

A Review On: Formulate and Evaluate of Spirulina –Enriched Chocolate With Improved Nutritional Value .

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ABSTRACT

The aim of this work was to evaluate the spirulina dry biomass which is known as a greater protein and amino acids source in blue green algae as an innovative ingredient for newly formulated produced chocolates for baby and children diets. Children have great need for nutrients such as calcium, iron, zinc, protein and vitamin B12. Spirulina satisfies your child's nutritional need by providing all these nutrients as well as essential amino acids. Spirulina species has several pharmacological activities such as antimicrobial, anticancer, metalloprotective as well as immunostimulant and antioxidant effects due to its rich content of protein, polysaccharide, lipid, essential amino acids, dietary minerals and vitamins.

Keywords: Spirulina proteins, vitamin, Nutrition, chocolate.

1. INTRODUCTION

Nutraceutical is defined as a food or part of that provides the body with medical or health benefits, including the prevention and treatment of a disease. It is seen that more natural way to accomplish therapeutic result with minimal side effects. [1] Now Spirulina can be used as a Nutraceutical ingredient due to its unique combination of Phytonutrients like Phycocyanin, Carotenoids, Xanthophylls, GLA, Galactolipids, Sulfolipids, Chlorophyll, Minerals, etc. Spirulina is nature's richest source of protein. Its protein value is six times more than eggs and 20 times more than milk, with protein content 60-70% on dry weight basis is equivalent to 1000 kg. of assorted vegetables in terms of nutrition. Spirulina is a good source of beta-carotene that enhances and protect eye sight. Spirulina is a good source of Gamma-Linolenic acid that reduces bad cholesterol in blood. Also reduces obesity, alcoholism and mental disorders. Spirulina is a good "ANTIOXIDANT".

The United Nations Organization (UNO) has recommended Spirulina as the ideal food for mankind and the World Health Organization (WHO) has also declared Spirulina as a safe food with excellent nutritional value. Recently, great attention and extensive studies have been devoted to evaluate its therapeutic benefits on an array of diseases. Such as hypercholesterolemia, hyperglycemia, cardiovascular diseases, inflammatory diseases, cancer, viral infections, hypolipidemic, antioxidant, and anti-inflammatory activities. Spirulina, like many other plant-based super foods, is absolutely safe for kids and adults to eat. Spirulina Represents a complete vegetarian protein source. When it is sourced safely and administered correctly, it can be a fantastic supplement for adults as well as children. The keys to safely giving your kids spirulina is to know that you are getting it from a safe, reputable source, and to whom much to give them. Spirulina is like the fuel that will boost overall development, growth and boost immunity. But due to bitter taste of spirulina, it is very difficult to consume, especially for children's. But if we make chocolates from spirulina it gets very easy for consumption for small children's. Spirulina chocolate could be that rare, sweet spot between health and taste, which could help indulge in chocolate without guilt. [2]

