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RESEARCH PAPER

Quality Evaluation of Noodles Supplemented with Germinated Mungbean Flour

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ABSTRACT

The mungbean seeds were soaked (overnight), germinated (for 24 hrs) and heated at (80˚C) for 15 min. The germinated seeds were dried in a tray drier at 40-45°C for about 12 hrs till the desired moisture content was obtained and then converted into flour. The flour was blended with refined wheat flour in different ratios for the preparation of noodles which were stored under ambient conditions in polypropyelene packs and subjected to physico-chemical evaluation at 30 days interval. Blending of mungbean flour produced noodles rich in moisture, protein, fibre, ash with reduced amount of fat content. The mungbean flour could be incorporated upto 15% level in the refined wheat flour having good functional properties. The noodles were found to be acceptable by the sensory panelists.

Keywords: Mungbean, soaking, germination, roasting, noodles, organoleptic evaluation

India is the major pulse producing country and among various pulses, mungbean stands third. It is an important pulse crop belonging to the family of *leguminosae.* Pulse flours are high in total dietary fibre, low in fat, high in protein and contain the amino acid lysine, which when combined with wheat, contributes to a complete protein. Incorporating pulse flours into food items is not a new concept. Considerable research work exist that examines the addition of pulses to baked goods such as breads (Dalgetty and Baik, 2006), cookies and cakes (Gomez *et al.*, 2008) as well as pasta (Cabello *et al.*, 1992), snack products (Hardacre *et al.*, 2006) and meat products (Serdaroglu *et al.*, 2005, Modi *et al.*, 2003). In western cultures, mungbean sprouts are popularly used as a fresh salad vegetable. Noodles are widely consumed in many parts of the world. The addition of pulse flours into the formulation would greatly improve the nutritional properties of the noodles and could potentially offer some favourable functional characteristics. The objective of this research was to produce white salted noodles using a blend of germinated mungbean flour to create a noodle with nutritional benefits and better functional properties.

MATERIALS AND METHODS

Preparation of mungbean flour

Mungbean grains were procured from local market and were steeped in potable tap water for 12 hrs at room temperature in 5L capacity plastic container and the grain to water ratio was kept 1:3 (1 part grain and 3 parts water). After soaking, the water was drained-off and soaked grains were subjected to germination for 24 hrs in BOD incubator at a temperature of 25± 2°C after placing in germination sheets. After requisite incubation period, the germinated mungbeans were given heat treatment in hot water at 80°C for 15 minutes and were dried in a tray drier at 40-45°C for about 12 hrs turning in between till the desired moisture content was obtained. All the grains after drying were milled to flour fineness.

Development of mungbean based noodles: Mungbean flour was incorporated into refined wheat flour in various ratios of 5, 10, 15, 20 and 25% into refined wheat flour for the preparation of noodles. The preparation of noodles involved the mixing of refined wheat flour and mungbean flour in their respective levels by adding optimum water. All these ingredients were mixed properly to get desirable consistency of the dough. The prepared dough was smeared with a little of refined oil and then, it was sheeted and extruded through a noodle making machine (Biogen, Meerut, India). The noodles were then dried for 12 hours at 50-55°C in a tray drier. After drying they were cooled and packed in polypropylene bags and stored under ambient temperature (Bui and Small, 2007). The detailed flow sheet for the preparation of noodles is illustrated in Fig. 1.

***Storage*:** Noodle samples prepared from different combinations of refined wheat flour and mungbean flours were packed in polypropylene bags and then, stored for a period of 90 days under room conditions. The flour blends were analysed for their functional properties. The fresh and stored noodles were analyzed for physico-chemical changes and sensory characteristics at an interval of 30 days.

Functional parameters for flour/noodles

Water Absorption Index (WAI) and Water solubility index (WSI)*:* Water absorption index and water solubility index of the noodles was determined by standard method (Anderson *et al.*, 1969).

Foaming properties: Foam capacity and foam stability were determined according to the method reported by Coffman and Garcia (1977).

Cooking quality: The cooking yield and cooking loss of noodles were determined by the standard method AACC (1976).

