

Original Research Article

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Effect of Incorporation of Drumstick Leaf Powder and Defatted Soybean Flour on Texture, Colour and Organoleptic Evaluation of Instant Noodles

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ABSTRACT

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Refined wheat flour (RWF) was blended with drumstick leaf powder (DLP) and defatted soybean flour (DSF) to prepare instant noodles. Prepared instant noodles were evaluated for texture of raw and cooked noodles, L^* a^* b^* values and organoleptic parameters. Texture profile analysis of raw and cooked noodles indicated that hardness values significantly increased as the incorporation of DLP decreases. L^* a^* b^* values were decreased as the incorporation of DLP increases and acceptable instant noodles were prepared by 5 per cent incorporation of DLP into the instant noodles. These results suggest that reduction of incorporation of DLP could provide beneficial effect on the quality improvement of instant noodles.

Introduction

Moringa oleifera commonly called Moringa is a valuable tree whose fruits, roots and leaves have been advocated for traditional, medicinal and industrial uses. The phytochemical and nutritional properties of the dried leaf powder of *M. oleifera* used as nutraceuticals, dietary supplements, functional foods or a source of vegetable in meal preparation. Drumstick leaf powder is a rich source of tannins, saponins, alkaloids, flavonoids, cardiac glycosides and reducing sugars and also proteins (24.31%), carbohydrate (55.97%), ashes (11.50%), crude fiber (10.28%), total fat (9.22%),

moisture (6.12 %), caloric value (404.10 Kcal /100g) and saturated fatty acids (3.77 %), unsaturated fatty acids (5.45 %), monounsaturated fatty acids (0.87%), polyunsaturated fatty acids (4.58 %) and Trans fatty acid (0.00 %) for fatty acid profile Isitua *et al.*, (2015).

Wheat flour and defatted soybean flour are widely used in the food industry (Vetter, 1988) these are rich source of dietary fibres and proteins. There is a new tendency to add vegetable materials to the basic ingredients of wheat flour (Collins and Pangloli (1997); Senthil, Ravi, Bhat and Seethalakshmi (2002); Skrbic, Milovac, Dodig, and Filipcev (2009);

Wang, Rosell, and Benedito de Barber (2002). Such added ingredients can provide different flavours, colours, additional nutrients and often health benefits. Physicochemical properties of basic ingredients will be changed, in part, by the addition of these materials. Noodles that are prepared with drumstick leaf powder and defatted soybean flour can increase the β -carotene and protein content as well as increase the cooking loss of noodles (Collins and Pangloli (1997)).

Noodles are traditional food in China and other Asian countries, and have been flavoured by the Chinese people for over 2000 years. Noodles constitute almost 40% of wheat products in Asia (Janto *et al.*, (1998); Hu *et al.*, (2006). The quality of wheat noodles and instant noodles depends mainly on their physical, chemical and microbiological stability (Menkov *et al.*, 2005). Among ready to eat foods, noodles form an important part of Indian dietary. It is rich in starch and energy but depleted in fibre and other nutrients. So, value addition to noodles can help to improve its physicochemical and sensory characteristics. Therefore, value addition of instant noodles is of prime importance to improve nutrient content and to save its delicacy. Secondly, use of value added processed foods could be a solution to the problem of supplementary feeding in under nutrition (Gernah *et al.*, 2011). The objective of this study was to investigate the texture, colour and sensory properties of instant noodles incorporated with drumstick leaf powder and defatted soybean flour.

Materials and Methods

Fresh drumstick leaves were procured from the trees of drumstick variety KDM-01 (Bhagya) plantation maintained by Main Horticulture Research and Extension Centre, UHS, Bagalkot at Sector No.1. These leaves were made into a powder after drying under electrical tray drier at 60°C temperature.

