Int.J.Curr.Microbiol.App.Sci (2018) *7*(2): 3642-3651

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 02 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.702.433

Development and Evaluation of Cooking Properties of Instant Noodles Incorporated with Drumstick Leaf Powder and Defatted Soybean Flour

Vittal Kamble[1*], G. Bhuvaneshwari[1], S.L. Jagadeesh[1], Vasant M. Ganiger[2] and Deepa Terdal[1]

[1]Department of Post-Harvest Technology, [2]Department of Vegetable Science, College of Horticulture, Bagalkot, Karnataka-587 104, India
**Corresponding author*

Keywords

Noodles, Refined wheat flour, Drumstick leaf powder, Defatted soybean flour

Article Info

Accepted:
28 January 2018
Available Online:
10 February 2018

A B S T R A C T

Instant noodles were prepared by blending of refined wheat flour (RWF) with drumstick leaf powder (DLP) and defatted soybean flour (DSF). Instant noodles masala taste maker was developed by using different ingredients at different levels. Instant noodles prepared from blending with DLP, DSF and other ingredients shows less volume of 100 g dried noodles, cooking time, swelling index, cooked weight, volume of cooked noodles, per cent increase in volume but more cooking loss was observed in DLP, DSF blended noodles compared to control. The study indicated that, as the incorporation of DLP increases the cooking properties of the instant noodles decreases.

Introduction

Noodles are one of the staple foods consumed in many Asian countries. Instant noodles have become internationally recognized food, and worldwide consumption is on the rise. Many researchers are exploring the potential of noodle fortification as an effective public health intervention and improve its nutritional properties. The properties of instant noodles like taste, nutrition**,** convenience, safety, longer shelf life, and reasonable price have made them popular. Instant noodles appear to have originated in Japan in the 1950s and today, are produced in over 80 countries worldwide. During 2008, approximately 93.6 billion servings of instant noodles have been consumed worldwide. With changing lifestyles, greater awareness about health and preference for instant food items have made instant noodles very popular and an item of mass consumption. In this era of global industrialization and advancement of technologies, the life style of the people has changed a lot. Demand for ready to eat foods like extruded foods has risen considerably. 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 convenient/processed foods could be a solution to the problem of supplementary feeding in under nutrition (Gernah *et al.,* 2011). Due to the nutritional advantages along with the appeal of noodles amongst consumers, have made this food product a potential vehicle for neutraceuticals.

Drumstick (*Moringa oleifera*) is an important perennial vegetable crop and is now seen as one way of helping subsistence farmers make better use of their land and improve their living standards. Since the trees can grow in arid and semi-arid areas and are able to withstand temperature up to 40 ˚C, they can offer new income generating opportunities for people living in areas regarded as agriculturally unproductive. A wide variety of nutritional and medicinal virtues have been attributed to its roots, bark, leaves, flowers, fruits and seeds (Kumar *et al.,* 2010). Phytochemical analyses have shown that its leaves are particularly rich in potassium, calcium, phosphorous, iron, vitamins A and D, essential amino acids as well as antioxidants such as β-carotene, vitamin C and flavonoids (Amaglo *et al.,* 2010; Gowrishankar *et al.,* 2010).

The soybean, a grain legume, is one of the richest and cheapest sources of plant protein that can be used to improve the diet of millions of people, especially the poor and low income earners in developing countries. The main ingredients of noodles are wheat, which is having deficiency of essential amino acid lysine, whereas soybean is richer in lysine and can be complement to wheat in noodles. Soybean protein is more economical than high priced meat protein and so they are considered as best source of protein especially in vegetarian diet. It increases nutritional status of vulnerable groups like pregnant woman, nursing mother, school going and young children (Khalid *et al.,* 2012). Therefore the present study was carried out with an objective of development of instant noodles and evaluation of their cooking properties.

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. The twigs containing half matured drumstick leaves were taken to laboratory. The leaves were separated from twigs, washed thoroughly in clean running water, drained and spread on the clean stainless steel tray to remove surface moisture. After removal of surface moisture leaves were weighed and dried under electrical tray drier at 60˚C until they were crisp. Dried drumstick leaf powder was packed separately in LDPE bags (200 gauze) 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.

