Journal of Food and Dairy Sciences

Journal homepage: www.jfds.mans.edu.eg
Available online at: www. jfds.journals.ekb.eg

Properties of Noodles Fortification with Turnip Leave powder

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ABSTRACT

The chemical composition, cooking quality, color and sensory evaluation of noodles fortification with turnip leaves powder were studied. Noodles were developed by using turnip leaves powder at different level ratio. Tup_2 (Noodles fortification with 2% turnip leaves powder), Tup_4 (Noodles fortification with 4% turnip leaves powder) and Tup_6 (Noodles fortification with 6% turnip leaves powder) for the study. The protein, fiber, ash, Ca, Mg, F, Mn, Na and K content were observed higher for turnip leaves powder, and also a rich source of anti-oxidants. The results of chemical and nutritional quality characteristics of noodles revealed that protein, fiber and ash were higher in noodles fortification with turnip leaves powder compared to control sample. Increment of turnip leaves powder from 2 to 6% increase of cooking loss and decrease cooking time, cooking weight, water absorption and brightness. Sensory scores of noodles were a slightly decreasing with increasing the levels of addition turnip leaves powder. The best scores of sensory evaluation were found in control sample and 2% leaves powder incorporation. The turnip leaves powder can be successfully using in the noodles formula and improving the nutritional quality of noodles.

Keywords: Turnip leaves powder, vegetables wastes, Noodles, Cooking qualities

INTRODUCTION

The crops of leafy vegetables considered the important crops because these contain amounts of vitamins and minerals for people. Low intake of leafy vegetables leads to a lack of vitamins and minerals especially iron (Pallavi and Beena, 2010).

There are various varieties of turnips, the leaves of (*Brassica Rapus L.*) have a great nutritional value and considered one of the cheapest locally available nutrients as they contain a high levels of dietary fiber, vitamins, minerals and bioactive components such as flavonoids. Both the roots and leaves have a pungent flavor and the edible portions of the turnip are used as an ingredient in stews and soups. Similarly, turnip tops and turnip greens have been used as vegetable products in some parts of the globe (Schonhof *et al.*, 2007 and Javed *et al*., 2019).

Noodles are one of the most important food in the worldwide and their international consumption is second only to bread (World Instant Noodle Association, 2016).

Leaves vegetables have health benefits but are often unappealing to consumers. One of the potential solutions to increase vegetable intake by children is to mix vegetables in a food that they do like. The noodles were very much loved by children, making it an ideal candidate for the development of vegetable. However, noodles contained bioactive compounds of vegetable origin are limited (Zeinstra *et al.*, 2010; Rekha *et al.*, 2013 and Deep *et al.*, 2014).

In this work, Turnip leaves powders were used in fortification of noodles formula, with the aim of benefiting from agricultural turnip wastes, and also to develop noodles with good acceptability and to evaluate the effects of fortification of turnip leaf powder on the physical, chemical and sensory properties of the noodles.

MATERIALS AND METHODS

Material

Sample collection

Fresh turnip (*Brassica rapa*) leaves were obtained from local private farm, EL- Mansoura, AL-Dakahlya Government, Wheat flour and egg were obtained from local market, at Tanta City, Egypt.

Methods

Preparation of Turnip powder:

Fresh Turnip leaves were washed under running tap water to eliminate dust and other foreign particles. Leaves were cut into small pieces, blanched by immerse in water at 98 ± 1°C for 2.5 min after which they were filtered from water and dried in an air oven at 40°C for 24h then the samples were grinding into powder by electric mill (Braun- Germany) and passed through 72 (210 µm) mesh sieve to obtain uniform sized flour then kept in plastic sachets at room temperature (20 ºC) till further used.

Noodle preparation

Noodles were prepared according to a method described by Collado and Corke (1996). Control sample was prepared using 100% wheat flour. Experimental samples were prepared by adding turnip leaves powder. The adding levels were 2%, 4%, and 6% based on solid contents. Dry ingredients were mixed for about 5 minutes, followed by addition of whole egg and water to form a crumbly mass and then extruded through a die with 12 outlets of 0.8 mm in diameter. The noodles were cut and dried at 40˚C for 8h and packed in polyethylene.

Analytical methods

Moisture, ash, ether extract, crude protein, crude fiber, and non protein nitrogen were determined according to the methods of AOAC (2000). Carbohydrate content was determined by differences 100- (moisture + protein + fat + ash + fiber). Minerals content was measured by digestion of 0.5 g of

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DOI: 10.21608/jfds.2020.111755

samples in HNO_3: $HClO_4$ (2:1) for 2-3 h on heating mantle (AOAC, 1984). Digested samples were filtered. Concentration of Ca, P, Mg, Fe, Mn and Zn was determined on Hitachi Zeeman Japan Z-8000, Atomic Absorption Spectrophotometer equipped with standard hallow cathode lamps, while Na and K concentration was determined on Flame Photometer.

