

Original Research Article

<https://doi.org/10.20546/ijcmas.2021.1001.346>

Development of Healthy Snacks (*Sev*) Supplemented from *Spirulina platensis* Powder and Organoleptic Evaluation

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ABSTRACT

Keywords

Proximate composition, *Spirulina*, Organoleptic evaluation

Article Info

Accepted:
18 December 2020
Available Online:
10 January 2021

Today is world of processed foods (snacks) that are less healthy food. The main aim of the study was development of healthy snacks (*Sev*) from wheat-bengal gram flour supplemented with different levels of *Spirulina* powder (2, 4, 6 and 8%). Accepted levels were further evaluated for proximate composition. The results of the study revealed that overall acceptability scores in terms of colour, appearance, texture, aroma and taste of prepared snacks (*Sev*) by using four types of composite flour were rated as 'liked moderately' to 'neither liked nor disliked' by the judges. Snacks products were found acceptable up to 6 per cent level of supplementation of *Spirulina* powder. Control *Sev* made from Bengal gram flour which exhibited 2.38 per cent moisture, 19.38 crude protein, 30.20 per cent crude fat, 2.62 per cent crude fibre and 2.62 per cent ash contents which were found significantly improved with the addition of *Spirulina* powder at 2, 4 and 6 per cent level.

Introduction

Today, malnutrition is one of the *severe* crisis in world. As per Several statistical reports it affects not less than one in four children around the world. Indeed, it is a major killer of children every hour of every day. Chronic malnutrition is more lethal and more extensive than short term acute malnutrition (Bhan and Bahl, 2003). Both under and over nutrition posing threat of double burden of malnutrition. Thus urgent step is required to be taken towards the direction of providing

proper balanced nutrition. Though, malnutrition can be easily cured with supportive nutrition balance and drug regimen. It is always better to fortify them with required nutritional contents to avoid future chances of malnutrition. So there is need of development of fortified food items.

Snacks are very popular today among all generations of human beings specially children and adolescent. These foods are generally refined, rich in fat, carbohydrates and energy, but lacking in dietary fibre and

micronutrients (Udayasree *et al.*, 2013; Padma and Rajendran, 2017). Therefore, nutritional enrichment of these food products can be advantageous to use as carrier of nutrients due to their simple manufacturing process, better shelf life, high acceptability and consumption (Fadaei *et al.*, 2013; Hafsa *et al.*, 2014).

Spirulina is well known blue-green algae with heavily loaded micronutrients required for human body. *Spirulina* is categorized as super food and recommended by WHO and NASA. For value addition, nutrient rich ingredients like *Spirulina* and chickpea flour can be used along with wheat flour for enhancing the nutritional quality of wheat based bakery and traditional recipes (Mohammed *et al.*, 2012; Lohekar 2014; Samta & Jood 2018; Rao 2018). Keeping this fact in view, the present study was planned with objectives to develop value added healthy snacks, and evaluation of their sensory properties and nutritional value.

Materials and Methods

The present study was carried out in the Department of Foods and Nutrition, I.C. College of Home Science, Choudhary Charan Singh Haryana agricultural university, Hisar, Haryana during the year 2017-2019.

Procurement and preparation of samples

Wheat and bengal gram flour were procured in a single lot from local market. *Spirulina* powder (food grade) was also procured from market. All the samples were stored in air-tight plastic containers for further use.

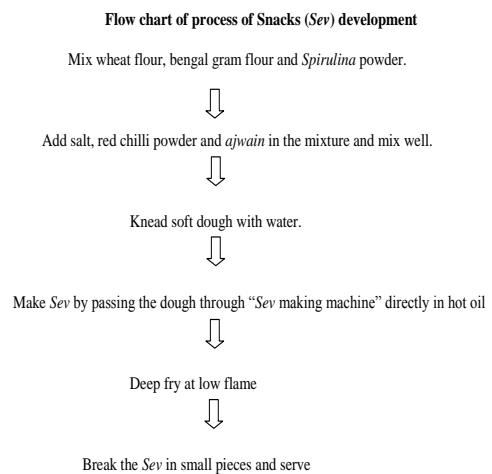
Standardization and formulation of composite flour

Different proportions of wheat flour, bengal gram flour and *Spirulina* powder were used

for formulation of composite flour. As a control, bengal gram flour (100%) was used for *Sev*. Four types of composite flours were prepared by using wheat flour, bengal gram flour and *Spirulina* powder i.e in the ratios of 50:50:0 (control), 49:49:2 (Type-I), 48:48:4 (Type-II), 47:47:6 (Type-III) and 46:46:8 (Type-IV).