Dough Handling: Dough handling is the method in which small ball of dough is prepared to check the three parameters of dough Sticky, Non-Sticky and

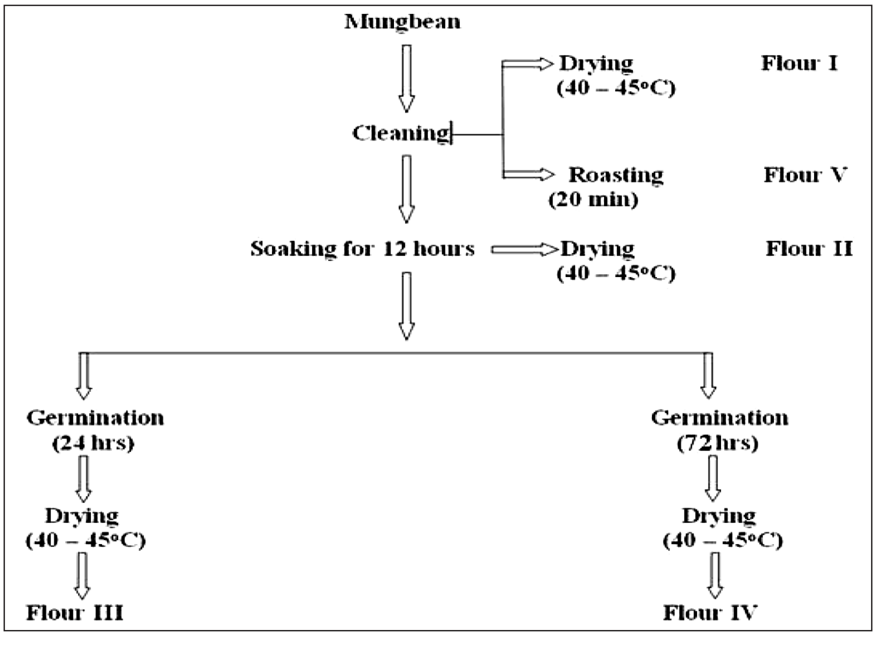

Fig. 1: Flow sheet for the preparation of mungbean flours

Table 1: Effect of blending germinated mungbean flour on Functional parameters of mungbean flour blends

Functional parameters	100:0	95:5	90:10	85:15	80:20	75:25	Mean	C.D (P=0.05)
WAI (g/g)	1.70	1.90	1.93	1.97	1.99	2.02	**1.91**	**0.03**
WSI (%)	3.23	3.50	3.62	3.86	4.13	4.99	3.88	0.03
FC (%)	1.96	2.51	2.69	2.86	2.98	3.39	**2.73**	**0.07**
FS (%)	10.13	12.16	12.27	12.45	12.72	13.93	**12.27**	**0.05**
Cooking yield (%)	185.65	202.28	208.58	211.89	217.85	223.91	208.36	0.23
Cooking loss(%)	2.05	2.56	3.47	4.10	4.54	4.95	**3.61**	**0.06**
Dough handling*	NS	NS	NS	SS	SS	**S**	—	—

NS = non sticky; SS = slightly sticky; S = sticky

Very Sticky (Dogra, 1999).

Proximate composition of noodles

Proximate composition: All the samples of mungbean blended noodles were analysed for moisture (AOAC 1995), crude protein content (N × 6.25, Micro Kjeldhal method of AOAC 1995), Fat (AOAC 1995), ash (AOAC 1995), fibre (AOAC 1995) and Nitrogen Free Extract (AOAC 2000).

Statistical Analysis: The data were analysed by ANOVA for significance of difference.

RESULTS AND DISCUSSION

Functional parameters of mungbean blended flour

Significant differences in water absorption index (Table 1) of refined wheat flour incorporated with different ratios of mungbean flour were observed. The maximum increase in water absorption index (2.02 g/g) was recorded in T_6 (75:25:: Refined wheat flour: Mungbean Flour) Also, significant differences in water solubility index were observed in all the treatments. Similar results have been reported by Onimawo *et al.* (1998). With increasing level of mungbean flour into refined wheat flour, the water solubility index also increased and the maximum increase in water solubility index (4.99 %) was recorded in T_6 (75:25:: Refined wheat flour: Mungbean Flour). There were significant differences in foam stability and it increased with increasing level of mungbean flour. Significant differences in foam capacity were observed in all treatments and it increased as the level of mungbean flour increased. The value ranged from 10.13 to 13.93% and the maximum increase in foam capacity was recorded in T_6 (75:25:: Refined wheat flour: Mungbean Flour). Similar results have been reported by Blessings and Gregory (2010).