Basic formulation

Treatments are formulated as shown in the Table 1.

Preparation of instant noodles

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.

Preparation of masala taste maker

Masala taste maker was prepared by using different ingredients as shown in the Table 2.

Volume of 100 g dried raw noodles (ml)

The volume of dried raw noodles was determined by sand displacement method. A known amount (100g) of noodles were weighed and put in a measuring cylinder.

A known amount of sand (100ml) was taken (V_1) and it was poured into the measuring cylinder containing 100g dried noodles. The volume was measured again (V_2). The volume of the noodles was calculated by finding the difference between total volume (V_2) and the volume of sand.

Cooking time (min.)

Determination of optimum cooking time was achieved by using method similar to that described by Oh *et al.,* (1983) where 10 g of instant noodles were boiled in 300 mL of distilled water and after each minute of cooking for the first 2 minutes, noodles were removed and squeezed between clear glass slides. This procedure was then repeated by removing the noodles every 15 seconds until the white core disappeared. This point is the optimum cooking time.

Cooked weight (g)

Cooked weight was defined as the weight gain of the noodles during the cooking and indicated the amount of water that was absorbed and was therefore an index for the swelling ability of the noodles.

Instant noodles (10g) were cooked in 300ml of distilled water in a beaker to their optimum cooking time, rinsed with distilled water, drained and left to cool for 5 minute at room temperature. The cooled cooked noodles were then reweighed. The cooked weighed was expressed in grams.

Swelling index (%)

The swelling index of cooked noodles was estimated using the protocol stated by Cleary and Brennan (2006).

$$\text{Swelling index (\%)} = \frac{\text{Weight of the cooked noodles (g)} - \text{Weight of noodles after drying (g)}}{\text{Weight of noodles after drying (g)}}$$

Volume of cooked noodles (ml)

Volume of cooked noodles was determined by cooking 100g of dried noodles in a known amount of water. Volume was measured as per the procedure given in 2.3

Per cent (%) increase in volume

The per cent increase in volume of cooked noodles was determined by

$$\% \text{ increase in volume} = \frac{\text{Vol. of cooked noodles (ml)} - \text{Vol. of raw noodles (ml)}}{\text{Volume of raw noodles}} \times 100$$

Cooking loss (%)

Cooking loss was analysed according to the AACC International Approved Method (Anon 2000). In 300 mL of boiling water 25 grams of noodle sample was cooked at an optimum cooking time (OCT). Noodles were strained and the cooked water was collected in a beaker and then solids material was determined in the cooking water by evaporating in a hot air oven at 105°C overnight until a constant weight was reached. The cooking loss was expressed as a percentage, based on the weight difference between the initial solid material and final dry matter.

Statistical analysis

The data on the cooking properties recorded subjected to completely randomised block design and analysed by using wasp software (ICAR Research Complex Goa). The level of significance used in F and t test was at one per cent level of significance.

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. Masala taste maker was made by using different ingredients as shown in the Table 2.

Volume of 100 g dried raw noodles (ml)

Incorporation of drumstick leaf powder and defatted soybean flour had significant effect on volume of 100g dried noodles. The volume of 100g dried noodles was ranged from 187.33 to 215ml. Among the different treatments, the maximum mean volume of dried noodles was recorded in T_1 (215ml) followed by T_2 (201.66) and the minimum volume was observed in T_7 (187.33). The treatments T_1 and T_2 had significantly more volume when compared with other treatments (Table 3). No significant difference was observed between the T_1 and T_2 treatments. Maximum increase in the volume of noodles was observed in these two treatments due to formation of protein-amylose complex in native starches and flours. Decreased volume in 100 gram dried noodles of all the drumstick leaf powder incorporated samples may be due to less starch and protein where they play an important in gelatinization of starch and in turn swelling of the dough. However, there was no significant difference observed between the volume of soybean incorporated and all the treatments of drumstick incorporated noodles.

