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Physical, textural and sensory characteristic of noodles with incorporated of different powders

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Abstract
Noodles are popular among all age groups. The shift towards the healthy options by consumers is increasing day by day. Hence the entitled study had carried out for preparation of noodles with addition of different proportions of DSF, CP and SP. The sample T_1 scored acceptable sensory scores with good textural, physical and cooking qualities. The addition of DSF with increase in CP and SP showed decreasing sensory value. The sample T_1 had comparable hardness to that of control. The hardness and chewiness of sample T_1 was 0.78 N and 1.42 ± 0.03 Nm respectively.

Keywords: Healthy, noodles, soy noodles, texture analysis, cooking loss

Introduction
Noodle is a commonly consumed staple food made from dough of grain flour that is rolled flat and cut into long thin strips. Wheat flour is the primary ingredient of most noodles. It may be cold extruded from an extruder. (Kim *et al.*, 2011) [6] The main qualities of noodles that seem to appeal the most to consumer preferences are colour and texture. Typically, noodles made from wheat flour are characterised by a smooth and soft texture. Gluten, the main structure-forming protein in wheat flour, contributes to the elastic characteristics of the dough and the final product. (Kovacs *et al.*, 2004) [7] Due to increasing demand for a greater variety of healthy foods, new types of noodle need to be developed. To enhance protein or fibre contents, wheat flour can be replaced by vegetable powders, fruit pomace, soy flour etc. There is increasing demand for such value-added noodles among consumers due to their health benefits. The vegetables have added advantages of fibre, minerals and vitamins. The spinach and carrot both being good sources of vitamin A and iron can be used for preparation of noodles. The entitled research work had been carried out with addition defatted soy flour, spinach and carrot powder for development of nutritious noodles. The different levels of soy flour, carrot powder and spinach powder were used for this research and their effect on sensory, proximate and textural properties studied subsequently.

Materials and Methods
Materials
Defatted soy flour (DSF), carrot powder (CP), spinach powder (SP) and wheat flour (WF) used for preparation of noodles procured from local market.

Methods
The noodles were prepared from 100% wheat flour as control sample and used for comparative studies. The different combinations of wheat flour: soy flour: carrot powder: spinach powder was taken for study. The standardization of the recipe is given in table 1.

Table 1: Standardization of noodles

Flours	Control	T_1	T_2	T_3
Wheat flour	100	85	75	65
Defatted soy flour	-	10	15	20
Carrot powder	-	2.5	5	7.5
Spinach powder	-	2.5	5	7.5

Preparation of noodles
The noodles were prepared according to the recipe. The basic ingredients such as salt, water, wheat flour used according to standard recipe and with the combinations of different flour given in table 1.

All dry ingredients were mixed with the use of mixer at medium speed for 1-2 min. Then after 3g of salt and addition of water 75ml and again the dough mixed for 2 min. Then dough was rested for 2h at room temperature in a plastic bag at room temperature. Then noodles were extruded from hand extruder.

Water absorption capacity and cooking loss

Noodles (10 g) were first boiled in 400 mL water for 15 min to measure the water absorption capacity and cooking loss. To determine the water absorption capacity, the boiled noodles were kept in the boiled water for 0, 5, 10, and 15 min, respectively. The water absorption capacity was calculated as the difference in the weight of cooked noodles versus uncooked noodles expressed as the percentage of the weight of uncooked noodles (Galvez and Resurreccion, 1992) [3]. To determine the cooking loss, cooked noodles were rinsed with cold distilled water, drained for 3 min, and then weighed. The cooking loss was calculated as the difference between the weight of noodles after boiling versus uncooked noodles and expressed as the percentage of the weight of uncooked noodles (AACC, 1995) [1].

Texture profile analysis

An instrumental texture profile analysis was carried out for all noodles using a Texture Analyser (TA-XT2, Stable Micro Systems, Surrey, England). The analysis of textural characteristics was based on the procedures described by Champagne *et al*. (1999) [2]. To make a compression test, a stainless-steel cylinder probe with a diameter of 2 mm was operated at a pre-test speed of 1.0 mm/s, test speed of 1.0 mm/s, and post-test speed of 1.0 mm/s. The instrument was adjusted to achieve 50% compression with a waiting period of 1s. The parameters recorded from test curves included hardness and chewiness.

Sensory analysis

The prepared noodles were examined by semi trained sensory panel and the mean values and SD (standard deviation) was calculated for determination of the difference among noodles.

Results and Discussions

Effects of addition of defatted soy flour, carrot powder and spinach power on textural properties of noodles

The effects of defatted soy flour, carrot powder and spinach power on textural properties of noodles are shown in Table 2. With defatted soy flour addition, the hardness of noodles significantly ($p< 0.05$) increased from 0.62 for C to 0.78 N for T_1 and 0.88 N for T_3.