Dried drumstick leaf powder was packed separately in LDPE bags (200gauge) for further use. Defatted soybean flour was procured from Ahmed shopping centre, Bengaluru. Starch and guar gum was purchased from Aminghad Agencies, Dharwad. Masala ingredients, salt and vegetable oil were procured from local market Vidyagiri, Bagalkot. Hydrolysed ground nut cake was purchased from Kenchannawar oil mill, Bagalkot.

Preparation of noodles incorporated with drumstick leaf powder and defatted soybean flour

All the ingredients such as refined wheat flour, drumstick leaf powder, defatted soybean flour, salt, starch, citric acid, potassium carbonate, sodium carbonate, vegetable oil and gum were weighed as shown in Table 1. The composite flour was mixed with water and kneaded for 10 minutes and kept the dough aside for 30 min. The dough was passed through a dough roller to make in to sheet. These sheets overlapped one on the other and passed through a vertical noodles making machine mechanically to make cuts and longer types of noodles. The prepared raw noodles were then steamed at 100°C for 15 minutes in a pressure cooker. The noodles were then dried in a tray dryer at 80°C for 2 hours. The cooled and dried instant noodles were packed in polythene bags (50 micron). Each replication in a treatment has 250g instant noodles.

Texture of raw and cooked noodles (Newton)

Texture measurements in this study were obtained using TA-XT-plus Texture Analyser (Stable Micro Systems, London, England) as used by Park and Baik (2004), Cato, Halmos and Small (2006). The instrument was first calibrated using 10 kg load cell and the return trigger path was 15 mm. The settings were as

follows; mode setting was on measure force in compression; pre-test speed, test speed and post-test speed were all set to 2.0 mm/sec; strain was on 75%; trigger type was set on auto 10 g; and either 35 mm (Stable Micro Systems, 2000) or 45 mm of cylinder probe were used for different tests purposes. The noodle strands were arranged completely flat and as closely as possible to each other. Three measurements were taken for both raw and cooked noodles. The results were presented as noodle hardness in Newton (N) which was obtained from the peak of the graph.

***L** *a** *b** values**

Noodles colour was measured with a Color Flex EZ (mode CFEZ 1919, Hunter associates laboratory, Inc., Reston) with a 45 mm (diameter) measuring tube using a white tile background. *L**, *a** and *b** values denote lightness (white-black), red-green and yellow-blue scales, respectively. Three colour readings per noodle sample were made. Measurements were made three times, each at a different location on the consistent (same) side of the surface of the noodles. There were three replicate noodle samples for each treatment.

Sensory evaluation (9 point hedonic scale)

Noodles of different treatments (Table 1) were prepared as per the procedure given in Figure 1. Samples (30g) from each treatment were cooked for 2 minutes by adding masala taste maker (0.35g), kept in hot boxes and used for sensory evaluation.

Sensory evaluation of noodles incorporated with drumstick leaf powder and defatted soybean flour was carried out by a panel of semi-trained judges consisting of Teachers and Post-Graduate students of College of Horticulture, Bagalkot. The sensory characters like colour and appearance, flavour, taste, mouth feel (texture) and overall acceptability were evaluated on a 9 point

Hedonic scale using the score card.

Statistical analysis

All measurements were performed in triplicate. Statistical analyses were carried out with the software wasp (ICAR Research Complex Goa) using one-way analyses of variance (ANOVA). $P < 0.01$ was considered to be significant.

Results and Discussion

Preliminary evaluation

The level of ingredients and formulation of the layered dough was based on the preliminary work (Table 1). For instance the reason for using 10 g/100 g of DSF in all the treatment was to check the cooking properties of instant noodles at same level of incorporation.

Texture of raw and cooked noodles (Newton)

Initially, the use TA-XT-plus Texture Analyser with different sizes of the cylinder probe and sampling arrangement on this apparatus were studied. Finally 45 mm of cylinder probe was found to be suitable and it was used for different tests (Fig. 2).