Cooking time (min)

The data on effect of incorporation of drumstick leaf powder and defatted soybean flour on cooking time of noodles is presented in Table 3. The cooking time showed the significant difference among the treatments. The cooking time was ranged from 5.47 to 6.41 minutes. Treatments T_1 (6.41min), T_2 (6.23min) and T_3 (6.11min) were on par with each other. Significantly lowest cooking time was observed in T_7 (5.47min) which was on par with the treatment T_6 (5.57min), T_5 (5.68min), and T_4 (5.80min). Highest cooking time was observed in T_1 (6.41min). As drumstick leaf powder addition level increased, cooking time gradually decreased. Ingredients other than wheat flour such as

drumstick leaf powder may cause discontinuity of gluten network (Manthey *et al.*, 2004; Izydorczyk *et al.*, 2004) resulting in faster moisture penetration and therefore leading to optimum cooking time. The results are in agreement with the findings of Eyidemir and Hayta (2009) who found that incorporation of apricot kernel flour to noodles results in decreased cooking time. Cooking time of the noodle samples decreased with the incorporation of partially defatted flour samples to the wheat-cassava composite flour. The difference in the cooking time of the noodle samples might be attributed to their compositional differences.

Cooking loss (%)

As the cooking loss is an indicator of noodles resistance to cooking (Nagao, 1996) low levels are preferable. In the present study cooking loss of noodles was influenced by incorporation of drumstick leaf powder and defatted soybean flour. The cooking loss of noodles was ranged from 6.58 to 8.25 per cent. The minimum and maximum cooking loss was observed in T_1 (6.58%) and T_7 (8.25%) respectively (Table 3). As the level of incorporation of drumstick leaf powder increased the cooking loss was also found to be increased. The reason for this could be attributed to weak protein-starch interaction or destroyed protein matrix. Moreover, high cooking loss of drumstick leaf incorporated noodles compared to control may result from the presence of high water soluble protein fraction fibre and minerals in drumstick leaf powder. Ovando-Martinez *et al.*, (2009) reported that partial or complete substitution of durum wheat semolina with fiber material can result in increased cooking loss. The results of the present study for cooking loss agree with Turkish noodle standard which states that cooking loss should not exceed the level of 10% on dry matter basis. The results of the present findings are in agreement Eyidemir and Hayta (2009) who reported that incorporation of apricot kernel powder (5.20%) to noodles resulted in more cooking loss (6.78-7.37 %) than control (6.54%).

Swelling index (%)

Swelling index of noodles is an indicator of water absorbed by the starch and protein during cooking which is utilized for the starch gelatinization and protein hydration. The swelling index of the noodles of different treatments shows that there were significant difference between the samples at $p<0.01$. The maximum swelling index was recorded in T_1 (2.16%) followed by T_2 (2.14), T_3 (2.13) and T_4 (2.10) and they were on par with each other (Table 4). The swelling index of the nutri densed noodles decreased with increasing levels of incorporation of drumstick leaf powder.

Table.1 Basic formulation of composite flour for instant noodles

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

T_1: Control

Table.2 Masala taste maker of noodles was prepared by using the following ingredients

Sl. No.	Name of the ingredients	Quantity (%)
1	Onion powder	14
2	Chilli powder	14
3	Garlic powder	12
4	Coriander powder	2.5
5	Turmeric	2.5
6	Cumin	2.5
7	Aniseed	2.5
8	Black pepper	2.5
9	Fenugreek	0.9
10	Ginger	0.9
11	Clove	0.9
12	Nutmeg	0.9
13	Cardamom	0.9
14	Salt	5
15	Hydrolyzed groundnut meal powder	38

Table.3 Effect of incorporation of drumstick leaf powder and defatted soybean flour on volume of dried noodles, cooking time and cooking loss of noodles