Development of healthy snacks (*Sev*)

Snacks were prepared by blending wheat flour, bengal gram flour and *Spirulina platensis* powder at different levels. *Sev* were prepared by blending wheat flour, bengal gram flour and *Spirulina platensis* powder at different levels. Ingredient with different levels are given in Table 1.



Sev prepared by using *Spirulina platensis* powder is represented in Figure 1.

Organoleptic acceptability of developed value added snacks (*Sev*)

All the developed value added food products were organoleptically evaluated for their colour, texture, appearance, taste and overall acceptability by using 9-point Hedonic scale. On the basis of organoleptic acceptability, acceptable value added healthy snacks were further evaluated for their proximate composition.

Proximate composition

The proximate composition of food products were determined by employing the standard methods of analysis AOAC, (2000). Crude protein was estimated by standard method of (AOAC 2000) using KEL PLUS Automatic Nitrogen Estimation System.

The micro Kjeldahl method was employed to determine the total nitrogen and the crude protein (N x 5.95). Crude fat was extracted using petroleum ether using the Automatic SOCS Plus Solvent Extraction System. The ash and crude fibre contents were determined based on methods outlined in AOAC, (2000).

Statistical analysis

The data obtained were analyzed statistically using standard methods of analysis (Sheoran & Pannu 1999).

Results and Discussion

Organoleptic characteristics of developed value added food products

Mean scores of organoleptic characteristics (colour, appearance, aroma, texture, taste and overall acceptability) of developed value added snacks (*Sev*) are presented in the Table 2. Overall acceptability scores of *Sev* made from wheat flour and four types of composite flour i.e. Type-I, Type-II, Type-III and Type-IV were 8.26, 7.72, 7.42, 6.74 and 5.62, respectively. It was observed that *Sev* made from Type-IV composite flour scored lowest overall acceptability scores. Acceptability of *Sev* was found to be decreased with increasing the level of incorporation of *Spirulina* powder in wheat-bengal gram flour blend. Similar results were also reported by the workers in *Spirulina* supplemented bread, biscuits and snacks (Navacchi *et al.*, 2012; Minh 2014; Saharan 2017; Shinde *et al.*, 2018).

Table.1 Proportion of different ingredients

Supplementation level (%)	Ghee (g)	Ajwain (g)	Red chilli powder	Salt	Oil	Lukewarm water
Control (100 % BF)	10.0	2.5	To taste	To taste	For frying	For kneading Dough
WF:BF:SP						
49:49:2 (Type-I)	10.0	2.5				
48:48:4 (Type-II)	10.0	2.5				
47:47:6 (Type-III)	10.0	2.5				
46:46:8 (Type-IV)	40.0	2.5				

WF = Wheat flour BF = Bengal flour SP = *Spirulina* powder

Table.2 Mean scores of organoleptic characteristics of value added *Sev*

Types of <i>Sev</i>	Colour	Appearance	Aroma	Texture	Taste	Overall Acceptability
Control (BGF 100%)	8.40±0.48	8.40±0.33	8.10±0.26	8.20±0.25	8.20±0.30	8.26±0.32
Type-I	7.70±0.17	7.70±0.22	7.70±0.23	8.00±0.17	7.50±0.31	7.72±0.29
Type-II	7.50±0.11	7.30±0.17	7.30±0.20	7.80±0.20	7.20±0.27	7.42±0.31
Type-III	7.10±0.17	6.30±0.19	6.30±0.31	7.10±0.21	6.90±0.16	6.74±0.11
Type-IV	6.20±0.18	5.70±0.40	5.70±0.28	6.00±0.20	5.50±0.17	5.62±0.15
CD (p=0.05)	0.15	0.12	0.22	0.16	0.15	0.05

