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Development of Spirulina Based "Biscuits": A Potential Method of Value Addition

Vandita Sharma and Vimla Dunkwal

Department of Food and Nutrition, College of Home Science, RAU, Bikaner, Rajasthan, India

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ABSTRACT The present study was undertaken to assess the nutritional composition of Spirulina powder, development of Spirulina based value added products and their nutritional composition and shelf life. Value added biscuitswere prepared by using refined wheat flour, sugar powder, ghee, milk, ammonia, baking powder, custard powder, milk powder, vanilla and pineapple essence and 10 per cent level of Spirulina powder. Mean score for overall acceptability of value added biscuitwas 7.5 against the control sample, 7.9 on nine point hedonic ranking scale. The developed value added biscuitcontained 2.95 per cent moisture, 19.6g protein, 26.71g fat, 2.08g crude fiber, 1.83g ash, 46.83 g carbohydrate and 506.11 kcal energy per 100g on dry weight basis. Spirulina supplemented biscuits had β-carotene, vitamin C, iron and potassium contents in the range of 349.75 µg/100g, 2.75 mg/100g, 17.62 mg/100g and 292 mg/100g, respectively. Fat acidity revealed satisfactory quality of the value added biscuitat the end of three months of storage period. Thus, Spirulina based value added products may be beneficial for vulnerable population due its high nutritive value. These would also be advantageous for those who are suffering from degenerative diseases because of its therapeutic properties.

INTRODUCTION

Spirulina is a nutrient rich super food for super health. Super foods can be defined as foods that have health promoting benefits and disease preventing properties over and above their usual nutritional value. Spirulina is the common name for human and animal food supplements produced primarily from two species of Cynobacteria, that is, *Arthrospireaplatensis* and *Arthrospira maxima*. Spirulina has many therapeutic properties such as hypocholestrolemic, immunological, antiviral and antiglutagenic effects (Mark 2007).Spirulina is an excellent source of protein. Today, food is lower in essential nutrients than foods produced 50 years ago. Farming practices have depleted our soil fertility (http://www.spirulinasource.com). Stress from environmental pollutants and lifestyle demands have increased our dietary requirements for certain essential nutrients. To overcome these problems, some super foods like aloe vera, garlic, tomato, walnut, blue green algae (spirulina) have been introduced. Spirulina, Blue green algae (fusiformis) is being used as nutrient dense food materials in natural and health foods. It also has some potent nutrients and probiotic compounds that enhance health condition (Shrilaxmi 2001). Interest in food application of micro algae has its origin on three counts. Firstly, in certain countries a small section of the population has been eating naturally grown algae harvested from lakes etc. without ill effects for centuries (Becker 1986). Secondly, the focus on protein calorie malnutrition in the third world countries was drawn by the FAO in sixties, which led to identification of newer protein source, particularly algae (Anonymous 1963). Thirdly, Spirulina has been proposed by both NASA and the European space agency as one of the primary foods to be consumed during long stay in space (Khader 2001). Spirulina is a nutrient dense food. It is particularly rich in proteins and also contains carotenoids, vitamins, minerals and essential fatty acids (Khan 2005). It contains 55-70 per cent protein, 15-25 per cent carbohydrates, 6-7 per cent moisture and 8-13 per cent minerals, 3-7 per cent fat and 8-10 per cent fiber (http://www.spirulinasource.com).

METHODOLOGY

Procurement of SpirulinaPowder: Spirulina powder was purchased from *"Manjul Spirulina Samvardhan Sansthan",* Jaipur**.**

Development of Value Added Biscuit: Most acceptable value addition level of Spirulina powder, that is, 10 per cent was incorporated into the recipe with other ingredients.

Organoleptic Evaluation: The developed value added *Biscuit* was standardized using organoleptic evaluation technique with the help of 10 panel members using 9-point hedonic ranking scale. (Swaminathan1987). The developed value added *biscuit* along with control

Table 1: Organoleptic acceptability of value added biscuit

S. No.	*Biscuit*	*Colour*	*Appearance*	*Aroma*	*Texture*	*Taste*	*Overall acceptability*
1	*Control*	7.8 ± 0.22	7.8 ± 0.12	7.9 ± 0.61	8.0 ± 0.37	8.0 ± 0.12	7.9 ± 0.48
2	*Spirulina based*	7.4 ± 0.66	7.7 ± 0.78	7.7 ± 0.90	7.6 ± 0.80	7.3 ± 0.64	7.5 ± 0.60
3	*'t' value*	NS	NS	NS	NS	NS	NS

Values are mean ±SD of three replicates NS = Non significant

sample served to the panel members for organoleptic evaluation.

Nutritional Evaluation: Prepared *biscuit* were analyzed for moisture, crude protein, crude fat, crude fiber, ash, Vitamin C, β-carotene, iron and potassium contents along with total carbohydrate and energy contents. (AOAC 1995).