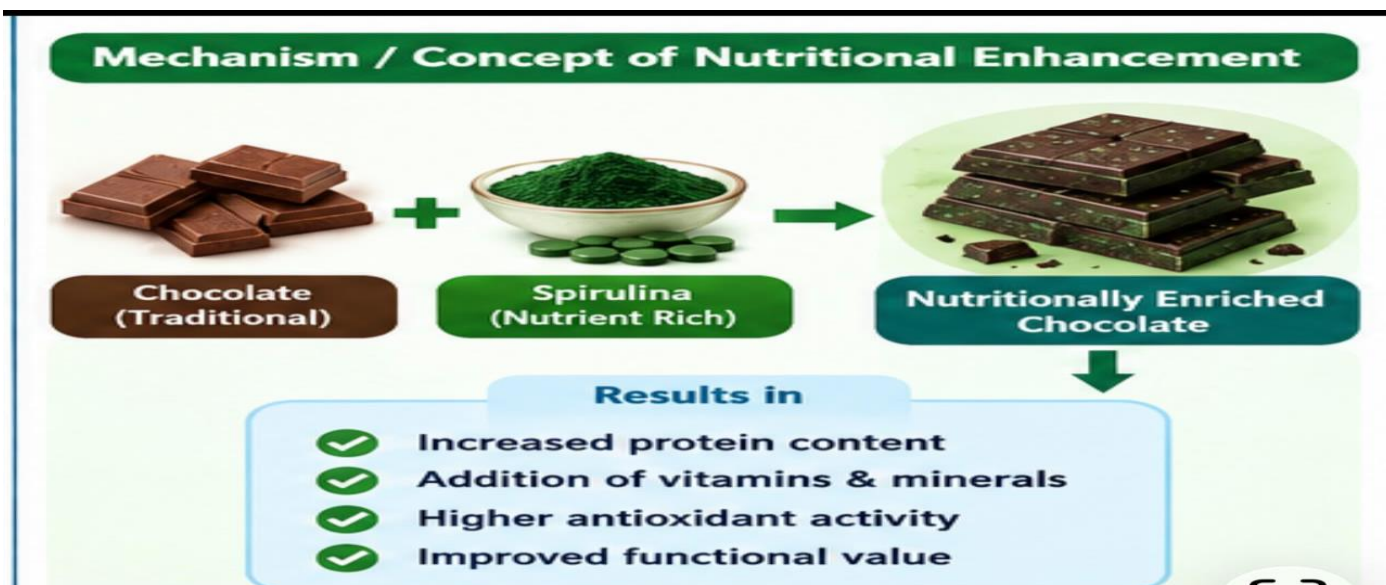


Figure 1.1 Concept of Nutritional Enhancement.

2. Taxonomy of spirulina plantesis :- [3]

The genus *Spirulina* was established by Turpin for *Spirulina oscillarioides* in 1827. It belongs to the kingdom Monera and division Cyanophyta which is a genus of the phylum Cyanobacteria (“Cyano” from the Greek meaning blue). Nowadays, there are more than 39 species of *Spirulina* in which *S. platensis*, *S. fusiformis* and *S. maxima* are the most investigated because of their high nutritional and pharmacological values. *S. plantesis* species is the most commonly available and widely used in different fields specially food industry and medicine.

Table 2.1 Taxonomy of spirulina plantesis

Domain	Bacteria
Phylum	Cyanobacteria
Class	Cyanophyceae
Order	Oscillatoriales
Family	Microcoleaceae
Genus	Arthrospira

Spirulina, like many other plant-based super foods, is absolutely safe for kids and adults to eat as food, *spirulina* represents a complete vegetarian protein source. When it is sourced safely and administered correctly it can be a fantastic supplement for child

3. Nutritional supplementation: - One health problem that is of great concern, especially in developing countries, is malnutrition. Severe forms of malnutrition are expressed as protein energy malnutrition defects such as kwashiorkor, marasmus and marasmic kwashiorkor. Apart from protein deficiencies, affected children usually do not have a complete balanced diet which includes the micronutrients such as vitamins and minerals that are essential for normal growth and development. The consequences of malnutrition represent a global problem, which affects morbidity as well as mortality. Increased tissue production of prostaglandin E2 as a result of high intake of linoleic acid in a polyunsaturated fatty acid deficient diet, causes inhibition of the proliferation and cytokine production of Th1 cells, the mediators of cellular immunity. [4]

Spirulina is rich in proteins, carbohydrates, polyunsaturated fatty acids, sterols and some more vital elements such as calcium, iron, zinc, magnesium, manganese and selenium. It is a natural source of vitamin B12, vitamin E, ascorbic acid, tocopherols and a whole spectrum of natural mixed carotene and xanthophylls phytopigments. *Spirulina* as a supplement serves to provide these nutrition requirements and seems to be a ‘wonder food’. In diabetic rat models concluded that *Spirulina maxima* was effective in correcting the abnormal carbohydrate and lipid metabolisms caused by excess fructose within the body. [5]

4. Vitamins:

4.1 Vitamin E: - Children need plenty of vitamin E for proper growth, and this need begins before a child is even born, according to a 2006 article published in the “American Journal of Clinical Nutrition.” Vitamin E also plays a role in gene expression and helps children convert the foods they eat into energy, according to the National Institutes of Health. *Spirulina* contains vitamin E that helps to supply the RDA for children.

4.2 Vitamin C (Ascorbic Acid): - It contains vitamin C, also known as ascorbic acid, this is one of the most essential elements of any diet, and is particularly beneficial to the immune system, in helping to prevent colds and flu which the children are quite prone to.

4.3. Vitamins A (Beta Carotene): - Children require 3 to 6 mg of beta-carotene (the equivalent of 5,000 to 10,000 Units of vitamin A activity) per day. *Spirulina* contains beta carotene, that is pure vitamin A, this antioxidant aids vision in dim light. [6]

Spirulina platensis is a blue-green microalga classified as single-celled cyanobacteria with spiral body shape. [7]

Spirulina has good protein, essential fatty acids, vitamins, minerals, chlorophyll, and phycocyanin used as a functional food. Spirulina is often referred to as a nutraceutical ingredient because it has phytonutrients (phycocyanin, carotene, and xanthophylls), gamma-linolenic acid (GLA) galacto-lipids, sulfo-lipids, chlorophyll and minerals. Besides, phycocyanin, phycocyanobilin, and allophycocyanin compounds in Spirulina biomass are known a function as effective anticancer, antibacterial, antifungal, and antiviral agents [8].

