International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(5): 208-210

Received: 06-06-2020
Accepted: 29-07-2020

T Manoj Kumar
College of Food Science and Technology, Rudrur, Telangana, India

M Nikhil
College of Food Science and Technology, Rudrur, Telangana, India

TVN Padmavathi
Assistant Professor, Department of Food Safety and Quality Assurance, College of Food Science and Technology, Rudrur, Telangana, India

Corresponding Author:
T Manoj Kumar
College of Food Science and Technology, Rudrur, Telangana, India

Development and evaluation of spirulina ragi biscuits

T Manoj Kumar, M Nikhil and TVN Padmavathi

DOI: https://doi.org/10.22271/chemi.2020.v8.i5c.10301

Abstract
Spirulina (*Arthrospiraplatensis*), the blue green algae is a rich source of proteins and has several therapeutic properties. The present study focused on incorporating Spirulina powder with ragi (Fingermillet) flour for the preparation of biscuits respectively. Physico-chemical properties, textural profiles and sensory qualities of developed spirulina supplemented biscuits were analysed. Biscuits were prepared by incorporating spirulina powder (1-3%) respectively. Results of sensory evaluation showed that 2% spirulina powder incorporated biscuits was highly acceptable, with a score for overall acceptability 7.9 for biscuits. Carbohydrate, protein, fat, fibrecontent of the standardized biscuits was found to be 56.11, 11.64, 26.11, 3.08 respectively for biscuits.

Keywords: Spirulina powder, finger millet, biscuits, nutrient, sensory qualities, physico-chemical properties

Introduction
Spirulina is a cyanobacterium, (Oscillatoraceae family) which acquired the ability for photosynthesis before any other organism and is considered to be the ancestor from which the higher plants evolved. Spirulina (Arthrospira platensis) is a naturally occurring blue-green micro-algae which grows and thrives in warm water alkaline lakes. Spirulina is a Latin word meaning “helix” or “spiral”, denoting the physical configuration of the organism when it forms swirling, microscopic strands. It is a single celled organism that turns sunlight into micronutrient life energy. Spirulina has a blend of nutrients that no single plant source can provide. It has very high macro nutrient and micronutrient contents. It isrichinaminoacids, unsaturatedfattyacids, minerals, andvitamins. Spirulinaconsists of 55–70% protein content, 15–25% polysaccharide, 5–6% total lipid, 6–13% nucleic acids, and 2.2–4.8% minerals rich in potassium and sodium; moderate in magnesium, phosphorus, iron and calcium along with traces of zinc, copper, manganese and selenium (Khader 2001) [10]. Cobalamin is not required or synthesized by higher plants (Croft *et al*., 2005) so fruits and vegetables are poor sources of vitamin B12, which explains why vitamin B12-deficiency is common among people following strict vegetarian or vegan diets (Wagner-Dobler *et al*., 2010). The fact that Spirulina has an exceptionally high content of vitamin B12. Thus, it is considered as a good source for vegans for B12 vitamins (Gutierrez *et al*., 2015). In contrast to most vegetable matter, Spirulina does not have a cell wall made of cellulose, thereby making it easily digestible. Furthermore, Spirulina contains such molecules as phycocyanin, β-carotene and xanthophyll pigments,α tocopherol and phenolic compounds, which are responsible for the antioxidant.

Materials and method
Procurement of raw materials: Spirulinaplatensis powder was purchased from Herbalist indiaNascens enterprise India private limited, Mumbai. Ragi, wheat and other ingredients were procured from the local market.

Method of preparation: Spirulina, ragi flour and wheat flour sieved together by adding baking powder. Then butter is creamed by adding icing sugar. The above flour mixture is added to the cream and made into dough which was further rolled into uniform sheet of desired thickness. Using biscuit cutter sheet was cut into biscuits and baked in an oven at 160^0C for 35min. The baked biscuits was cooled for about 2 hours and packed in polypropylenebags.

Development of value added Spirulina ragi biscuit: To standardize the Biscuits different formulations were taken namely T_1, T_2, T_3 in comparison the standard control sample (T_0). The formulations were given in table 3.1 and 3.2 respectively.

