

# Spirulina as super food: Product enrichment

Kiran Agrahari and Shabnam Jahan

The objective of present investigation “Spirulina as super food: Product Enrichment” was to standardize and develop the products using spirulina powder and their organoleptic evaluation. Dried Spirulina contains 5% water, 24% carbohydrates, 8% fat, and about 60% (51–71%) protein. It is a complete protein source containing all essential amino acids, provided in its typical supplement form as a dried powder, a 100 gram amount of spirulina supplies 290 Calories and is a rich source of numerous essential nutrients, particularly B vitamins and dietary minerals, such as iron and manganese. The lipid content of spirulina is 8% by weight providing the fatty acids, gamma-linolenic acid, alpha-linolenic acid, linoleic acid, stearidonic acid, eicosapentaenoic acid, docosahexaenoic acid, and arachidonic acid. Spirulina benefits are so amazing that taken on a daily basis. They could restore and revitalize health such as detoxes heavy metals (especially arsenic), improve HIV/AIDS, prevent cancer, lower blood pressure, reduce cholesterol and speed up weight loss. Developed products of spirulina powder were biscuit and smoothie. The organoleptic evaluation of products was done by using (9-Point hedonic scale). The result of spirulina powder based products for biscuit, smoothie (T<sub>1</sub>) and (T<sub>2</sub>) were best in all treatments in case of all sensory attributes. The overall acceptability of experimental (T<sub>1</sub>) and (T<sub>2</sub>) spirulina biscuit and smoothie were 8.0, 8.5 and 8.5, 9, respectively. Developed products were accepted by panel members.

**Key Words :** Spirulina powder, Super food, Enrichment, Products

**How to cite this article :** Agrahari, Kiran and Jahan, Shabnam (2018). Spirulina as super food: Product enrichment. *Food Sci. Res. J.*, 9(1): 194-197, DOI : 10.15740/HAS/FSRJ/9.1/194-197.

## INTRODUCTION

Spirulina represents a biomass of cyanobacteria (blue-green algae) that can be consumed by humans and other animals. There are two species, *Arthrospira platensis* and *Arthrospira maxima*. The maxima and platensis species were once classified in the genus spirulina. The common name, spirulina, refers to the dried biomass of *Arthrospira platensis*, which belongs to the oxygenic photosynthetic bacteria that cover the groups cyanobacteria and prochlorales. The major protein in

spirulina is phycocyanin which is a deep blue color pigment and about 150 mg of it is present in 1 g of spirulina. Spray dried spirulina is rich in proteins. Vitamins particularly β-carotene and gamma linolenic acid. Provided in its typical supplement form as a dried powder, a 100 g amount of spirulina supplies 290 Calories and is a rich source of numerous essential nutrients, particularly B vitamins and dietary minerals, such as iron and manganese (Table A). The quality of protein of spirulina is better than cereal and soya proteins (Brill, 2006). About 70% β-carotene is absorbed. One gram spirulina contains carotenoids equivalent to 1 kg of vegetables and yellow fruits. Spirulina is many times richer in iron, vitamin A, thiamine, riboflavin, nicotinic acid and vitamin B12 compared to milk and egg. Chlorophyll present in spirulina is a detoxifying phytonutrient. Spirulina apart from being rich in nutrients contains phytonutrients like, gamma linolenic acid, sulpholipid, phycocyanin and antioxidant vitamin. Freshly

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Spirulina (dried)	
Energy	290 kcal
Carbohydrates	23.9 g
Fat	7.72 g
Protein	57.47 g

harvested and sun dried or spray-dried spirulina can be incorporated in any recipes.

Among the varied products in which dried, flaked, or powdered Spirulina is now incorporated are: baked desserts, beer, breakfast cereals, confectionary, corn chips, crackers, doughnuts, food bars, frozen desserts, juice smoothies, muffins, pasta, popcorn, salad dressing, snack foods, and soups (Copper, 2008 and Fraser, 2001). Usually spirulina's taste does not justify serving it as a stand-alone item, and it is normally used in relatively small amounts at meals, and mixed with other foods. Spirulina thrives at a pH around 8.5 and above, which will get more alkaline, and a temperature around 30° C (86° F). They are able to make their own food, and do not need a living energy or organic carbon source. In addition, spirulina has to have an ensemble of nutrients to thrive in a home aquarium or pond.

#### Objective :

- To enrich the products using spirulina powder.
- Organoleptic evaluation of developed products.