In raw noodles the mean texture ranged between 17.92 N and 23.83 N (Table 2). Maximum score was recorded in T₃ (23.83 N) and minimum score was recorded in T₇ (17.92 N). There was no significant difference observed in T₂ [RWF (78g) + DLP (0g) + DSF (10g)], T₃ [RWF (73g) + DLP (5g) + DSF (10g)], and T₄ [RWF (70.5g) + DLP (7.5g) + DSF (10g)]. Gluten has been reported to be responsible for hardness of noodles (Chompreeda *et al.*, 1987). As the level of drumstick leaf powder incorporation increased the texture of the noodles decreased. This may be due to relative reduction of gluten.

The mean variation range in texture of cooked noodles was 0.56 N to 1.73 N (Table 2). The maximum value of texture in cooked noodles was recorded in T₃ (1.73 N) and minimum was recorded in T₂ (0.56 N). No significant difference was observed in cooked noodles of control and T₃ [RWF (73g) + DLP (5g) + DSF (10g)], T₄ [RWF (70.5g) + DLP (7.5g) + DSF (10g)] and T₅ [RWF (68g) + DLP (10g) + DSF (10g)]. High value of hardness has been correlated positively with swelling capacity of flours/starches. Past research has indicated that flour quality and protein content affect noodle texture (Park and Baik, 2004) particularly the gluten forming proteins due to their unique visco-elastic properties (Crosbie *et al.*, 1999).

L* a* b* values

Colour is a key quality trait (Mares and Campbell, 2001) because of the visual impact at the point of sale as it provides some indication of the quality of the product during initial and in the age of the product. Among the treatments, the L* value was found to be statistically significant in all the treatments except with T₁ (66.99) and T₂ (63.09). The maximum and minimum L* value was

recorded in T₁ (66.59) and T₇ (28.67) respectively. The per cent of increase in drumstick leaf powder incorporation resulted in decreased L* a* and b* values that indicates darkening of noodles compared to control (Table 3). These results are in accordance with the studies of Yadav *et al.*, (2015) who revealed that, the apple pomace powder added noodles had significantly lower lightness than the control sample. As the level of apple pomace powder increased in the formulations (10%, 15% & 20%), the colour of the noodles became darker than the control, but 10% formulation was slightly less darker colour as compared to 15 per cent and 20 per cent formulations.

The maximum a* value was recorded in T₁ (4.94) and minimum was recorded in T₇ (0.94). Maximum b* value was recorded in T₁ (27.81) and minimum was recorded in T₇ (13.05) (Table 3). The visual difference, however, was relatively minor with variances of less than 6 units among L*, a* and b* values. Park and Baik (2004) highlighted that instant noodles made from flour of high protein content (>13.6%) exhibited a positive relationship in brightness (high L* values) but negative relationship in b* values.

Table.1 Treatment details

Sl. No	Ingredients	Treatments						
		T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇
1	Refined wheat flour (g)	88.00	78.00	73.00	70.50	68.00	65.50	63.00
2	Drumstick leaf powder (g)	0	0	5.00	7.50	10.00	12.50	15.00
3	Defatted soybean flour (g)	0	10.00	10.00	10.00	10.00	10.00	10.00
4	Salt (g)	1.50	1.50	1.50	1.50	1.50	1.50	1.50
5	Starch (g)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
6	Citric acid (g)	0.10	0.10	0.10	0.10	0.10	0.10	0.10
7	Potassium carbonate (g)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
8	Sodium carbonate (g)	0.05	0.05	0.05	0.05	0.05	0.05	0.05
9	Edible vegetable oil (Ground nut) (g)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
10	Guar gum (g)	0.30	0.30	0.30	0.30	0.30	0.30	0.30
11	Water (ml)	31.00	31.00	31.00	31.00	31.00	31.00	31.00

T₁: Control

Table.2 Effect of incorporation of drumstick leaf powder and defatted soybean flour on texture (raw and cooked) of instant noodles