Values are mean± SE of ten panelists

Type-I: WF: BGF: SP (49:49:2) Type-II: WF: BGF: SP (48:48:4)

Type-III: WF: BGF: SP (47:47:6) Type-IV: WF: BGF: SP (46:46:8)

WF: Wheat flour BGF: Bengal gram flour SP: *Spirulina* powder

Table.3 Proximate composition of value added *Sev* (% , on dry matter basis)

Types of <i>Sev</i>	Moisture*	Crude protein	Crude fat	Crude fiber	Ash
Control (BGF 100%)	2.38±0.39	19.38±0.06	30.20±0.66	2.62±0.19	2.62±0.21
Type-I	2.92±0.48	16.54±0.14	31.40±0.45	2.82±0.18	2.73±0.15
Type-II	3.60±0.51	18.39±0.16	32.70±0.79	3.04±0.16	2.92±0.19
Type-III	4.02±0.23	20.52±0.15	34.30±0.67	3.98±0.18	3.42±0.12
CD (p=0.05)	0.29	0.07	0.43	0.14	0.10

*On wet matter basis Values are mean± SE of three independent determinations.

Type-I: WF: BGF: SP (49:49:2) Type-II: WF:BGF: SP (48:48:4) Type-III: WF: BGF: SP (47:47:6)
 WF: Wheat flour BGF: Bengal gram flour SP: *Spirulina* powder

Fig.1 *Spirulina platensis* powder supplemented *Sev*



Control: Bengal gram flour (100%)

Type-I: Wheat flour: Bengal gram flour: *Spirulina* powder (49:49:2)

Type-II: Wheat flour: Bengal gram flour: *Spirulina* powder (48:48:4)

Type-III: Wheat flour: Bengal gram flour: *Spirulina* powder (47:47:6)

Type-IV: Wheat flour: Bengal gram flour: *Spirulina* powder (46:46:8)

WF = Wheat flour BF = Bengal flour SP = *Spirulina* powder

Therefore, it can be concluded that, highly acceptable *Sev* can be prepared using 6 per cent levels of *Spirulina* powder and addition of beyond 6 per cent levels of *Spirulina* powder significantly reduced the mean scores of colour, appearance, texture, taste and overall acceptability scores. Shinde *et al.*, (2018) reported that *Spirulina* supplementation affected slightly sensory characteristics of supplemented products

might be due to its green colour and appearance. Snacks up to 6 % *Spirulina* had sensory acceptance.

Proximate composition

The proximate compositions of snacks have been summarized in Table 3. Bengal gram flour made served as control which exhibited 2.38 per cent moisture, 19.38 crude protein,

30.20 per cent crude fat, 2.62 per cent crude fibre and 2.62 per cent ash contents which were found to be significantly improved with incorporation of *Spirulina* powder at 2, 4 and 6 per cent level. Type-III composite flour made *Sev* exhibited significantly higher content of moisture, crude protein, crude fat, crude fiber and ash followed by Type-II and Type-1 composite flour made *Sev*.

Similar results were reported in *Spirulina* supplemented biscuits, cookies and snacks by other workers (Sharma & Dunkwal 2012; Vijayarani *et al* 2012; Ponciano 2015; Saharan 2017; Shinde *et al.*, 2018)

Conclusively, this study has shown that healthy snacks can be developed using *Spirulina* powder supplementation along with bengal gram flour and wheat flour. Snacks up to 6 % *Spirulina* manifested sensory acceptance. Consumption of Food products using such supplementation can go a long way in improving the nutritional status and health of the population especially for those suffering from Protein Energy Malnutrition.

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How to cite this article:

Seema, S. Jood and Mahima Kumari. 2021. Development of Healthy Snacks (Sev) Supplemented from *Spirulina platensis* Powder and Oragnelopetic Evaluation. *Int.J.Curr.Microbiol.App.Sci*. 10(01): 2993-2998.
doi: <https://doi.org/10.20546/ijcmas.2021.1001.346>