Table 1: Organoleptic scores of developed spirulina supplemented biscuits

Parameter	T0	T1	T2	T3
Colour and Appearance	7.31 ± 0.96	6.81 ± 0.75	8.0 ± 0.80	6.62 ±0.74
Texture	7.56 ± 0.62	7.31 ±0.79	7.9023 ± 0.41	7.18 ± 0.75
Taste	7.68 ± 0.70	7.06 ± 1.01	7.81 ± 0.53	6.75 ± 0.70
Flavour	7.56 ± 0.67	7.0 ± 0.75	7.62 ± 0.58	6.81 ± 0.65
Mouth feel	7.61 ± 0.45	7.41 ± 0.41	7.80 ± 0.27	6.98 ± 0.65
Overall Acceptability	7.50 ± 0.46	7.31 ± 0.79	7.87 ± 0.58	6.68 ± 0.70

Values are means ± SD of Ten independent determinations

Nutritional evaluation

Prepared biscuit we were analysed for moisture, protein, fat, crude fiber, ash, carbohydrates and minerals.

Results and discussion

Organoleptic evaluation of developed Spirulina ragi biscuit

Colour and Appearance

The mean sensory score for colour and appearance was highest for T2 and lowest for T3. Increase in supplementation of spirulina develops green which makes biscuits less acceptable. According to mean scores of panelists, T2 had best acceptable color and appearance compared to other products.

Taste

According to the mean scores the panelists, T2 has better taste than T1 and T3. T3 is less acceptable due to the more due to high content of spirulina powder.

Texture

Texture is the sensory and functional manifestation of the structural, mechanical and surface properties of foods detected through the senses of vision, hearing, touch and kinesthetic. Texture is how the food feels in your mouth, hard, soft, crunchy, smooth etc. Texture is the feel of anything on our senses. According to the mean scores of the panel lists, T2 biscuits has better texture than T1 and T3. T1 has soft texture compared to T2 and T3.

Flavour

According to the mean scores of the panelists, T2 had better flavour compared to T1 and T3. The low acceptance of T3 is mainly due to the earthy flavour of the spirulina.

Mouthfeel

It is a texture of a substance as it is perceived and the tactile sensation a food gives to the mouth. The mean sensory score for mouth feel was highest for T2. Because of the earthy flavour of spirulina T3 has low score.

Overall Acceptability

The mean sensory score for overall acceptability was highest for T2 and lowest for T3.

The evaluation suggested that the T2 was most acceptable as it did not affect the quality and also improved the product in terms of taste, texture and flavour.

Physical characteristics of developed spirulina

Physical characteristics of biscuits such as thickness, width and weight and spread ratio were evaluated for biscuits. The thickness of the control biscuit was 10.06 mm which increased slightly with the incorporation of spirulina powder. The average thickness of T1, T2, T3 biscuits were 10.53, 10.61, 10.72 mm respectively. The width of control biscuit was 49.86 mm which increased with increase in level of supplementation of spirulina powder. The width of T1, T2, T3 were observed as 50.20, 50.28, 50.33 respectively. The changes in width and thickness are reflected in spread ratio which was calculated by dividing the width (W) by thickness (T) of the biscuits. Spread ratio of control biscuits was 4.95 which decreased with incorporation of spirulina powder. The spread ratio of T1, T2, T3 biscuits were 4.76, 4.73, 4.69 respectively.

Nutritional composition of acceptable spirulina

Moisture content of control biscuits was 4.80 percent which decreased gradually upon incorporation of spirulina powder maximum moisture content was observed in T1 biscuits and low moisture content in T3. The moisture content of T1, T2, T3 biscuits is 4.53, 4.30, 4.22 percent respectively.

Fat content of control biscuits was 26.26 per cent. Fat content of spirulina supplemented biscuits was found to be near to control sample. Maximum fat content was found in T3 and minimum fat content in T2. The fat content of T1, T2, T3 is found to be 27.45, 26.11, 28.58 percent respectively. Ash content of control biscuits was 1.65 percent. As the upon increasing the level of supplementation of spirulina powder the ash content of the biscuits is increased. Maximum ash content was observed in T3 biscuits and lowest in in T1. The ash content of T1, T2, T3 biscuits was 1.82, 1.84, 2.32 percent respectively.

Protein content of spirulina powder is observed to be 53 percent. Protein content of the biscuits increases with in creasein the level of supple mentation of spirulina powder. protein content in control biscuits is 8.79 percent. The protein content of T1, T2, T3 was 10.48, 11.64, 12.35 percent respectively.

Crude fiber content of the control biscuits was 2.11 percent. With increase in supplementation of spirulina powder the crude fiber content increased slightly compared to control sample. The fiber content of spirulina powder supplemented products T1, T2, T3 was 2.56, 3.08, 3.27 percent respectively.

Carbohydrate content of the control sample was 58.54 percent, which decreases with increase in supplementation of spirulina powder. The carbohydrate content of T1, T2, T3 was 56.19, 56.11, 52.77 percent respectively.