Treatments		Texture of raw noodles (N)	Texture of cooked noodles (N)
T₁	: RWF (88g)+ DLP (0g)+ DSF (0g)	18.34	1.66
T₂	: RWF (78g)+ DLP (0g)+ DSF (10g)	21.65	0.56
T₃	: RWF (73g)+ DLP (5g)+ DSF (10g)	23.83	1.73
T₄	: RWF (70.5g) + DLP (7.5g)+ DSF (10g)	23.77	1.47
T₅	: RWF (68g) + DLP (10g)+ DSF (10g)	20.47	1.43
T₆	: RWF (65.5g) + DLP (12.5g)+ DSF (10g)	18.96	0.74
T₇	: RWF (63g) + DLP (15g)+ DSF (10g)	17.92	0.71
Mean		20.70	1.18
SEm±		0.96	0.16
CD at 1%		2.89	0.50

RWF: Refined Wheat Flour, DLP: Drumstick Leaf Powder, DSF: Defatted Soybean Flour N: Newton

Common ingredients used in all the treatments

- | | | |
|--------------------------------|-----------------------------|---|
| 1. Salt (1.5g) | 2. Starch (5g) | 3. Citric acid (0.10g) |
| 4. Potassium carbonate (0.05g) | 5. Sodium carbonate (0.05g) | 6. Edible vegetable(Groundnut) oil (5g) |
| 7. Guar gum (0.3g) | 8. Water (31ml) | |

Table.3 Effect of incorporation of drumstick leaf powder and defatted soybean flour on Colour (L^* a^* b^*) values of instant noodles

Treatments		L^*	a^*	b^*
T₁	: RWF (88g)+ DLP (0g)+ DSF (0g)	66.59	4.94	27.91
T₂	: RWF (78g)+ DLP (0g)+ DSF (10g)	63.09	2.43	22.81
T₃	: RWF (73g)+ DLP (5g)+ DSF (10g)	34.03	1.88	18.30
T₄	: RWF (70.5g) + DLP (7.5g)+ DSF (10g)	33.81	1.64	18.15
T₅	: RWF (68g) + DLP (10g)+ DSF (10g)	30.05	1.27	13.32
T₆	: RWF (65.5g) + DLP (12.5g)+ DSF (10g)	29.13	1.14	13.19
T₇	: RWF (63g) + DLP (15g)+ DSF (10g)	28.67	0.94	13.05
Mean		40.76	2.03	18.10
SEm±		1.93	0.25	1.30
CD at 1 %		5.77	0.76	3.88

RWF: Refined Wheat Flour, DLP: Drumstick Leaf Powder, DSF: Defatted Soybean

Common ingredients used in all the treatments

- | | | |
|--------------------------------|-----------------------------|---|
| 1. Salt (1.5g) | 2. Starch (5g) | 3. Citric acid (0.10g) |
| 4. Potassium carbonate (0.05g) | 5. Sodium carbonate (0.05g) | 6. Edible vegetable(Groundnut) oil (5g) |
| 7. Guar gum (0.3g) | 8. Water (31ml) | |

Table.4 Effect of incorporation of drumstick leaf powder and defatted soybean flour on sensory evaluation of instant noodles

Treatments	Colour *and appearance	Flavour *	Taste *	Texture * (mouth feel)	Overall * acceptability
T₁ : RWF (88g)+ DLP (0g)+ DSF (0g)	7.95	7.78	7.51	7.58	7.70
T₂ : RWF (78g)+ DLP (0g)+ DSF (10g)	6.56	6.24	6.44	6.67	7.08
T₃ : RWF (73g)+ DLP (5g)+ DSF (10g)	8.66	8.25	8.11	8.28	8.21
T₄ : RWF (70.5g) + DLP (7.5g)+ DSF (10g)	8.24	7.10	7.58	7.58	7.46
T₅ : RWF (68g) + DLP (10g)+ DSF (10g)	7.50	6.90	7.25	7.60	7.24
T₆ : RWF (65.5g) + DLP (12.5g)+ DSF (10g)	6.58	6.66	6.75	6.61	6.53
T₇ : RWF (63g) + DLP (15g)+ DSF (10g)	6.26	6.11	6.18	6.41	6.08
Mean	7.39	7.00	7.11	7.25	7.18
SEm±	0.61	0.51	0.43	0.38	0.46
CD at 1%	1.83	1.52	1.30	1.15	1.36

