Formulation of Nutrients Rich Multigrain *Sev* and It's Storage Potential

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***Abstract*— A study was conducted to develop a nutrient rich snack product *sev* by using multiple flours i.e. soybean flour, bengal gram flour and rice flour to check its storage stability and nutritional values. Soybean flour is used as key flour which is rich in protein. The main objective to incorporate rice flour is to provide crispiness and instant energy to the *sev* whereas Bengal gram is rich source of protein, iron and calcium. Chickpea and soybean is an important legume with a rich source of protein and dietary fiber. In present study soybean flour, rice flour and bengal gram flour with spices like cumin, asafoetida, chilli powder and turmeric was taken for preparation of multigrain *Sev*. To evaluate the acceptance of consumers four different combinations of these ingredients were made i.e. S_1 to S_4 simultaneously (soybean flour, bengal gram flour, rice flour, spices) i.e. S_1 (45:45:05:05), S_2 (50:35:10:05), S_3 (55:25:15:05), S_4 (60:15:20:05). The sensory properties were judged on the basis of color, appearance, texture, taste and overall acceptability by using 9 point Hedonic scale. On the basis of samples it was concluded that S_3 (55:25:15:05 ratio of soybean flour, bengal gram, rice flour and spices) was highest acceptable with respect to all sensory attributes and physical characteristics of final product with the nutritional value of carbohydrates, protein, ash, fat and energy value 45.99, 8.99, 4.76, 36.22 and 545.90 percent respectively. The selected sample was packed in LDPE and stored at ambient temperature (30 ± 4ºC) for 90 days of storage study. Then the sample was evaluated at the beginning and at interval of 15, 30, 45, 60, 75, and 90 days for chemical and microbiological analysis in order to study the storage stability of the product. The result shown the slight increase in moisture and peroxide value while decrease fat content and microbial count of multigrain *sev* was increased slightly during storage period but *sev* was acceptable upto 90 days.**

Keywords: LDPE, Sev, Chickpea, Multigrain, Crispiness.

I. INTRODUCTION

Sev is one of the Indian traditional deep fat fried snack food (Pruthi *et al*., 1983). Snacks are very popular today among all generations of human beings specially children and adolescent. These foods are generally refined, rich in protein, 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).
Traditionally, it is prepared form Bengal gram flour with additives such as salt, spices and sodium bicarbonate; various other additives are also added to impact crispy and crunchy texture organoleptic appeal and to increase the physical condition of the fried product (berry *et al*., 1986). *Sev* is eaten as a standalone snack as well as a topping on dishes like Bhelpuri and *Sev* puri. This popular snack being tasty and tempting is simultaneously full of fats as it is deep fried.

Soybean (*Glycine max*) belongs to the family *Leguminosae* and subfamily *Papilionaceae*. It is a remarkable source of protein for both animals and human consumption and is also a leading source of edible oils and fats (Singh *et al*., 1999; Alabi *et al*., 2001).The seeds of various varieties of soybeans may be spherical, elongated and flat in nature, but the industrial varieties are particularly yellowish in color and oval in shape (Iwe MO and Onuh JO., 1992). Soybean oil and protein content together account for about 60% of dry soybeans by weight with protein at

40% and oil at 20%. The remainder consists of 35% carbohydrate and about 5% ash. Soybean cultivars comprise approximately 8% seed coat or hull, 90%cotyledons and 2% hypocotyls axis or germs (Liu K., 2000). Soya is also known to be a good source of the trace elements copper, zinc and manganese and can be said to contain all the nutrients needed in food (Ampofo, 2009)

Chickpea (*Cicer arietinum* L.) is one of the top five important legumes based on whole grain production (FAO, 2000). It is an important component of the diets of those individuals who cannot afford animal proteins or those who are vegetarian by choice. It is also cholesterol free and a good source of dietary fibre, vitamins, minerals (Jukantil *et al*., 2012). It has been used for the preparation of various traditional foods (Ravi and Suvendu, 2004), such as an ingredient in bakery products, imitation milk, infant food formulations and meat products. Whole chickpea contains 17.1% protein, 5.3% fat and 3.0% minerals. According the scientific literature the chickpea consumption is helpful in lowering the risk of coronary heart disease and control the cholesterol accumulation, in improving the glucose tolerance and insulin sensitivity; also if chickpea seeds are incorporated as a part of regular diet that may help to reduce blood pressure, to prevent different forms of cancer, to control the body weight increment etc (Hefnawy *et al*., 2012)