Treatments	Volume of 100 g dried noodles (ml)	Cooking time (min)	Cooking loss (%)
T_1: RWF (88g)+ DLP (0g)+ DSF (0g)	215.00	6.41	6.58
T_2: RWF (78g)+ DLP (0g)+ DSF (10g)	201.66	6.23	6.99
T_3: RWF (73g)+ DLP (5g)+ DSF (10g)	196.00	6.11	7.06
T_4: RWF (70.5g) + DLP (7.5g)+ DSF (10g)	193.00	5.80	7.43
T_5: RWF (68g) + DLP (10g)+ DSF (10g)	191.33	5.68	7.46
T_6: RWF (65.5g) + DLP (12.5g)+ DSF(10g)	190.00	5.57	8.23
T_7: RWF (63g) + DLP (15g)+ DSF (10g)	187.33	5.47	8.25
Mean	**196.33**	**5.89**	**7.42**
SEm±	**6.00**	**0.11**	**0.35**
CD at 1%	**17.86**	**0.35**	**1.04**

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

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 swelling index and cooked weight of noodles

Treatments		Swelling index (%)	Cooked weight (g)
T_1	: RWF (88g)+ DLP (0g)+ DSF (0g)	2.16	158.33
T_2	: RWF (78g)+ DLP (0g)+ DSF (10g)	2.14	157.00
T_3	: RWF (73g)+ DLP (5g)+ DSF (10g)	2.13	156.66
T_4	: RWF (70.5g) + DLP (7.5g)+ DSF (10g)	2.10	155.33
T_5	: RWF (68g) + DLP (10g)+ DSF (10g)	2.06	153.00
T_6	: RWF (65.5g) + DLP (12.5g)+ DSF (10g)	2.05	152.66
T_7	: RWF (63g) + DLP (15g)+ DSF (10g)	2.03	151.66
Mean		**2.09**	**154.94**
SEm±		**0.07**	**1.18**
CD at 1%		**0.28**	**3.51**

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

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.5 Effect of incorporation of drumstick leaf powder and defatted soybean flour on volume of cooked noodles and per cent increase in volume of noodles

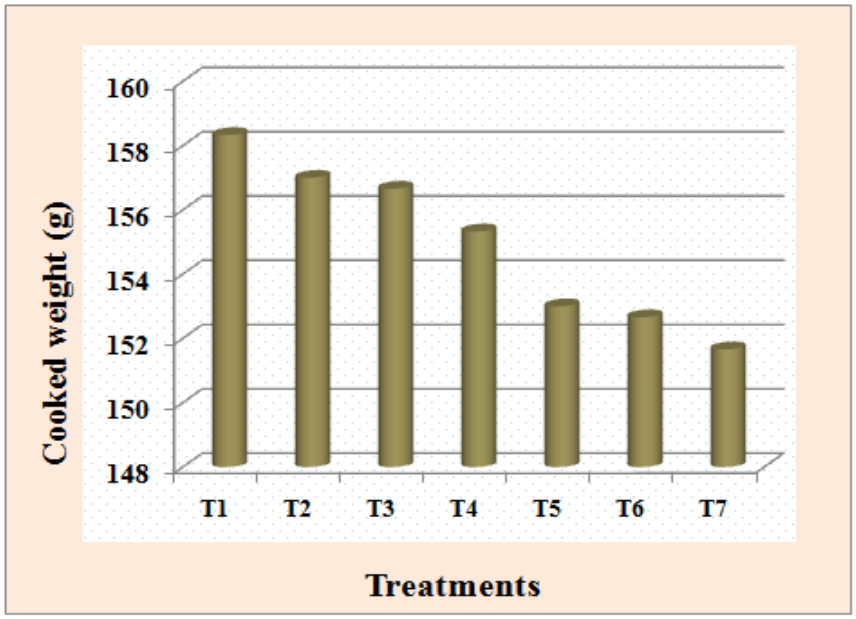
Treatments	Volume of cooked noodles (ml)	Per cent increase in volume (%)
T_1: RWF (88g)+ DLP (0g)+ DSF (0g)	319.33	68.98
T_2: RWF (78g)+ DLP (0g)+ DSF (10g)	316.00	68.33
T_3: RWF (73g)+ DLP (5g)+ DSF (10g)	318.00	68.24
T_4: RWF (70.5g) + DLP (7.5g)+ DSF (10g)	314.00	68.18
T_5: RWF (68g) + DLP (10g)+ DSF (10g)	313.00	68.16
T_6: RWF (65.5g) + DLP (12.5g)+ DSF (10g)	313.00	67.23
T_7: RWF (63g) + DLP (15g)+ DSF (10g)	311.33	66.30
Mean	**314.95**	**67.91**
SEm±	**1.33**	**0.42**
CD at 1%	**3.96**	**1.26**