High content of phycocyanin pigment shows antioxidant characteristic, which functions as an inflammatory, inhibits tumor necrosis and protects nerve cells. Besides, spirulina also contains high carotenoids, especially β -carotene. [9-10]

5. MATERIALS AND METHODS: -

Spirulina powder was obtained from local vendor, Milk powder, Caster sugar, Cocoa powder were purchased from local market and 10% NaCl Solution prepared at Laboratory.

6 . Methods Preparation of Chocolate: -

All the ingredients were weighed accurately. Evaluation of Spirulina powder and all dry contents were done by color, odor, taste, extractive value and Ash Value. Solubility of Spirulina was checked in different concentrations of NaCl as solubility enhancer with little warm condition and prepared Spirulina solution. Chocolates were prepared by mixing all the ingredients in required quantity along with Spirulina solution and was made into a dough. By using appropriate mould, dough transferred into designed mould. [11]

7. Health Benefits of Spirulina: -[12]

- Fights allergies
- Lowers Blood Pressure
- Fighting Liver disease
- Lowering blood sugar level and cholesterol
- Help in Weight loss Detoxification of heavy metal
- Lower risk of cancer

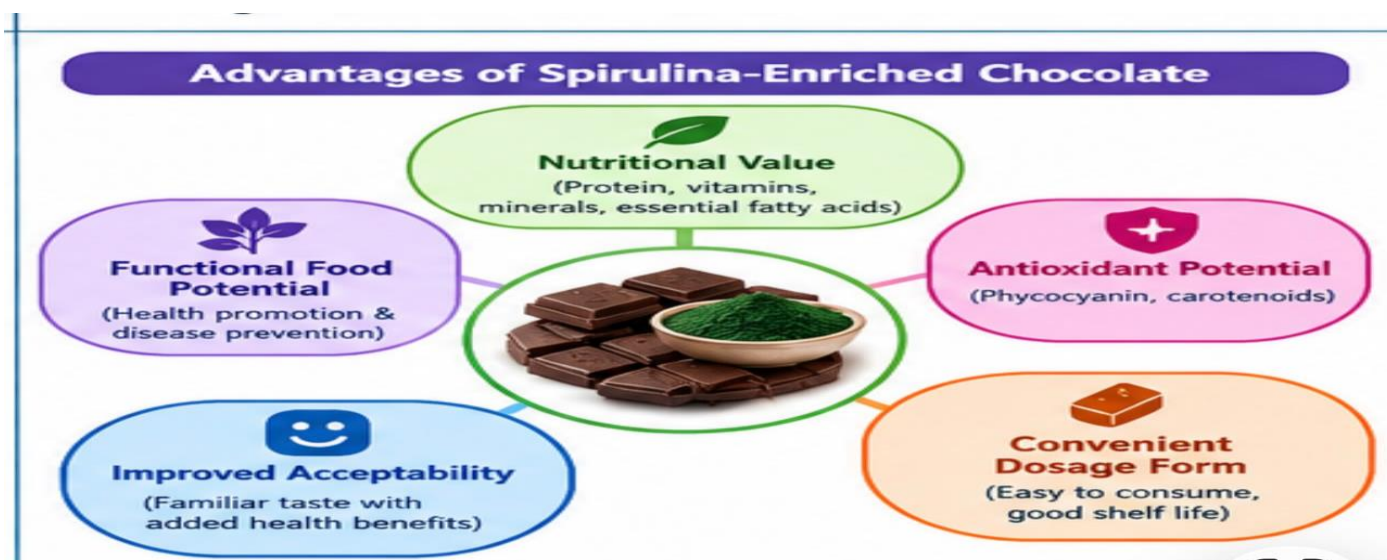


Figure7.1 Advantages of spirulina-enriched chocolate

8. EVALUATION PARAMETERS:-[13-14]

Determination of ash Place about 3 g of the ground material, accurately weighed, or the quantity specified in the monograph, in a suitable tarred dish (for example, of silica or platinum), previously ignited, cooled and weighed. Incinerate the material by gradually increasing the heat, not exceeding 450 °C, until free from carbon; cool, and weigh. If a carbon-free ash cannot be obtained in this way, exhaust the charred mass with hot water, collect the residue on an ash less filter-paper, incinerate the residue and filter-paper, add the filtrate, evaporate to dryness, and ignite at a temperature not exceeding 450 °C. Calculate the content in mg of ash per g of air dried material.

