
Minerals: Iron mg/kg of Product	475 min	580 max
Minerals: Sodium mg/kg of Product	275 min	412 max
Minerals: Chloride mg/kg of Product	4000 min	4400 max
Minerals: Magnesium mg/kg of Product	1410 min	1915 max
Minerals: Manganese mg/kg of Product	18 min	25 max

Minerals: Zinc mg/kg of Product	27 min	39 max
Minerals: Potassium mg/kg of Product	13305 min	15400 max
Minerals: Other mg/kg of Product	36000 min	57000 max
Total Carbohydrates %	13 min	16.50 max
Total Lipids %	6 min	7 max
Saturated Fatty Acids: Total Fatty Acids %	4.90 min	5.70 max
Saturated Fatty Acids: Lauric mg/kg of Product	180 min	229 max
Saturated Fatty Acids: Myristic mg/kg of Product	520 min	644 max
Saturated Fatty Acids: Palmitic mg/kg of Product	16500 min	21141 max
Saturated Fatty Acids: Stearic mg/kg of Product	Trazas min	353 max
Unsaturated Fatty Acids: Palmitoleic mg/kg of Product	1490 min	2035 max
Unsaturated Fatty Acids: Palmitic Linoleic mg/kg of Product	1750 min	2565 max
Unsaturated Fatty Acids: Heptadecanoic mg/kg of Product	90 min	142 max
Unsaturated Fatty Acids: Oleic mg/kg of Product	1970 min	3009 max
Unsaturated Fatty Acids: Linoleic (Essential) mg/kg of Product	10920 min	13784 max
Unsaturated Fatty Acids: d-Linoleic (Essential) mg/kg of Product	8750 min	11970 max
Unsaturated Fatty Acids: a-Linoleic mg/kg of Product	699 min	7000 max
Other Substances: Insaponic Acids %	1.10 min	1.30 max
Other Substances: Sterols mg/kg of Product	100 min	325 max
Other Substances: Triterpene Alcohols mg/kg of Product	500 min	800 max
Other Substances: Carotenoids mg/kg of Product	2900 min	4000 max
Other Substances: Chlorophyll mg/kg of Product	6100 min	7600 max
Other Substances: 3-4 Benzopyrene mg/kg of Product	2.60 min	3.60 max
Other Substances: Cholesterol mg/kg of Product	60 min	196 max
Other Substances: b-Sitosterol mg/kg of Product	30 min	97 max
Other Substances: Dihydro-Cholesterol 7, Cholesterol 7-o1-3 Stigmasterol mg/kg of Product	10 min	32 max
a-Carotene (Average) mg/kg of Product	Traces	
b-Carotene (Average) mg/kg of Product	1700	

Xanthophylls: Cryptoxanthin (Average) mg/kg of Product	1600.00
Xanthophylls: Echinenone (Average) mg/kg of Product	556.00
Xanthophylls: Zeaxanthin (Average) mg/kg of Product	439.00
Xanthophylls: Lutein and Euglenanone (Average) mg/kg of Product	289.00
Vitamins: Biotin (H) (Average) mg/kg of Product	0.40
Vitamins: Cyanocobalamin (B12) (Average) mg/kg of Product	2
Vitamins: d-Ca-Pantothenate (B5) (Average) mg/kg of Product	11
Vitamins: Folic Acid (B9) (Average) mg/kg of Product	0.50
Vitamins: Inositol (B8) (Average) mg/kg of Product	350.00
Vitamins: Nicotinic Acid (PP) (Average) mg/kg of Product	118.00
Vitamins: Pyridoxine (B6) (Average) mg/kg of Product	3
Vitamins: Riboflavin (B2) (Average) mg/kg of Product	40.00
Vitamins: Thiamin (B1) (Average) mg/kg of Product	55.00
Vitamins: Tocopherol (E) (Average) mg/kg of Product	190.00

Instructions for Use: Although many studies indicate that the best results of Spirulina are achieved by taking the equivalent of 2% and 2.5% of the daily food we eat, which would mean taking approximately between 12 and 15 grams per person per day, most brands recommend taking between 4 and 9 grams per person per day, the average amount established by most manufacturers is approximately 6 grams per person per day, if we use the same example given in presentations and consume Spirulina in tablets of 400mg., we should take 5 tablets at breakfast, 5 tablets at lunch and 5 tablets at dinner.

The treatment time depends on the needs of each person, in cases of help to prevent problems or as a simple invigorating, it can be taken for periods

of 3 months, resting between 30 and 45 days from dose to dose, in cases in which that the health problem has manifested, it must be taken without interruption. In any case, and since Spirulina acts as a regulator of the body as well as a food, it can be taken uninterruptedly in the indicated doses for as long as desired without fear of adverse effects.

Quality: For the Spirulina we consume to have the desired effect, it must always be pure, without mixing any other ingredients, totally natural and organic with the recognized "Bio" certification. Although all brands of Spirulina contain the same nutrients and in similar proportions, the organically grown ingredients of Spirulina or "Spirulina Bio" are of much higher quality and digestibility, so the favorable effects on the body are much more noticeable.

Contraindications: know each other.

Some works carried out with Spirulina in animals

A study carried out in Egypt by Abdel-Taw-Wab in 2009, demonstrated the benefit and importance of the consumption of an algae (Spriulina) in the survival of juvenile Nile tilapia after exposing them to the bacterium Aeromonas hydrophila, a common bacterium in tilapia farms and other species). The accumulated mortality in the 10 days after exposure was around 80% for the fish that received the ration without Spirulina, against 47 to 10% for the fish that received the ration with Spirulina between 2.5 and 10 g per kilo of ration.

In another work also carried out in Egypt by Ibrahem et al. in 2013, juvenile Nile tilapia weighing 8 grams showed better growth when they received a ration containing 10 g of dry Spirulina/kilo, compared to fish that did not receive Spirulina in the ration (final weight of 58 g versus 35 g, respectively). After an infection with an injection of the pathogenic bacterium Pseudomonas fluorescens, tilapia fed for 3 months with a ration containing 120g of Spirulina/kg showed 42% mortality against 63% for fish fed a ration without Spirulina. The complementary tests showed improvement in various components and processes of the immune system of the tilapia fed with the rations that contained Spirulina.

The results of these experiments indicate that the inclusion of the Spirulina alga contributes with the supply of some nutrient/s or specific substance/s to the immune response (defense) of tilapia against these pathogenic bacteria.

The result of these works carried out in the breeding of tilapia can be extrapolated to other species using spirulina in their feeding, in the proportions used for the works presented here.

Important Information:

Although Spirulina Algae has many properties to improve people's health; does not replace traditional medical treatments.

by J. Bilbao