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

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 Effect of incorporation of drumstick leaf powder and defatted soybean flour on Cooked weight of noodles



Note:

T_1: RWF (88g) + DLF (0g) + DSF (0g)
T_2: RWF (78g) + DLF (0g) + DSF (10g)
T_3: RWF (73g) + DLF (5g) + DSF (10g)
T_4: RWF (70.50g) + DLF (7.50g) + DSF (10g)
T_5: RWF (68g) + DLF (10g) + DSF (10g)
T_6: RWF (65.50g) + DLF (12.50g) + DSF (10g)
T_7: RWF (63g) + DLF (15g) + DSF (10g)

The swelling index has been related to the association binding within the starch granules and apparently the strength and character of the miscelle netwotk as related to the amylase content of the flour. Low amylase content produces high swelling power (Adebowale *et al.*, 2005. Emmamual *et al.*, (2009) reported that swelling index depends on the compositional structure of the sample. Sample with the least swelling index value would provide more nutrient density.

Cooked weight (g)

The maximum cooked weight was recorded in T_1 (158.33g) and this was on par with T_2 (157.0g), T_3 (156.66) and T_4 (155.33) and minimum was recorded in T_4 (151.66g) (Table 4, Fig. 1). As the incorporation of drumstick leaf powder increases, the cooking weight decreased when compared to T_1 and T_2 (without incorporation of drumstick leaf powder). This might be due to less water binding and holding capacity of drumstick incorporated noodles. This is directly related with the swelling power of the noodles where water was absorbed by the starch and protein during cooking which is utilized for starch gelatinization and protein hydration. The highest cooked weight in T_1 and T_2 would be attributed to the high starch and protein content of the noodle samples (Omeire *et al.*, 2015)

Volume of cooked noodles (ml)

The data pertaining to incorporation of drumstick leaf powder and defatted soybean flour on volume of cooked noodles is presented in Table 5. Volume of the cooked

noodles varied among the treatments. Treatment T_1 (319.33 ml) showed the maximum volume of cooked noodles followed by T_3 (318.00 ml) and T_2 (316.00 ml) and minimum was found in T_7 (311.33ml). The low volume of drumstick leaf powder incorporated noodles may be due to substitution of wheat flour with drumstick leaf powder decreases the starch content in the flour thereby reducing the swelling power which in turn reduces the volume of cooked noodles.

Per cent increase in the volume

A highly significant difference ($P<0.01$) was noticed in noodles in per cent increase in the volume of the cooked noodles enriched with drumstick leaf powder and defatted soybean flour (Table 5). The maximum per cent increase in the volume was recorded in T_1 (68.98%) and minimum per cent increase in the volume was recorded in T_7 (66.30%). All the treatments were on par with T_1 except T_6 and T_7 (5). The per cent increase in volume was decreased as the level on incorporation of drumstick leaf powder increases. This depends on the compositional structure of the treatments (Emmanual *et al.*, 2009).

Noodles incorporated with drumstick leaf powder and defatted soybean flour shows the significant difference in cooking qualities. The best cooking qualities among the drumstick leaf powder added treatments, treatment T_3 (73% Refined wheat flour + 5% Drumstick leaf powder and 10% Defatted soybean flour) was found better acceptance when compared to other treatments.

Acknowledgment

University of Horticultural Sciences Bagalkot facilitates all the difficulties that suffered this research. Therefore, my Deepest thanks to University of Horticultural Sciences Bagalkot for the finance, cooperation and encouragement.

References

Adebowale, A.A., Sanni, L.O. and Awonorin, S.O. 2005. Effect of texture modifiers on the physico-chemical and sensory properties of dried fufu. *Food Sci Technol Int* 11:373-382.