Rice *(Oryza sativa)* is the most common staple food which is consumed by half of the World's human population. Rice, as a cereal, serves as a basic food source for over half the world population whilst it provides about 80 % of the food intake as ready-to-eat convenience and inexpensive gluten-free snacks (Awolu *et al*., 2015). Nutritionally, cereals are important sources of carbohydrates, dietary fibre and vitamins (Katina *et al*., 2005). Rice flour is a particularly good substitute for wheat flour, which causes irritation in the digestive systems of those who are gluten-intolerant (Chandra S. and Shamsher *et al*., 2013). It is also a good source of thiamine (vitamin B1), riboflavin (vitamin B2) and niacin (vitamin B3) (Depa *et al.*, 2008). Rice flour possesses functional properties in enhancing texture and whiteness.

Red chilli (*Capsicum annuum*) belonging to the plant genus Capsicum, is among the most heavily consumed spices throughout the world. The name, which is spelled chili, chile, or chilli, comes from Nahuatl chilli via the Spanish word chile. Red chili has been used as an alternative medicine for the treatment of inflammation, diabetes, low back pain and also in homeopathy medicine to treat acute tonsillitis (Spiller F *et al*., 2008: Wiesenauer M., 1998).

Turmeric (*Curcuma longa*) is a yellow-colored spice derived from the rhizome of the plant Curcuma longa and has been used as traditional medicine. As a traditional remedy, turmeric has also been quite extensively used for centuries to treat various disorders such as rheumatism, body ache, skin problems (e.g. wounds, burns and acne), intestinal worms, diarrhea, intermittent fevers, hepatic diseases, urinary discharges, dyspepsia, inflammations, constipation, leukoderma, amenorrhea, dental diseases, digestive disorders such as dyspepsia and acidity, indigestion, flatulence, ulcers, and colic inflammatory disorders such as arthritis, colitis and hepatitis (Aggarwal BB *et al*., 2007: Thangapazham RL *et al.*, 2007).

Cumin seeds (C*uminum cyminum*) are nutritionally rich; they provide high amounts of fat (especially monounsaturated fat), protein, and dietary fibre. Vitamins B and E and several dietary minerals, especially iron, are also considerable in cumin seeds. Cumin aldehyde cymene, and terpenoids are the major volatile components of cumin (Bettaieb *et al*., 2011). They are also commonly used in traditional medicine to treat a variety of diseases, including chronic diarrhoea and dyspepsia, acute gastritis, diabetes, and cancer. The literature presents ample evidence for the biological and biomedical activities of cumin, which have generally been ascribed to its bioactive constituents such as terpenes, phenols, and flavonoids (Mnif and Aifa, 2015).

Asafoetida (*Ferula assa-foetid*) is used as a flavoring agent in food and as a traditional medicine for many diseases in many parts of the world. Asafoetida is traditionally used for the treatment of different diseases, such as whooping cough, asthma, ulcer, epilepsy, stomachache, flatulence, bronchitis, intestinal parasites, antispasmodic, weak digestion and influenza (Takeoka G *et al*., 2001: Lee C.L *et al*., 2009) Asafoetida is an effective remedy for several diseases of the stomach. The digestive stimulant actions of asafoetida are the most commonly experimented beneficial physiological effect via enhanced secretion of saliva and activity of salivary amylase (Mahendra P *et al*., 2012: Al-Jafari A.H *et al*., 2012)

II. MATERIALS AND METHODS

The raw materials for preparation of multigrain *sev* i.e. soybean flour, bengal gram flour, rice flour and spices (cumin, asafoetida, chilli powder and turmeric) were collected from local market Shrigonda. The study was carried out in at the Department of Food Process Technology in SCFT, Ghargaon, Ahmednagar (MS), India.