### METHODOLOGY

The present investigation on spirulina as super food: Product enrichment was carried out to standardize spirulina and its products. The study was conducted in department of food and nutrition, Faculty of Home Science, Kamla Nehru Institute of Physical and Social Science, Sultanpur.

Justified, judicious and scientific methodological consideration is indispensable for any investigation to deduce meaningful interferences concerning the objectives of the study. The study design reflects to the logical manner in which units of the study are assessed and analyzed for the purpose of drawing generalizations. Thus, with the view of available resources, the best procedures for taking correct observation should be first sorted out in a logical manner so that unbiased interference can be drawn. This chapter delineates information pertaining to the research design and methodological steps

used for investigation. The research procedure has been distinctly described as under in the following heads:

#### Procurement of materials:

For the present investigation material *i.e.* spirulina powder was procured from the lucknow city and other materials were procured from local market of sultanmpur city. The procuring was done in single a lot to avoid variation compositional differences so that the quality differences should be ruled out.

#### Development of spirulina based products:

The powder was used for product development as follows:

#### Spirulina biscuit :

Biscuit is a term used for a variety of baked, commonly flour-based food product. The term is applied to two distinct products in North America and Commonwealth of Nations and Europe. The ingredients and the preparation of spirulina biscuits is given in Table B.

Ingredients	Amount		
	Controlled (T <sub>0</sub> )	Experimental (T <sub>1</sub> )	Experimental (T <sub>2</sub> )
Spirulina powder	-	1g.	2g.
Plain flour (Maida)	2 cup	2 cup	2 cup
Baking powder	1 tbsp	1 tbsp	1 tbsp
Baking soda	¼ tbsp.	¼ tbsp.	¼ tbsp.
Butter (salted)	100g.	100g.	100g.
Butter milk	¾ cup	¾ cup	¾ cup
Sugar	1 tbsp	1 tbsp	1 tbsp

#### Method:

- Mixed maida, butter milk, butter, baking powder, baking soda, sugar and spirulina powder.
- Mixed creamed mixture in sieved flour.
- Made soft dough with the help of water.
- Shaped dough in the form of biscuit.
- Baked for 25 minutes or until golden brown.

#### Spirulina Smoothie :

A smoothie (occasionally spelled smoothee or smoothy) is a thick beverage made from blended raw fruit or vegetable with other ingredients such as water, ice, or sweeteners. The ingredients and the preparation of spirulina smoothie is given in Table C.

Ingredients	Amount		
	Controlled (T <sub>0</sub> )	Experimental (T <sub>1</sub> )	Experimental (T <sub>2</sub> )
Spirulina powder	-	1g.	2g.
Milk	75 ml	75 ml	75 ml
Ripe banana	1	1	1
Curd	1 tbsp	1 tbsp	1 tbsp
Cardamom powder	1 pinch	1 pinch	1 pinch
Sugar	1 tbsp	1 tbsp	1 tbsp

**Method:**

Peeled and cut the banana.

Blended banana, spirulina powder, curd, milk, sugar and cardamom powder till smooth.

Serve immediately.

**OBSERVATIONS AND ASSESSMENT**

The data were collected on different aspects per plan were tabulated and analyzed statistically. The result from the analysis presented and discussed chapter in the following sequence.

Organoleptic evaluation of spirulina powder based product:

Organoleptic evaluation of spirulina powder based product:

Flavour and taste

Body and texture

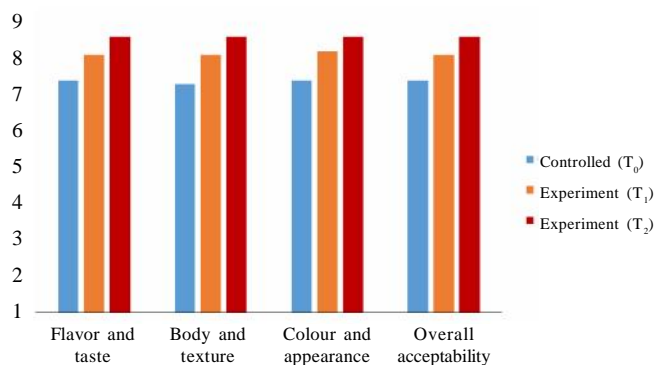
Colour and appearance

Over all acceptability :