RWF: Refined Wheat Flour, DLP: Drumstick Leaf Powder, DSF: Defatted Soybean

* Out of 9 points

Common ingredients used in all the treatments

- | | | |
|--------------------------------|-----------------------------|---|
| 1. Salt (1.5g) | 2. Starch (5g) | 3. Citric acid (0.10g) |
| 4. Potassium carbonate (0.05g) | 5. Sodium carbonate (0.05g) | 6. Edible vegetable(Groundnut) oil (5g) |
| 7. Guar gum (0.3g) | 8. Water (31ml) | |

Fig.1 Flow chart for preparation of instant noodles incorporated with drumstick leaf powder and defatted soybean flour

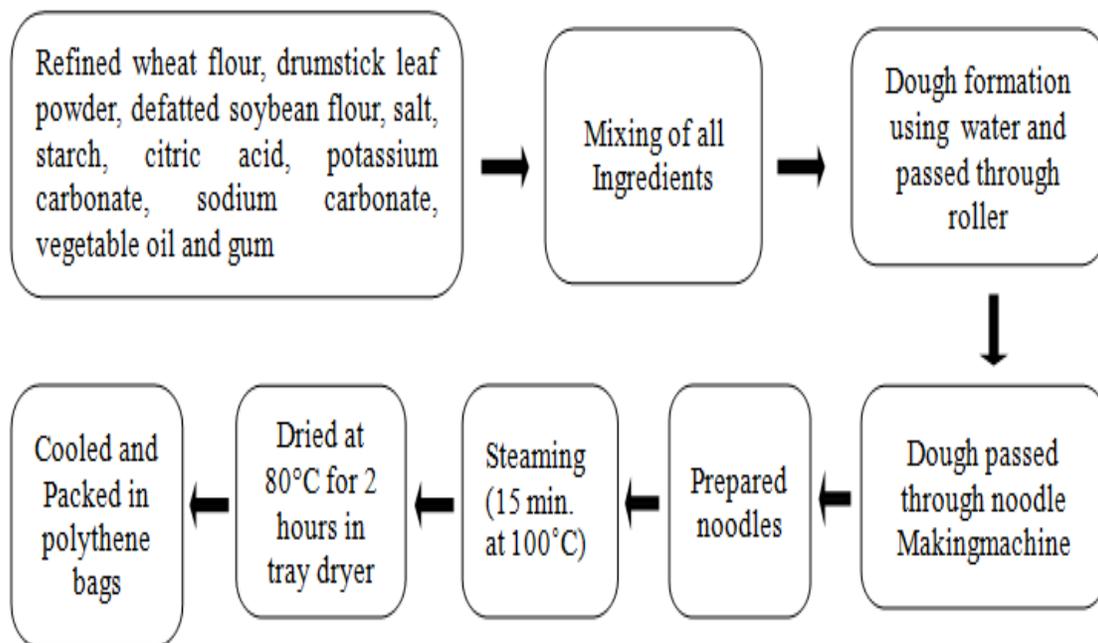


Fig.2 Noodles prepared from drumstick leaf powder and other ingredients at different levels



Factors controlling colour stability, which include alkaline formulation, flour refinement and enzymatic browning associated with poly phenoloxidase, have been extensively investigated (Hatcher *et al.*, 2008). Ramu *et al.*, (2016) found that with the increase in spinach paste, there was a significant decrease ($p \leq 0.05$) in brightness (L) value from 82.45 to 44.35 and also there was an increase in redness (a) in instant noodles from 0.73 to 25.68. Yellowness (b) in instant noodles significantly ($p \leq 0.05$) increased from 13.37 to 61.48.