Formulations of multigrain Sev

Table No 01: Formulations of multigrain *Sev*

Sr. No.	Ingredients	Sample No.	Formulations
1	Soybean flour + Bengal gram flour + Rice flour + Spices	1	45+45+05+05
2	Soybean flour + Bengal gram flour + Rice flour + Spices	2	50+35+10+05
3	Soybean flour + Bengal gram flour + Rice flour + Spices	3	55+25+15+05
4	Soybean flour + Bengal gram flour + Rice flour + Spices	4	60+15+20+05

Preparation of multigrain Sev

Selection of ingredients
(Soybean Flour, Bengal gram Flour and Rice Flour)
↓
Seiving
↓
Scaling (all ingredients)
↓
Mixing (Spices and Flours)
↓
Dough making
↓
Extrusion
↓
Frying (170˚C to 190˚C for 25 to 30 sec)
↓
Cooling at room temperature
↓
Weight of final product
↓
Labelling and Packaging
↓
Storage

Sensory Evaluation

The quality of multigrain *sev* was evaluated for sensory characteristics (color, taste, flavour, mouth feel and overall acceptability) during storage on hedonic rating scale by a semi trained panellist members.

Physico-Chemical analysis

The physio-chemical attributes like protein, fat, carbohydrate, moisture and ash were analysed to assess the quality of multigrain *sev*. The protein, fat, carbohydrate, moisture and ash was determined by the standard method of AOAC (2000).

Microbiological Evaluation

The microbiological analysis of *sev* was performed by following the method of Harrigan (1998). The samples were prepared by 10 fold serial dilution and the total viable count was estimated by using nutrient agar as medium. The colonies were manually counted by colony counter.

III. RESULTS AND DISCUSSION

The research was conducted to study the quality parameter of multigrain *sev* by physico-chemical, microbial and sensory parameter during storage period. The four different trials of multigrain *sev* were prepared with different proportions of soybean flour, bengal gram flour, rice flour and spices (cumin, asafoetida, chilli powder and turmeric)

Sensory Analysis

	Sensory Attributes				
	Color and Appearance	Flavour and Taste	Body and Texture	Mouth Feel	Overall Acceptability
S_1	7.4	7.2	7.6	8.2	7.6
S_2	7.8	7.4	7.4	7.2	7.4
S_3	8.2	8.4	8.0	8.4	8.2
S_4	8.0	7.8	7.4	7.6	7.7

Table No.02: Sensory Analysis of multigrain *Sev*

Color and Appearance score

There was significant difference in color and appearance score of different combinations of multigrain *sev*. Maximum color and appearance score was recorded in the S_3 (8.2) i.e. 55:25:15:05 followed by S_1 (7.4) i.e. 45:45:05:05, S_2 (7.8) i.e. 50:35:10:05 and S_4 (8.0) i.e. 60:15:20:05. The difference in color and appearance was due to the difference in combinations of soybean flour, bengal gram flour, rice flour and spices which are used in different proportions in different samples.

Flavour and Taste score

There was significant difference in flavour and taste score of different combinations of multigrain *sev*. Maximum flavour and taste score was recorded in the S_3 (8.4) i.e. 55:25:15:05 followed by S_1 (7.2) i.e. 45:45:05:05, S_2 (7.4) i.e. 50:35:10:05 and S_4 (7.8) i.e. 60:15:20:05. The difference in flavour and taste was due to the difference in combinations of soybean flour, bengal gram flour, rice flour and spices which is used in different proportions in different samples.

Body and Texture score

There was significant difference in body and texture score of different combinations of multigrain *sev*. This could be due to absorption of moisture by *sev*. Maximum body and texture score was recorded in the S_3 (8.0) i.e. 55:25:15:05 followed by S_1 (7.6) i.e. 45:45:05:05, S_2 (7.4) i.e. 50:35:10:05 and S_4 (7.4) i.e. 60:15:20:05. The difference in body and texture was due to the difference in combinations of soybean flour, bengal gram flour, rice flour and spices which is used in different proportions in different samples.