Functional parameters of mungbean blended noodles

The maximum increase in cooking yield (Table 1) (223.91 %) was observed in T_6 (75:25:: Refined wheat flour:Mungbean Flour) and the minimum increase in cooking yield (185.65 %) was observed in T_1 (100:00:: Refined wheat flour: Mungbean Flour). This might be due to the higher protein content of the mungbean flour with that of wheat flour (Sandhu *et al*., 2010) in potato starch noodles. The maximum increase in cooking loss (4.95 %) was recorded in T_6 (75:25:: Refined wheat flour: Mungbean Flour) and the minimum increase in cooking loss (2.05 %) was recorded in T_1 (100:00::Refined wheat flour: Mungbean Flour). The cooking loss of the noodles increased as the solid content increased. Due to high solid content, the water content in the noodles may become insufficient for starch to fully gelatinize and more water leached out from the noodles into the cooking water. Similar results have been reported by Bergman *et al*. (1994) in noodles supplemented with soft wheat flour and cowpea. The dough handling characteristics changed from non sticky to non sticky with increasing level of mungbean flour incorporation into wheat flour.

Table 2: Effect of blending germinated mungbean flour on moisture and crude protein contents of noodles

	Moisture					Protein				
Blends	0	30	60	90	Mean	0	30	60	90	Mean
100:0	9.80	9.9	10.75	11.01	**10.35**	14.41	14.35	14.23	14.12	**14.27**
95:05	9.77	9.98	10.38	10.62	**10.18**	16.79	16.74	16.62	16.51	**16.60**
90:10	9.7	9.87	10.23	10.44	**10.06**	18.17	18.13	18.08	18.02	**18.10**
85:15	9.47	9.58	9.80	10.27	**9.78**	19.55	19.49	19.42	19.36	**19.45**
80:20	9.35	9.54	9.69	10.11	**9.67**	20.94	20.89	20.85	20.78	**20.86**
75:25	9.19	9.43	9.58	9.96	**9.54**	22.32	22.27	22.21	22.16	**22.24**
Mean	9.54	9.71	10.07	10.48		18.69	18.64	18.56	18.49	
C.D. (P=0.05%)	**Treatment**			**0.01**		**Treatment**		**0.01**		
	Storage			**0.01**		**Storage**		**0.01**		
	Treatment × Storage			**0.03**		**Treatment × Storage**		**0.03**		

Table 3: Effect of blending germinated mungbean flour oncrude fibre and ash contents of noodles

Blends	**Crude fibre**					**Ash**				
	0	**30**	**60**	**90**	**Mean**	**0**	**30**	**60**	**90**	**Mean**
100:0	2.26	2.24	2.23	2.19	**2.23**	0.85	0.81	0.78	0.66	**0.77**
95:05	2.48	2.47	2.45	2.43	**2.45**	1.0	0.94	0.90	0.84	**0.92**
90:10	2.71	2.70	2.68	2.66	**2.68**	1.15	1.09	1.02	0.97	**1.05**
85:15	2.94	2.92	2.90	2.87	**2.90**	1.31	1.26	1.20	1.13	1.22
80:20	3.17	3.15	3.13	3.10	**3.13**	1.46	1.39	1.33	1.26	**1.36**
75:25	3.40	3.38	3.35	3.32	**3.36**	1.62	1.56	1.38	1.38	**1.51**
Mean	2.82	2.81	2.79	2.76		1.23	1.17	1.10	1.04	
C.D. (P=0.05%)	**Treatment**			**0.03**		**Treatment**		**0.016**		
	Storage			**0.02**		**Storage**		**0.013**		
	Treatment × Storage			**N.S.**		**Treatment × Storage**		**0.03**		

Effect of storage on proximate composition of mungbean based noodles

A general increase in moisture content (Table 2) took place during the storage period and it was found that moisture content increased from its initial value 9.54 to 10.48% after 90 days of storage. The maximum moisture content of 10.35 was recorded in treatment T_1 (100:00:: Refined wheat flour: Mungbean Flour) and minimum of 9.54 was observed in treatment T_6 (75:25:: Refined wheat flour: Mungbean Flour). This might be resulted from the low amount of moisture content in the mungbean flour. Similar findings have been reported by Savita *et al*. (1995) in breads supplemented with pigeon pea and chickpea. Crude protein content (Table 2) of different treatments decreased during storage period of 90 days from the initial mean value of 18.69 to 18.49% which might be due to breakdown of amino acids (Premlatha *et al*., 2010) during storage.