RESULT AND DISCUSSION

Organoleptic Evaluation: Data reveal that the calculated overall mean organoleptic scores for the control sample of *biscuit* was to be ranging between 7.8 to 8.0 against 7.3 to 7.7 scores for develop value added *biscuit* on nine point hedonic ranking scale (Swaminathan 1987).The statistical analysis also showed non-significant difference between the control and developed samples of biscuits (Table 1).

Nutritional Evaluation: Data from Table 2 unfold the nutritional contents of control and developed *biscuit*. Moisture content of control and developed sample was analyzed as 2.57 per cent and 2.95 per cent, respectively. Crude protein content was observed lower (13.01%) in control sample whereas higher value (19.06%) was observed in developed sample. Data from the table depicts that 28.11 per cent and 26.71 per cent crude fat found in control and developed sample, Crude fiber content of control and developed *biscuit* was 1.28 per cent and 2.08 per cent respectively, indicating higher crude fiber in the developed sample than its control counterpart. On the other hand, ash content was 1.13 per cent and 1.83 per cent respectively.

In control *biscuit*, total carbohydrate was calculated 53.81 per cent whereas in developed sample it was 46.83 per cent. Total energy content of control sample was 520.06 kcal/100 g whereas in developed *biscuit*, it was noted to be 506.11 kcal/100 g (Table 2). Crude proteins, crude fat, crude fibre, total carbohydrate and total energy content of developed *biscuit* were found to be higher and significantly differ at 1 per cent of the control sample. In control sample, β-carotene, vitamin C, iron and potassium content were 335.75 mg/100 g, 1.75 mg/100 g, 2.62 mg/100g and 152 mg/100 g respectively whereas in developed *biscuit*, values were recorded 349.75 mg/100 g, 2.75 mg/100 g, 17.62 mg/100 g and 292 mg/100 g β-carotene, vitamin C, iron and potassium respectively (Table 3). The

Table 2: Proximate composition of value added biscuit (on dry weight basis)

Biscuit	*Moisture (%)*	*Crude protein(%)*	*Crude fat(%)*	*Crude fiber(%)*	*Ash (%)*	*Carbohydrate (%)*	*Energy (kcal)*
Control	2.57 ± 0.01	13.1 ± 0.16	28.11 ± 0.01	1.28 ± 0.67	1.13 ± 0.02	53.81 ± 0.05	520.6 ± 0.07
Spirulina based	2.95 ± 0.58	19.6 ± 0.02	26.71 ± 0.24	2.08 ± 0.45	1.83 ± 0.54	46.83 ± 0.22	506.11 ± 0.02
't' value	3.12**	48.20*	9.70*	10.39*	3.32**	32.67*	178.25*

Values are mean ±SD of three replicates *significant at 1% significant **significant at 5% significant

Table 3: Vitamin and mineral contents of value added biscuits

Biscuit	*Vitamins*		*Minerals*	
	β-carotene (mg/100 g)	*Vitamin C (mg/100 g)*	*Iron (mg/100 g)*	*Potassium (mg/100 g)*
Control	335.75 ± 0.43	1.75 ± 0.45	2.62 ± 0.09	152 ± 0.77
Spirulina based	349.75 ± 0.78	2.75 ± 0.34	17.62 ± 0.11	292 ± 0.26
't' value	5.89*	22.20*	28.16*	78.74*

Values are mean ±SD of three replicates *significant at 1% significant **significant at 5% significant

values were found to differ significantly at 1 per cent level in developed than that of control sample.

CONCLUSION

So it can be inferred from the present study that the developed *Biscuits* by using Spirulina were nutritious and acceptable. Reviews clearly show that Spirulina has many therapeutic uses and great nutritional value. Therefore, results suggest that there is a great scope for use and marketing of value added *Biscuits* using Spirulina and it can be concluded that Spirulina has a great scope in the field of product development and can be utilized for achieving food and nutritional security for nation.

RECOMMENDATIONS

Results suggest that there is a great scope for use and marketing of value added biscuits using spirulina. Since the scope of this research is limited, it is suggested that the present investigation may be continued for following:

- Ø To study the microbial levels of value added products using spirulina.
- Ø To estimate the cost variable of developed value added products.
- Ø To study commercial aspect of the value added products using Spirulina.

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APPENDIX

Score Card
Score Sheet for taste panel/data under Hedonic Rating Scale

Name : _____

Product: _____ Date: _____

Test these samples and check how much you like or dislike one. Use appropriate scale to show your attitude by assigning points thatbest describe your feeling about the sample. An honest feeling of yourexpression will help to get unbiased data.

CodeNo.	Colour	Appearance	Texture	Aroma	Taste	Overall Acceptability	Totalremarks

Rate	Organoleptic Score
Liked Extremely	9
Liked very much	8
Liked moderately	7
Liked slightly	6
Neither like nor dislike	5
Disliked slightly	4
Disliked moderately	3
Disliked very much	2
Disliked extremely	1

Remarks:
Signature