Overall Acceptability score

There was significant difference in overall acceptability score of different combinations of *sev*. Maximum overall acceptability score was recorded in the S_3 (8.2) i.e. 55:25:15:05 followed by S_1 (7.6) i.e. 45:45:05:05, S_2 (7.4) i.e. 50:35:10:05 and S_4 (7.7) i.e. 60:15:20:10. The difference in overall acceptability was due to the difference in combinations of soybean flour, bengal gram flour, rice flour and spices which is used in different proportions in different samples.

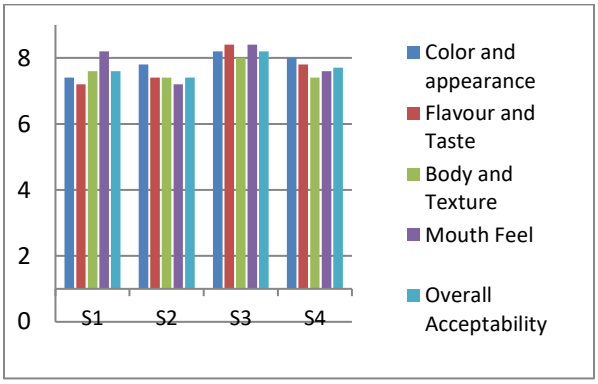

Fig No 01: Sensory Analysis of multigrain *Sev*

Nutritional Analysis

The selected sample i.e. 55% soybean flour , 25% bengal gram flour, 15% rice flour and 05% spices has got high ratings during sensory evaluations, so it was taken for a nutritional analysis. The result of nutritional analysis is as shown in table.

Table No.03 : The Nutritional Analysis of multigrain *Sev*

Sr. No.	Test Parameters	Result	Units
1	Moisture	4.04	g/100 gm
2	Ash	4.76	g/100 gm
3	Total Fat	36.22	g/100 gm
4	Protein	8.99	g/100 gm
5	Carbohydrate	45.99	g/100 gm
6	Energy Value	545.90	Kcal/100 gm
7	Total sugar	<0.1	g/100 gm

Storage stability

Sample	Storage Period (Days)	Moisture (%)	Total Fat (g/100g)	Peroxide value (meq/kg)
Final Product	0	4.04	36.22	0.31
	15	4.06	36.19	1.10
	30	4.09	36.16	2.21
	45	4.11	36.11	3.28
	60	4.16	36.07	4.72
	75	4.21	36.04	5.64
	90	4.26	36.01	5.91

Table No.04: The storage study on the chemical analysis of multigrain *Sev*

Changes in chemical constituents of multigrain Sev during storage

The selected multigrain *sev* sample was packed in LDPE and stored at ambient temperature. The stored multigrain *sev* was analyzed for various chemical constituents initially and regular intervals of once in 0 to 90 days.

The result of storage study has been presented in the table no 4 given above. From results it can be concluded that the increase in moisture content were observed during storage period. It might be due to the number of ways, it could be related to the production method of the product, the atmospheric moisture in the food production area, the packaging method of the product and storage conditions (Isengard, H., 2001). The fat content of multigrain *sev* was found to be decreasing on storage period. It might be due to fats are rich in unsaturated fatty acid, which is susceptible to oxidation degradation. The peroxide value was found to be increasing on 90 days of storage period. It might be due to oxidation of oil.

Microbiological analysis

Sample	Storage Period (Days)	Coliform (log cfu/g)	Yeast and Mold (log cfu/g)	TPC (log cfu/g)
Final Product	0	ND	ND	ND
	15	ND	ND	ND
	30	ND	ND	ND
	45	ND	ND	ND
	60	ND	ND	ND
	75	ND	0.01	ND
	90	ND	0.90	3.6×10^2

Table No.05: Microbiological Analysis of Multigrain *Sev*

ND- Not Detected

Yeast and Mould Count

On microbial analysis during storage period yeast and moulds growth was observed at 90 days of storage period, there was no any growth upto 75 days. The yeast and mould count was recorded in the final product was 0.90 log cfu/g.

