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Sensory, Nutritional and Shelf Life Assessment of Value Added Soy Vermicelli

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Vermicelli is an important extruded product with solid rod like structure and can be prepared by using blend of cereal flours with chiroti rava. It has a good market potential. Considering its demand and nutritional contribution, a study was conducted to develop vermicelli by incorporating different levels of soy flour. Shelf life stability of the developed products in different packaging materials for a period of three months at room temperature was undertaken along with the analysis for nutrients and microbial counts of the stored products. Sensory evaluation of vermicelli stored in polyethylene covers (20%) showed higher scores for sensory attributes than the samples stored in corrugated paper boxes (30%). When compared to normal vermicelli, soy vermicelli showed higher protein, fat, ash and fiber, but lower CHO and energy content. Maximum number of spores (19) and Yeast (13) counts were recorded in soy vermicelli stored in polyethylene covers followed by paper boxes.

Key words: Soy vermicelli, Value addition, Packaging and storage, Nutrient and microbial analyses.

Soybean (Glycine max (L) Merril), a long time known principal food crop has paramount importance in Indian agriculture and oil industry. Being a versatile and fascinating crop with innumerable possibilities; it helps not only in improving agriculture but also supporting industries. Yellow revolution through soybean and sunflower has a remarkable contribution to the economy of the country.

Soybean belongs to family *Leguminosae* and sub family *Papilionidae* (Chauhan and Chauhan, 2007). It can be easily cultivated in a short duration of 80-90 days. Soybean is cultivated mainly in china for more than 4000 years. It has also been cultivated in Myanmar, Japan, India, Malaysia, Nepal, Indonesia, Philippines and Thailand since first century AD. Soybean has been variously called the miracle golden bean, the nugget of nutrition, the cow of china, yellow jewel, gold from soil, the meat that grows on vines, the crop of the west, the protein hope of future, magic bean, gift of nature, golden bean of globe and wonder bean etc, indicating its value and importance in human diets in different parts of the world over several hundred years (Chhabra, 1995 and Ali, 2008). Until recently, traditional soy foods were consumed mostly in the East. However, now-a-days such products have started gaining popularity in many parts of the world. India has a versatile cultural heritage of traditional foods. Almost all traditional foods are region specific. A wide variety of Indian foods can be prepared by replacing traditional ingredients up to 50 per cent. Hence, considering the benefits of inclusion of soy flour in the dietaries, this study was planned to develop vermicelli by incorporating different levels of soybean flour and to study the shelf life stability of such products in different packaging materials such as polyethylene covers, plastic and steel containers for a period of three months at ambient temperature. Nutrients and microbial counts of the stored products have also been analyzed and reported.

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Materials and Methods

Procurement of raw material

The present study was carried out at the Department of Food Science and Nutrition, University of Agricultural Sciences, Bangalore. The study aimed to develop extruded product by incorporating soybean full fat flour. Soybean and Chiroti rava were purchased from local market and cleaned. Soy variety JS-335 was collected from soybean growing farmers of Tumkur district in Karnataka State.

Preparation of full fat soy flour

The grains were cleaned manually, dehusked and splitted in to dhal. The dhal was roasted for five minutes, ground in a flour mill and sieved (Fig. 1)

Soybean cleaning
↓
Dehusking and splitting in to dhal
↓
Roasting (5 min)
↓
Milling and Sifting
↓
Full fat Soy flour

Fig. 1. Flow chart for preparation of full fat soybean flour

Development of Soy value added product

Soy flour was substituted with chiroti rava in varying levels at 0, 20, 30, 40, and 50 per cent. To prepare soy vermicelli, dough was prepared by boiling of soy flour and chiroti rava mixture (Fig. 2). Using an extruder required size / length of vermicelli was extruded. Packaging materials used were polyethylene covers and paper boxes. Developed products were subjected for shelf life study. These products were stored in separate packages in triplicate and maintained at ambient temperature for a period of 90 days. Profile of sensory characteristics (Organoleptic evaluation) was performed by a panel of 15 experts once in a month, for a period of three consecutive months. Product was assessed for appearance, texture, taste aroma / flavour, colour and overall acceptability using 5 point hedonic scale (Amerine *et al*., 1965) Scoring pattern followed was 5- Highly acceptable, 4-Moderately acceptable, 3-Slightly acceptable, 2- Fairly acceptable and 1-Poorly acceptable. These products were subjected for chemical and microbial analysis after three months of storage. Microbial contamination was assessed by analyzing microbial load such as bacteria, spores, yeast and moulds in vermicelli by using Nutrient Agar (NA) for bacteria and spores, Martin's Rose Bengal Agar (MRBA) for moulds and Davis Yeast Salt Agar (DYSA) for yeast following the dilution plate technique. The three dilutions 10^{-2} were used for analyzing bacteria, mould, spores and yeast, respectively. Chemical analysis of soy vermicelli was carried out for moisture, protein, fat, fiber and ash as per standard procedures (AOAC,1975 and 1980). Carbohydrate and energy was computed and protein was estimated following the procedure suggested by Raghuramulu *et al*., (2003). Micronutrients of the developed product were computed using food tables (Gopalan, *et al*, 1999). Mix the cleaned Soy flour with chiroti rava

Pour the mix into boiling water (100ºC), boil for 5 min.