Sensory evaluation

Colour and appearance are the most important assessment attributes for noodle quality (Bhattacharya, Luo. and Corke (1999); Miskelly (1984). Colour is one of the major response variables governing food acceptance. Since colour relies on the sense of sight, the colour of the noodles was one of the outstanding parameters in the decision of the panelist. In the present study significant differences were observed in colour and

appearance of noodles in different treatments. Maximum score for colour was recorded in T₃ (8.66) and minimum in T₇ (6.26). Among the treatments, T₃ (5% drumstick leaf powder incorporated noodles) had good colour and appearance scores, it might be due to the fact that incorporation of drumstick leaf powder at lower levels gives attractive light green colour which was well accepted by the consumers (Table 4). Omeire *et al.*, (2015) revealed that the average sensory scores for colour of the prepared cassava noodles ranged from 5.25 to 8.70. The results of the study is similar to the findings of Taneya *et al.*, (2014) who reported that the instant noodles containing 30 per cent sweet potato flour secured the highest score (7.7) for colour and the noodles containing only wheat flour gave lowest score (6.9).

Significantly maximum score for flavor was recorded in T₃ (8.25) and the minimum mean score was recorded in T₇ (6.11). Lowest score of flavour in T₇ might be due to typical drumstick leaf powder flavour and astringency after cooking. Flavour of noodles was accepted by incorporation of drumstick

leaf powder and defatted soybean flour up to 10 per cent but beyond 10 per cent significantly reduced the flavour scores.

The maximum taste was recorded in T₃ (8.11) followed by T₄ (7.58) and minimum taste score was recorded in T₇ (6.18). The data in Table 4 shows that the taste score decreased with the increase in incorporation of drumstick leaf powder. Least scores in T₇ might be due to typical flavour and astringency of drumstick leaf powder which adds bitterness after taste. No significant difference was observed between the taste scores of control (T₁), 10 per cent defatted soybean flour incorporated noodles (T₂) and 10 per cent defatted soybean flour + 10 per cent drumstick leaf powder (T₅) incorporated noodles. So from these results one can conclude that noodles incorporated with 10 per cent drumstick leaf powder were acceptable for taste. These results are in accordance with study of Wani *et al.*, (2013) who reported that the addition of cauliflower leaves to noodles up to 10% was found acceptable.

The maximum and minimum mean texture score was recorded in T₃ (8.28) and T₇ (6.41) respectively. The texture scores of the nutridensed noodles was found to be good in T₃ (5% drumstick leaf powder + 10% defatted soybean incorporated) treatment compared with other treatments (Table 4). Omeire *et al.*, (2015) reported that the average sensory score for texture of the prepared cassava noodles ranged between 6.75 and 8.25. Taneya *et al.*, (2014) revealed that the range of instant noodles score for texture was 6.5-8.0. The lowest score (6.5) was secured by noodle containing wheat flour and the highest score (8.0) for texture was in instant noodles containing 30 per cent sweet potato flour.

A perusal of data in Table 4 showed significantly maximum score for overall

acceptability in T₃ [RWF (73g) + DLP (5g) + DSF (10g):8.21] and minimum mean score was recorded in T₇ [RWF (63g) + DLP (15g) + DSF (10g): 6.08]. The maximum score in T₃ may be due to low percent of drumstick leaf powder incorporation, which did not affect the quality in terms of colour and appearance, flavour, texture and taste through sensory evaluation. However, there was no significant difference observed between T₅ [RWF (68g) + DLP (10g) + DSF (10g)] and control [RWF (88g) + DLP (0g) + DSF (0g)]. Wani *et al.*, (2013) reported that the addition of cauliflower leaves to noodles up to 10 per cent was found to be highest score for overall acceptability.

Instant noodles prepared by incorporated with drumstick leaf powder and defatted soybean flour shows the significant difference in texture, colour and organoleptic evaluation. The best results observed among the drumstick leaf powder added treatments, treatment T₃ (73% Refined wheat flour + 5% Drumstick leaf powder and 10% Defatted soybean flour) was found better quality and acceptance when compared to other treatments.

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