Coliform Count

Coliform count also shows that there was no any growth of bacterial colonies. The coliform count showed negative result assuring hygienic production of the product.

Discussion

The traditional *Sev* made from dehusked Bengal gram flour was found to be improved by the replacement of whole Soybean flour (55%), Bengal gram flour (25%) and Rice flour (15%). The formulated products were subjected to evaluation for sensory characteristics. Sensory evaluation revealed that the quality characteristics were found to be significantly different from each other in various products. Sample S_3 got high score for color and appearance, flavour and taste, body and texture. Sample S_3 was found to have the highest overall acceptability scores (8.2) hence the sample S_3 has selected as final product. Proximate analysis of final product confirms the good amount of protein, fat and carbohydrate i.e., 8.99%, 36.99% and 45.99% respectively.

CONCLUSION

Multigrain *sev* is a snack food having good nutritional value of different nutrients such as protein, dietary fiber and carbohydrate etc.The preparation of multigrain *sev* with the sample 3 consisting of 55% soybean flour, 25% bengal gram flour, 15% rice flour and 05% spices was significantly best over the rest treatment and can be stored successfully for 3 months at ambient condition.

REFERENCES

[1] A.O.A.C. (2000). Official methods of analysis. 16th Edn, Association of Official Analytical Chemists, Washington. D.C.

[2] Aggarwal BB, Sundaram C, Malani N and Ichikawa H (2007). Curcumin: The Indian solid gold. Adv. Exp. Med. Biol. 595: 1–75.

[3] Alabi, M.O., J.C. Anuonye, C.F. Ndaeji and A.A. Idowu, 2001. Comparison of the growth and development of selected children in soybean and non-soybean producing and utilization of villages in Niger State, Nigeria. Poly Math J., 2: 8-12.

[4] Al-Jafari A.H., Vila R., Freixa B., Costa J., Canigueral S. Antifungal compounds from the rhizome and roots of *F. hermonis*. *Phytother Res.* 2012.

[5] Ampofo, V., 2009. Production and sensory analysis of soybean and wheat flour composite cake, HND Dissertation, Cape Coast Polytechnic, Cape Coast, Ghana, 1: 5-7.

[6] Berry SK, Kulkarni SG, Senghal RC, Kaur S, Kalra CL (1986) Studies on the utilization of post cold stored potatoes in the preparation of potato based 'sevian'. *Indian Food Packer* 40:42–49

[7] Bettaieb, I., Bourgou, S., Sriti, J., Msaada, K., Limam, F., Marzouk, B. (2011). Essential oils and fatty acids composition of Tunisian and Indian cumin (*Cuminum cyminum* L.) seeds: a comparative study. *Journal of the Science of Food and Agricultur*, 91: 2100-2107

[8] Chandra S, Samsher. Assessment of functional properties of different flours. *African Journal of Agricultural Research.* 2013; 8(38):4894-4852.

[9] Fadaei, V., Mohamadi, A. and Darani, K. (2013) Influence of *Spirulina platensis* powder on the starter culture viability in probiotic yoghurt containing spinach during cold storage. *European Journal of Experimantal Biology*, 3, 389-393.

[10] FAO 2000, *Global Forest Products Outlook Study: Thematic Study on Plantations* by Brown, C. Working Paper No. GFPOS/WP/03. Food and Agriculture Organization of the United Nations, Rome, 129 pp.

[11] Gajanana, K. 2002. Processing of Aonla (Emblica offi cinalis Gaertn.) fruits. Thesis submitted to UAS, GKVK, Bangalore, India.

[12] Hafsa, Y.A., Amel, D., Samia, S. and Sidahmed, S. (2014) Evaluation of nutritional and sensory properties of bread enriched with Spirulina. *Annals Food Science and Technology*, 15(2), 270-275.

[13] Harrigan, W.F. (1998). Laboratory methods in Microbiology Academics Press, Califonia, USA.