↓

Stir well to prepare dough

↓

Keep the dough in an Extruder

↓

Press the machine slowly to get vermicelli

↓

Cut the vermicelli, according to required length

↓

Dry in a hot air oven at 60ºC for 6 hr

↓

Pack and Store

Fig. 2. Flow chart for preparation of soybean vermicelli

Results and Discussion

Vermicelli is an important extruded product with solid rod like structure and can be prepared using blend of cereal flours with chiroti rava. Sensory scores of soy vermicelli at different levels stored in corrugated paper boxes and in polyethylene covers at room temperature are presented in Table 1. The study revealed that, the mean sensory scores of the product for the attributes such as appearance, texture, aroma, taste, colour and overall acceptability varied from 4.03 to 3.76, 3.96 to 3.70, 3.50 to 3.30, 4.16 to 4.13, 3.60 to 3.23 and 3.80 to 3.30, respectively during the storage of products. The sensory attribute scores were maximum in the first month, which reduced significantly in second and third month after storage. Among the stored products, normal vermicelli showed the highest sensory scores followed by 20 per cent soy vermicelli. The least scores were for 30 per cent soy vermicelli stored in different packages. The products that were stored in polyethylene covers (20%) showed higher scores of sensory attributes than the samples stored in corrugated paper box (30%). Normal vermicelli stored in paper box scored the highest scores of sensory attributes followed by 20 per cent soy vermicelli stored in polyethylene covers and 30 per cent soy vermicelli stored in paper box packages. The results of interaction effect of products and duration were found to be non-significant. But, the statistical analysis of stored soy vermicelli showed significant difference in appearance and overall acceptability. This may be due to the addition of rava which gave bright colour at higher levels. But, in contrast, higher levels of soy flours incorporation reduced the scores for appearance by imparting dark colour. Overall acceptability of soy vermicelli showed significant difference due to the optimum / well blend of flour with chiroti rava. With regard to packages, statistical analysis showed significant difference in appearance, texture and aroma of the soy vermicelli stored in corrugated paper box, because it acted as a good barrier to light and atmospheric moisture than polyethylene covers. Stored vermicelli showed white spots due to the action of lipoxidase enzyme, which bleached the carotenoid pigments of the flour. Vermicelli was prepared from malted wheat flour, whole wheat flour, malted wheat + greengram dhal + spinach flour to improve the nutrient content (Midha and Mogra, 2007). Significant difference was observed between colour, texture, taste, flavour and appearance of the malted and unmalted wheat flour vermicelli, but not with spinach flour added vermicelli. All the products were acceptable after two months of storage.

Chemical analysis is a method used to measure nutrient density of the products. Chemical analysis of stored products in different packaging materials was done. The results revealed that (Table-2) CHO and energy content at 90th day was found to be the highest in soy vermicelli stored in polyethylene covers (68g / 100g and 396.44 Kcal respectively). Protein and fat contents remained the same in both the packaging materials during storage. When compared to normal vermicelli, soy vermicelli higher protein, fat, ash and fiber; lower carbohydrate and energy content. Similar observations have been reported by Pattan et al, (2001). They had developed ready-to-eat madeli from wheat. Storage stability was observed by storing the product in higher protein, fat, ash and fiber; lower carbohydrate and energy content. Similar

Table 1. Effect of storage period on sensory quality of soy vermicelli in different packaging materials

	Mean sensory scores					
	Appearance	Texture	Aroma	Taste	Colour	Overall Acceptability
Storage Months						
1	4.03	3.70	3.50	4.13	3.60	3.80
2	3.83	3.80	3.50	4.10	3.40	3.60
3	3.76	3.96	3.30	4.16	3.23	3.30
F-ratio	1.5294**	1.4978 NS	1.1506 NS	0.0551 NS	2.3249 NS	4.1134*
$SE_M \pm$	0.1122	0.1101	0.1076	0.1420	0.1204	0.1241
CD (5%)	0.3156	0.3096	0.3027	0.3993	0.3386	0.3490
Packages						
Polyethylene	4.04	3.97	3.13	4.24	3.33	3.46
Paper box	3.71	3.66	3.73	4.02	3.48	3.66
F-ratio	6.6175**	5.9912**	23.3013**	1.8373 NS	1.2519 NS	1.9484 NS
$SE_M \pm$	0.0916	0.0899	0.0879	0.1159	0.0983	0.1013
CD (5%)	0.2577	0.2528	0.2472	0.3260	0.2765	0.2849
Month x Package						
M1 Poly1	4.13	4.00	3.20	4.33	3.60	3.80
M2 Poly2	4.00	3.80	3.20	4.20	3.20	3.40
M3 Poly3	4.00	4.13	3.00	4.20	3.20	3.20
M1 Pb1	3.93	3.40	3.80	3.93	3.60	3.80
M2 Pb2	3.66	3.80	3.80	4.00	3.60	3.80
M3 Pb3	3.53	3.80	3.60	4.13	3.26	3.40
F-ratio	0.3530 NS	1.8647 NS	0.0000 NS	0.3491 NS	0.7919 NS	0.6495 NS
$SE_M \pm$	0.1587	0.1557	0.1522	0.2008	0.1703	0.1755
CD (5%)	0.4463	0.4378	0.4281	0.5647	0.4789	0.4935