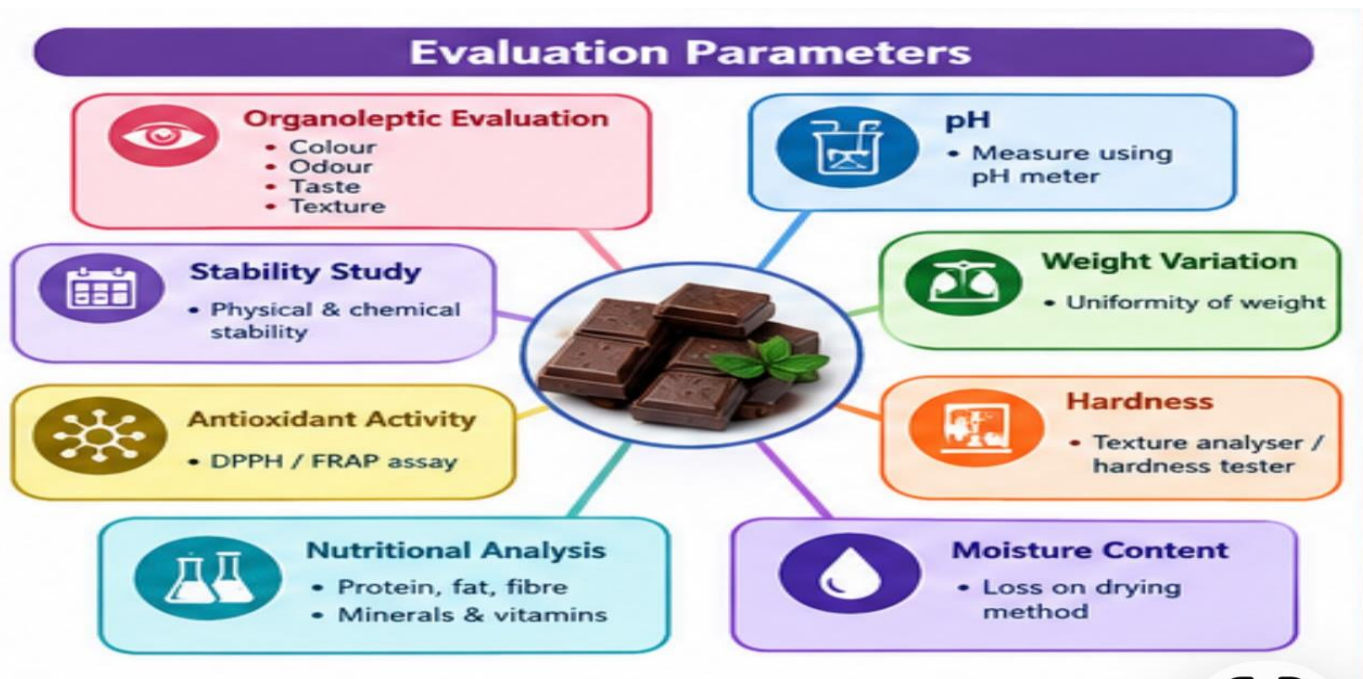


Figure 8.1 Evaluation parameters.

9. Tests for alkaloids: -

Dragendorff's test: By adding 1 mL of Dragendorff's reagent to 2 mL of extract, an orange red precipitate was formed, indicating the presence of alkaloids.

9.1 Mayer's test: - Few drops of Mayer's reagent were added to 1 mL of extract. A yellowish or white precipitate was formed, indicating the presence of alkaloids.

9.2 Hager's test:-Two milliliters of extract were treated with few drops of Hager's reagent. A yellow precipitate was formed, indicating the presence of alkaloids [15-18]

10.CONCLUSION:- Spirulina is already very popular and well regarded dietary supplement. These study to indicate the Spirulina's strong antioxidant, anticancer and antiviral properties as well as to combat obesity, diabetes and inflammatory allergic reactions It also great immunitybooster, hypocholesterolemic, and hypoglycemic potential.Due to sweet taste of spirulina chocolate it gets very easy to consume for children's.

The high content of all nutrients in spirulina chocolates makes it a perfect food for children suffering from different diseases like malnutrition, mental disorders, low immunity power.

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