[14] Hefnawy TMH, El-Shourbagy GA, Ramadan MF (2012). Impact of adding chickpea (*Cicer arietinum L.*) flour to wheat flour on the rheological properties of toast bread. *International Food Research Journal* 19(2): 521-525

[15] Isengard H-D. (2001). Water content, one of the most important properties of food, *Food Control*, 12, 395- 400.

[16] Iwe MO. The science and technology of soybean. Enugu; *Rojoint communication services Limited*. 2003;40-45.

[17] Jukanti AK, PM Gaur, CLL Gowda, RN Chibbar (2012). Nutritional quality and health benefits of chickpea *(Cicer arietinum* L.): a review. *British Journal of Nutrition Vol.* 108. S1:S11-S26.

[18] Katina, K., Arendt, E., Liukkonen, K. H., Autio, K., Flander, L., & Poutanen, K. (2005). Potential of sourdough for healthier cereal products. Trends *in Food Science & Technology,* 16 (1-3), 104–112. *2nd International Symposium on Sourdough, Brussels,* BELGIUM, OCT, 2003. doi:10.1016/j.tifs.2004. 03.008.

[19] Lee C.L., Chiang C.L., Cheng L.H., Liaw C.C. Influenza A (H1N1) antiviral and cytotoxic agents from *Ferula asafoetida*. *J Nat Prod.* 2009; 72:1568–1572.

[20] Mahendra P., Bisht S. *Ferula asafoetida*: traditional uses and pharmacological activity. *Pharmacogn Rev.* 2012;6:141–146.

[21] Mnif, S., Aifa, S. (2015). Cumin (*Cuminum cyminum* L.) from traditional uses to potential biomedical applications. *Chemistry & Biodiversity*, 12: 733–742.

[22] Olugbenga O. Awolua and Magoh A. Osigwea. Nutritional and Antioxidant Potential of Rice Flour Enriched with Kersting's Groundnut (Kerstingiella geocarpa) and Lemon Pomace. *International Journal of Food Studies*. April 2019 Volume 8 pages 30–40.

[23] Padma, A. and Rajendran, R. (2017) Development and evaluation of Spirulina

incorporated little millet cookies. *International Food and Fermentation* 7(1), 119-122.

[24] Pruthi, J. S. Kalra, C. L. Manan, J. K. and Raina, B. L. (1983). The manufacture, packaging and storage of traditional savoury foods, parts II. Phulwadian, mukandawadian and other savoury foods. *Indian food packer*, 37(6): 73-94.

[25] Ranganna S (1986) Handbook of analysis and quality control for fruit and vegetable products. 2nd edition. Tata McGraw Hill Publishing Company Ltd., New Delhi, India.

[26] Ravi R, Suvendu B (2004). Flow behavior of chickpea (*Cicer arietinum* L.) flour dispersions: effect of additives. *Journal Food Engineering* 65: 619-624.

[27] Singh, S.R., K.O. Rachie and Pashiell, 1999. Soybeans for the tropics. New York

[28] Spiller F, Alves MK, Vieira SM, Carvalho TA, Leite CE, Lunardelli A, Poloni JA, Cunha FQ and de Oliveira JR (2008). Anti-inflammatory effects of red pepper (Capsicum baccatum) on carrageenan- and antigen-induced inflammation. J. Pharm. Pharmacol. 60(4): 473–478.

[29] Takeoka G. Volatile constituents of Asafoetida. In: Takeoka G.R., Guntert M., Engel K.-H., editors. *Aroma Active Compounds in Foods.* American Chemical Society; Washington, DC: 2001. pp. 33–44.

[30] Thangapazham RL, Sharma A and Maheshwari RK (2007). Beneficial role of curcumin in skin diseases. Adv. Exp. Med. Biol. 595: 343–357.

[31] Udayasree,V., Manjula, K. and Sowjanya, M. (2013) Effect of Spirulina as a nutritional supplement in malnourished children. I*nternational Journal of Scientific Research*, 2, 2277-8179.

[32] Wiesenauer M (1998). Comparison of solid and liquid forms of homeopathic remedies for tonsillitis. Adv. Ther. 15(6): 362–371.