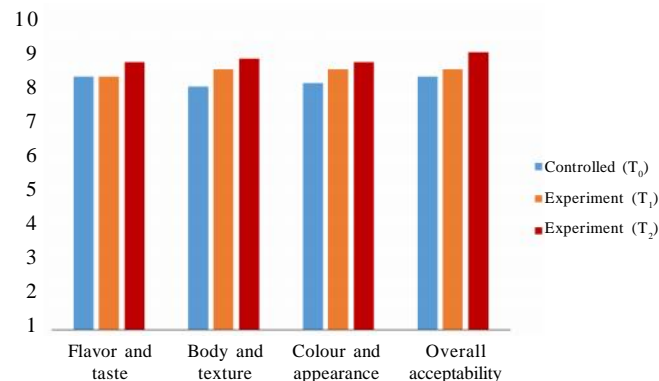
Table 1 shows that the Experimental (T<sub>2</sub>) obtained maximum 8.5, 8.5, 8.5, 8.5 for flavour and taste, body and texture, color and appearance and overall acceptability; and Experimental (T<sub>1</sub>) obtained 8.0, 8, 8.1, 8.0 for flavour and taste, body and texture, colour and appearance and overall acceptability; while control (T<sub>0</sub>)

obtained minimum 7.3, 7.5, 7.3, 7.3 for flavor and taste, body and texture, color and appearance and overall acceptability, respectively. This indicate the experiment (T<sub>2</sub>) biscuit was found to be fallen under category of “Liked Very Much to liked Extremely” (Fig. 1).

Ghaly *et al.* (2015) conducted that adding *Spirulina* cookies may affect their smell, color, appearance, texture and taste. The objectives of this study were to evaluate the acceptability of *Spirulina* added chocolate chip oatmeal cookies and to assess the effect of the amount



**Fig. 1 : Mean overall acceptability of biscuit**



**Fig. 2 : Mean overall acceptability of banana smoothie**

**Table 1 : Organoleptic evaluation of spirulina biscuit**

Product	Flavour and taste	Body and texture	Color and appearance	Overall acceptability
T <sub>0</sub> -Controlled	7.3	7.5	7.3	7.3
T <sub>1</sub> -Experimental	8.0	8	8.1	8.0
T <sub>2</sub> -Experimental	8.5	8.5	8.5	8.5

**Table 2 : Organoleptic evaluation of spirulina banana smoothie**

Product	Flavor and taste	Body and texture	Color and appearance	Overall acceptability
T <sub>0</sub> – Controlled	8.3	8	8.1	8.3
T <sub>1</sub> - Experimental	8.3	8.5	8.5	8.5
T <sub>2</sub> - Experimental	8.5	8.8	8.5	9

of added *Spirulina* on the sensory evaluation parameters (odor, color, texture, taste and shred) using a panel of 10 members. The results showed that all the baked samples had a noticeable smell. Adding and/or increasing the amount of *Spirulina* increased the vividness of the colour. The color appearance seemed acceptable to the majority of the panel members. The results showed that adding 3% *Spirulina* did not affect the odor and taste of the cookies and the addition of a strong aromatic compound to mask the smell of *Spirulina* or a flavoring agent to mask the taste of *Spirulina* may be required with higher concentrations of *Spirulina*.

Table 2 shows that the Experimental ( $T_2$ ) obtained maximum 8.5, 8.8, 8.5, 9 for flavour and taste, body and texture, color and appearance and overall acceptability; and Experimental ( $T_1$ ) obtained 8.3, 8.5, 8.5, 8.5 for flavor and taste, body and texture, colour and appearance and overall acceptability; while control ( $T_0$ ) obtained minimum 8.3, 8, 8.1, 8.3 for flavor and taste, body and texture, colour and appearance and overall acceptability, respectively. This indicate the experiment ( $T_2$ ) banana smoothie was found to be fallen under category of "Liked Very Much to liked Extremely" (Fig. 2).

Hosseini *et al.* (2013) conducted that spirulina and its products can be applied as feed and food additives in agriculture, food industry, medicine, science and cosmetic. It has high contents of macro and

micronutrients. This review article serves as an overview, introducing modified antioxidant rheological and anti-staling properties can be observed in spirulina incorporated food. *S. platensis* revealed to be a good stable ingredient when the desired colour is green. All possible usage of spirulina platensis in human food including beverages, gel dessert, bakery products, candy, dairy and confectionary are introduced.

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## ■ WEBLIOGRAPHY

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Received : 13.02.2018; Revised: 07.03.2018; Accepted : 22.03.2018