Amaglo, N.K., Bennett, R.N., Lo Curto, R.B., Rosa, E.A.S., Lo Turco. V., Giuffrid, A., Lo Curto, A., Crea, F. and Timpo, G.M. 2010. Profiling selected phytochemicals and nutrients in different tissues of the multipurpose tree *Moringa oleifera* L., grown in Ghana. *Food Chem*., 122:1047–1054.

Anonymous, 2000. Approved Method of the American Association of Cereal Chemists: Method 66-50 (10 Ed). St. Paul, MN: The Association.

Cleary, L., and Brennan, C. 2006. The influence of a (1 -3) (1- 4)-β- d-glucan rich fraction from barley on the physicochemical properties and *in-vitro* reducing sugars release of durum wheat pasta. *Int J Food Sci Technol*., 41:910-918.

Emmanual, C.A.I., Okol. J., and Osuchukwu, N.C. 2009. Functional, anti-nutritional and sensory acceptability of taro and soy bean based weaning food. *African J Food Sci.*, 3(11): 372-377.

Eyidemir, E., and Hayta, M. 2009. The effect of apricot kernel flour incorporation on the physicochemical and sensory properties of noodle. *African J Biotechnol*, 8(1):085-090.

Gernah, G.I., Ariahu, G.C. and Ingbian, E.K. 2011. Effect of malting and lactic fermentation on some chemical and functional properties of maize. *American J. Food Technol.*, 6:404–412.

Gowrishankar, R., Kumar, M., Menon, V., Divi, S.M., Saravanan, M.,

Magudapathy, P., Panigrahi, B.K., Nair, K.G. and Venkataramaniah, K. 2010. Trace element studies on*Tinosporacordifolia* (Menispermaceae), *Ocimumsanctum* (Lamiaceae), *M. oleifera* (Moringaceae) and *Phyllanthus niruri* (Euphorbiaceae) using PIXE. Biol Trace Elem Res 133:357–363.

Izydorczyk, M.S., Lagasse, S.L., Hatcher, D.W., Dexter, J.E., and Rossnagel, B.G. 2004. The enrichment of Asian noodles with fiber-rich fractions derived from roller milling of hull-less barley. *J Sci Food Agric.*, 85: 2094-2104.

Khalid, B., Vidhu, A. and Lubna, M. 2012. Physio-chemical and sensory characteristics of pasta fortified with chickpea flour and defatted soy flour. J *Environment Sci Toxicol Food Technol.*, 1:34-39.

Kumar, P.S., Mishra, D., Ghosh, G., and Panda, G.S. 2010. Medicinal uses and pharmacological properties of *Moringa oleifera*. *Int J Phytomed*, 2:210–216.

Manthey, F.A., Yalla, A.R., Dick, T.J., and Badaruddin, M. 2004. Extrusion properties and cooking quality of spaghetti containing buckwheat bran flour. *Cereal Chem*., 81:232-236.

Nagao, S., 1996. Processing technology of noodle products in Japan, In Pasta and Noodle technology. *Am. Assoc. Cereal Chem. St. Paul*., 169-194.

Oh, N.H., Seib, P.A., Deyoe, C.W. and Ward, A.B. 1983. Noodles. I. Measuring the textural characteristics of cooked noodles. *Cereal Chem*., 60(6):433-438.

Omeire, G.C., Nwosu, J.N., Kabuo, N.O. and Nwosu, M.O. 2015. Cooking properties and sensory evaluation of enriched cassava or wheat noodles. *Int J Innov Res Sci Eng technol*., 3(2):46-50.

Ovando-Martinez, M., Sayago-Ayerdi, S., Agama-Acevedo, E., Goni, I., and Bello-Perez, L.A. 2009. Unripe banana flour as an ingredient to increase the undigestible carbohydrates of pasta. *Food Chem*., 113(1):121-126.

How to cite this article:

Vittal Kamble, G. Bhuvaneshwari, S.L. Jagadeesh, Vasant M. Ganiger and Deepa Terdal. 2018. Development and Evaluation of Cooking Properties of Instant Noodles Incorporated with Drumstick Leaf Powder and Defatted Soybean Flour. *Int.J.Curr.Microbiol.App.Sci.* 7(02): 3642-3651. doi: https://doi.org/10.20546/ijcmas.2018.702.433