Noodles added with 5% each carrot powder and spinach powder T_2 showed 0.83 N hardness. This is in comparison with values reported by (Gan *et al.*, 2009) [4] the increased hardness of defatted soy noodles could be due to stronger interaction between water molecules. The noodle with strong protein network could be expected to be harder. (Janssen *et al.*, 2009) [5] Like hardness, chewiness also showed similar trend. The sample T_2 showed higher chewiness than control and T_1 whereas sample T_3 showed more chewiness than all other samples. A similar result was reported for rice-based noodles (Kim *et al.*, 2011) [6]. Thus, it can be observed that addition of defatted soy flour, carrot powder and spinach powder have significant and desirable textural properties on noodles.

Table 2: The textural properties of cooked defatted soy flour noodles added with different combination of carrot powder & spinach powder

Sample	Hardness (N)	Chewiness (Nm)	Tensile strength (N/cm2)
C	0.62	0.70 ± 0.05	188.05 ± 1.1
T_1	0.78	1.42 ± 0.03	198.82 ± 14.27
T_2	0.83	0.98 ± 0.03	225.21 ± 23.66
T_3	0.88	1.56 ± 0.04	272.72 ± 40.61

Physical properties of noodles

The pH values of all the studied noodles were in the range of 6.29 to 8.77. Except for T_1, noodles prepared from other formulations showed a significant ($P< 0.05$) increase in pH as compared to the control noodle. Table 3 shows pH values of noodles.

The values of L* were in the order: control, $T_1 > T_2 > T_3$ (Table 3). The values of yellowness (Positive b*) were in the order: control > $T_1 > T_2 > T_3$ (Table 3). Yellowness of the carrot powder is an important attribute for the perception and acceptability of consumers. The yellowness is contributed by the presence of flavonoids in the wheat flour as well as the colour of carrot powder. These compounds undergo a chromophoric shift and turn into yellow in the presence of alkaline (Gan *et al.*, 2009) [4]. The values of redness (positive a*) were in the order: $T_3 > T_2 > T_1$ > control (Table 3).

Table 3: Physical properties of noodles

Samples	pH	Colour values		
		L*	a*	b*
Control	6.29	59.78 ± 0.37	1.25 ± 0.40	16.33 ± 0.15
T_1	7.89	62.41 ± 1.74	0.07 ± 0.17	15.30 ± 1.56
T_2	8.20	64.36 ± 1.41	0.89 ± 0.28	13.78 ± 0.46
T_3	8.30	58.81 ± 1.65	2.38 ± 0.30	10.85 ± 0.25

Each value represent five determination

Cooking time for prepared noodles

Cooking time of noodles sample was significantly increased as compared to the control sample, in each case 50g of each sample was taken and cooked separately for the evaluation of cooking time. The result is shown in Table 4.

Table 4: Cooking time for prepared noodles

Sample	Cooking time (minute)
C	3.48±0.01
T_1	4.10±0.22
T_2	5.70±0.24
T_3	5.82±0.18

The cooking time had a significant difference with the addition of carrot powder and spinach powder. The more cooking time could be attributed to the added defatted soy flour in the noodles from 10% to 20% in noodles.

Sensory analysis of cooked noodles

The scores for different sensory parameters are shown in the table 5.

Table 5: Sensory score of prepared noodles

Sample	Colour	Flavour	Texture	Taste	Overall acceptability
C	8.20±0.66	8.30±1.16	8.50±0.70	7.80±0.78	7.63±0.55
T_1	8.30±0.25	8.40±0.96	8.90±1.10	8.40±0.69	8.25±0.39
T_2	7.80±1.94	7.60±1.07	8.10±0.73	7.70±0.94	7.77±0.46
T_3	7.00±1.15	7.60±0.84	7.40±0.84	7.80±1.22	7.45±0.61

Sensory evaluation of the products was carried out by using 9-point hedonic scale sensory test. The sample T_1 scored significantly higher than all other sample as well as control one. The good texture desired by the sensory panel members due to the addition of defatted soy flour, carrot powder and spinach powder. The colour had been liked by the panellists as the carrot powder and spinach powder gave unique colour to the noodles. The values for colour, flavour, texture, taste and overall acceptability for sample T_2 were 8.30±0.25; 8.40±0.96; 8.90±1.10; 8.40±0.69 and 8.25±0.39.

Conclusion

The research carried out on preparation of noodles with addition of different proportions of defatted soy flour, carrot powder and spinach powder can be concluded that the addition of defatted soy flour, carrot and spinach powder had significant effect on physical, textural and sensorial attributes of the noodle.

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