	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Polyethylene control	4.5	3.9	4.0	3.7	4.2	4.4	4.0	3.5	3.5	4.3	4.3	4.0	4.3	4.0	3.8	4.5	3.9	3.8
Corrugated paper box control	4.5	4.0	4.2	4.5	4.6	4.8	4.3	4.0	3.8	4.2	4.3	4.0	4.5	4.2	4.0	4.5	4.2	4.0

observations have been reported by Pattan et al, (2001). They had developed ready-to-eat madeli from wheat. Storage stability was observed by storing the product in aluminium box and polyethylene pouch at ambient condition. The product was also observed for changes in proximate composition. Slightly higher moisture and protein contents were observed in stored madeli. Madeli in polyethylene pouch had higher moisture content higher than aluminum box. There was a slight decrease in crude fibre and fluctuations in the values of fat, and ash contents. Ready-to-eat foods for elderly were developed by

Table 2. Effect of storage period (90 days) on nutrients in value added Vermicelli stored in different packaging materials

Type of package	Products	Moisture(g)	Protein(g)	Fat(g)	Ash(g)	CrudeFibre (g)	CHO(g)	Energy(Kcal)
Polyethylene covers	Soy vermicelli	6.15	18.29	5.70	0.83	1.03	68.00	396.44
	Control	3.10	7.18	0.39	0.03	-	89.30	389.43
Paper box	Soy vermicelli	5.85	18.21	5.70	1.16	1.22	67.86	395.58
	Control	2.70	7.18	0.40	0.08	-	89.64	390.88

Uma (1998). Chemical analysis of the stored products showed variations in nutrients. The increase in moisture levels of all the RTE foods during storage might be attributed to the hygroscopic nature of LDPE bags, when stored for longer duration under prevailing environmental condition with high relative humidity.

Table 3. Micronutrient composition of soy value added Vermicelli

Name of the Nutrients mg/100g	Soy vermicelli (30%)
Calcium	83
Phosphorous	278
Iron	04
Magnesium	53
Sodium	15
Potassium	58

Micronutrient composition of soy vermicelli is given in Table 3 and Fig. 3. The results revealed that, 40 per cent soy vermicelli had 278 mg of phosphorous, 58 mg of potassium, 83 mg of calcium, 4 mg of iron, 53 mg of magnesium and 15 mg of sodium per 100 gm of the sample.

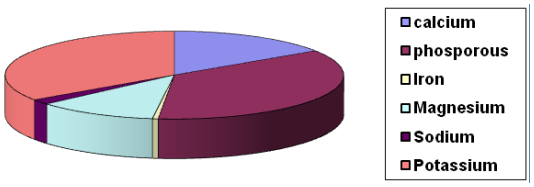

Fig. 3. Micronutrient composition of value added soy vermicelli

Bacteria, moulds and yeast may infect food produce after harvesting, during handling, processing and storage. Temperature, oxygen, light and duration of storage are the important factors that influence the type of microbial growth and spoilage of food. The maximum number of fungal spores (19) and yeast counts (13) were recorded in soy vermicelli stored in polyethylene covers followed by paper boxes. This could be because of higher water vapour and gas transmission rate, poor tensile strength and sun light / rays causing spoilage of food products. Sometimes the method of cooking (boiling), presence of moisture content, manual handling of dough with water and absence of spices could have lead to the increase

Table 4. Microbial counts (10^2 cfu/g) of different value added soy vermicelli stored for a period of 90 days in different packaging materials

Value added soy vermicelli	Polyethylene cover	Corrugated paper box
Mould	0.00	0.00
Yeast	13	11
Bacteria	10	7
Spores	19	3.5

in microbial counts during storage. The findings of this study are in line with the reports of Devaraju (2003). Incorporation of soy flour not only improved the nutritional quality of the sorghum flour, but also improved it's keeping quality (Jayalakshmi and Neelakantan, 1987). The results of the present study are also in agreement with the microbial analyses carried out by Chethana (2008) and Devaraju et al, (2006). The value added soy product developed in the present study is nutrient dense with good acceptability and storage stability.

Conclusion

It can be concluded that soy bean based vermicelli is highly nutritious. Soy incorporated vermicelli is found to be superior than traditionally prepared vermicelli with respect to nutritional, microbial and storage quality with ultimate acceptability.

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