Table 2: Composition (%) of Biscuits supplemented with spirulina powder

Formulation	Moisture	Protein	Fat	Ash	Carbohydrates	Crude fiber
Control	4.80 ± 0.16	8.79 ± 0.28	26.26 ± 0.41	1.65 ± 0.11	58.54 ± 0.49	2.11 ± 0.17
Supplementation level (%)						
T1	4.53 ± 0.25	10.48 ± 0.31	27.45 ± 0.23	1.82 ± 0.10	56.19 ± 0.35	2.56 ± 0.08
T2	4.30 ± 0.62	11.64 ± 0.23	26.11 ± 0.28	1.84 ± 0.08	56.11 ± 0.35	3.08 ± 0.15
T3	4.22 ±0.04	12.35 ± 0.12	28.58 ± 0.14	2.32 ± 0.20	52.77 ±0.24	3.27 ± 0.29

Values are means ± SD of three independent determinations

Summary

Food is not only taken to satisfy the hunger but also to serve the nutritional needs of our body for physical and mental wellbeing. Currently producing traditional foods cannot meet the nutritional needs of the increasing population, so world is looking towards the super foods. One of them is spirulina. The current study "development and evaluation of value added food products from spirulina" involves supplementation of developed foods with the spirulina powder. The summary of the study was discussed in the following lines:

The width and thickness of the biscuits increases with increase in level of supple mentation of spirulina powder from 49.66 -50.33mm and 10.06 -10.72 mm respectively.

The spread ratio of biscuits decreases with increase in supplementation of spirulina powder, the maximum spread ratio was observed in T1. The values were ranged in between 4.69 -4.93. The bulk density of IPM increases with increase in spirulina supplementation. Maximum bulk density was observed in T3. The values were ranged in between 0.360 – 0.423. Moisture content control sample biscuits and instant mixes ranged from 4.89-7.29 % which decreased gradually on supplementation of spirulina powder. The decrease is due to addition of dried spirulina powder. Protein content of spirulina supplemented products are more when compared to the control samples. Protein content values were ranged in between10.48 – 12.23. This is mainly due to the quality of protein in the spirulina. Similar results were also reported earlier by (Padma A *et al*., 2017).

Conclusions

From current study it can be concluded that spirulina powder is the potent source of all the major nutrients. Due to its high nutrient content it can be used in preparation of variety of products. It can used for preparation of variety of flours by blending it in different proportions that can be used in bakery, confectionary and snack industries. The products made by supplementing spirulina powder found to be acceptable in terms of taste and flavour.

References

1. Amerine MA, Pangborn RM, Roseller EB. Principles of Sensory Evaluation of Food. Academic Press London. 1965, 5.
2. Bishop WM, Zubeck HM. Evaluation of microalgae for use as nutraceuticals and nutritional supplements. Journal of Nutrition and Food Science. 2012; 2:1-6.
3. Bogahawatte C. Production and application of *Spirulina platensis* rich in fatty acids, and vitamins. International Journal of Agricultural Environment. 2013; 1:39-52.
4. Borchers AT, Belay A, Keen CL, Gershwin ME. Spirulina and Immunity in Spirulina in Human Nutrition and Health. Gershwin and Belay (ed.), CRC Press. 2007, 177-193.
5. Annapurna V, Shah N, Bhaskaram P, Bamji M, Reddy V. Bioavailability of *Spirulina* carotenes in pre-schoolchildren. Journal of Clinical Biochemistry Nutrition. 1991; 10:145-151.
6. Gouveia L, Raymundo A, Batista A, Sousa I, Empis J. Chlorella vulgaris and Haematococcus pluvialis biomass as colouring and antioxidant in food emulsions. J Euro Food Res technol. 2006; 222:362-7.
7. Jagathy K, Divya D. Cultivation of *Spirulina (Arthrospira platensis)* and its use as a food supplement to increase blood heamoglobin level. International Journal of Advance Research in Biology Science. 2014; 1(5):39-45.
8. Branger B, Cadudal JL, Delobel M, Ouoba H, Yameogo P, Ouedraogo D. Spirulina as a food supplement in case of infant malnutrition in Burkina-Faso. Archives de pediatrie. 2003; 10(5):424-431.
9. Bujard E, Braco U, Mauron U, Mottu J, Nabholz FA, Wuhrmann JJ *et al*. Composition and Nutritive Value of Blue Green Algae (Spirulina) and their Possible Use in Food Formulations." 3rd. International Congress of Food Science and Technology, Washington, 1970.
10. Khader V. Textbook of Food Science and Technology, New Delhi. Directorate of Information and Publication of Agriculture, Indian Council of Agriculture, 2001.