Maximum crude protein content of 22.24 was found in treatment T_6 (75:25:: Refined wheat flour: Mungbean Flour) and minimum of 14.27% in treatment T_1 (100:00 Refined wheat flour: Mungbean Flour). Similar results have been reported by Harinder *et al*. (1999) in bread and chapatti supplemented with pigeon pea. The mean crude fibre (Table 3) content

Table 4: Effect of blending germinated mungbean flour on crude fat and Nitrogen Free Extract (NFE) contents of noodles

Blends	Crude fat					NFE				
	0	30	60	90	Mean	0	30	60	90	Mean
100:0	1.81	1.76	1.70	1.62	**1.72**	70.87	70.94	70.31	70.40	**70.63**
95:05	1.88	1.84	1.79	1.68	**1.79**	68.12	68.03	67.84	67.92	**67.97**
90:10	1.95	1.92	1.87	1.80	**1.88**	66.35	66.29	66.12	66.11	**66.21**
85:15	2.02	1.98	1.93	1.86	**1.94**	64.75	64.77	64.75	64.51	**64.69**
80:20	2.09	2.02	1.96	1.89	**1.99**	63.06	63.01	63.04	62.86	**62.99**
75:25	2.16	2.07	2.01	1.95	**2.04**	61.76	61.29	61.47	61.23	**61.43**
Mean	1.98	1.93	1.87	1.80		65.81	76.56	65.58	65.50	
C.D. (P=0.05%)	**Treatment**		**0.04**			**Treatment**		**0.03**		
	Storage		**0.03**			**Storage**		**0.02**		
	Treatment × Storage		**N.S.**			**Treatment × Storage**		**0.06**		

during 90 days of storage declined significantly from the initial level of 2.82 to 2.76%. However, with the incorporation of mungbean flour the crude fibre content increased. Similar results have been reported by Chitra *et al*. (2008) in value added maize and Sharma and Chauhan (2000) with the supplementation of wheat flour with debittered fenugreek flour. With the advancement of the storage period the mean ash content (Table 3) decreased from the initial level of 1.23 to 1.04% during 90 days of storage. Treatment T_6 (75:25:: Refined wheat flour: Mungbean Flour) recorded highest mean ash content of 1.51) and lowest was recorded by treatment T_1 (100:00 Refined wheat flour: Mungbean Flour). This might be due to increased fibre content with the addition of mungbean flour. Similar results have been reported by Sharma and Chauhan (2000) with the supplementation of fenugreek flour in wheat breads.

With the progression of storage period, the fat content (Table 4) decreased from its initial value of 1.98 to 1.80%. The decrease in crude fat content might be due to increase in the activity of lipase enzyme (lipolytic oxidation). The lowest crude fat content of 1.72 was reported in treatment T_1 (100:00:: Refined wheat flour: Mungbean Flour) and the highest of 2.04 was recorded in treatment T_6 (75:25:: Refined wheat flour: Mungbean Flour). Similar results have been reported by Premalatha *et al.* (2010) in the development of high fibre noodles. It was observed that with the advancement of storage period, the mean nitrogen free extract (Table 4) decreased from its initial level of 65.81 to 65.50%. Treatment T_1 (100:00:: Refined wheat flour: Mungbean Flour) recorded highest mean carbohydrate content of 70.63% and lowest (61.43) was recorded by treatment T_6 (75:25:: Refined wheat flour: Mungbean Flour).

CONCLUSION

It can be concluded from the study that the blending of germinated mungbean flour had significant effect on functional and compositional properties of noodles. Increasing the level of mungbean flours in the noodle formulation resulted in noodles with a higher protein and fibre content which was an objective of this study. Blending upto 15% was acceptable for the preparation of best quality noodles.

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