Determination of antinutritional

Phytic acid was extracted according to AOAC (2000). Procedure and determined by HPLC. The HPLC used was a Bio-Rad HRLC system (500 series) equipped with a UV detector. The amount of phytic acid in the samples was determined by comparing the height of the peak obtained on injecting the sample extract with that obtained using standard solutions of phytic acids.

Tannins were measured by weighted 500 mg of turnip powder was weighted and put into 100 ml plastic bottle then, 50 ml of distilled water was added and shaken for 1h in a mechanical shaker. Then 5 ml of the filtrate was mixed with 2 ml of 0.1 M $FeCl_3$ in 0.1N HCL and 0.008 M potassium ferrocyanide. The absorbance was measured in a spectrophotometer at 530 nm wave length, within 10 min (Van-Burden and Robinson, 1981).

Preparation of extract

The dried sample (200 mg) was weighed, 10 mL 80% aqueous acetone was added, and homogenized for 1min. Tubes were centrifuged (15 min). Supernatants were taken to dryness (Kahkonen *et al.,* 1999).

Determination of total phenolic content

The amount of total phenolic in extracts was carried out by Folin- Ciocalteu test according to Chun *et al.* (2003) with some modifications. The total phenolic content was expressed as gallic acid equivalents (mg GAE/g of sample).

Determination of total flavonoid content

The total flavonoid content was measured by a colorimetric assay Zhishen *et al.* (1999). Catechin was used as standard for the calibration curve. The total flavonoid content was expressed as (mgCE/g of sample).

Cooking qualities

Optimum cooking time

Optimum cooking time was determined following AACC method 66-50.01 (AACC 2005). 10 g of dry noodles were dispersed in 300 ml boiling water. Optimum cooking time was achieved when the center of noodles become transparent.

Cooked weight

To determine the cooked weight, the following method Olaoye *et al.* (2007) was followed. 10 g of dry noodles were cooked in 300 ml of boiling water. Noodles were cooked till disappearance of the white core. The beaker was covered with aluminum foil. The cooked weight of the noodles was determined by weighing the wet mass after the cooked noodles were drained for 2.5 min.

Cooking loss

Cooking loss was determined according to Chillo *et al.* (2008). 10 g of dry noodles was placed into 300 ml boiling water. Cooking water was collected in an aluminum dish and placed in oven at 105 ˚C to dryness. The residue was weighed and reported as a percentage of starting material.

$$\text{Cooking Loss (\%)} = \frac{\text{Dried residue in cooking water}}{\text{Noodle weight before cooking}} \times \mathbf{100}$$

Swelling index

The swelling index of cooked noodles was determined according to the procedure described by Cleary and Brennan (2006).

$$\text{Swelling Index} = \frac{\text{Weight of cooked noodles} - \text{Weight of noodles after drying}}{\text{Weight of noodles after drying}}$$

Water absorption

The water absorption was determined by AACC (2005).

$$\text{Water absorption (\%)} = \frac{\text{weight of cooked noodles} - \text{Weight of raw noodles}}{\text{Weight of raw noodles}} \times \mathbf{100}$$

Color analysis

Objective evaluation color of noodles samples were measured by Hunter L*, a*, and b* parameters were measured with a color difference meter using a spectrocolorimeter with the CIE lab color scale (Hunter, Lab Scan XE - Reston VA, USA) in the reflection mode (Hunt, 1991).

Sensory evaluation

Noodle samples were boiled using water for the optimum cooking time. Optimally cooked noodles evaluated for color, flavor, taste, texture and overall acceptability of the samples by 10 untrained panelists using nine-point hedonic scales, where 9 =extremely like and 1 =extremely dislike. The optimal ratio of turnip powder in the noodles was investigated by sensory qualities in compared to the control noodles.

Statistical Analysis

Data were recorded as means and analyzed by (SPSS) Windows (Ver.10.1). One way analysis of variance (ANOVA) and Duncan comparisons were tested to signify differences between different treatments (Armitage and Berry, 1987).

RESULTS AND DISCUSSION

1. Chemical Composition

Table 1 shows the turnip leaves powder had the highest values in crude protein (16.44%), fiber (18.23%) and ash content (12.12%) than that of wheat flour (72% extraction) which contained 0.61% of fiber, 0.66% of ash and 11.00% of protein. These results were accordance with those reported by Gad El-Kareem (2006), who noticed that wheat flour 72% extraction has a low content of protein, fat, fiber and ash and a high content of carbohydrates. This might be due to the fact that wheat flour 72% extraction is freed from the outer layers of wheat grains which are rich in protein, fat, fiber and ash.

Table 1. Chemical composition of Wheat flour and turnip leaves powder

Components (%)	Wheat flour 72%	Turnip leaves powder
Moisture	11.91	9.6
Protein	11.00	16.44
Fat	1.61	1.69
Fiber	0.61	18.23
Ash	0.66	12.12
Carbohydrate	74.72	41.92

2. Minerals content

The data in Table (2) indicated that the highest mineral concentration was found in case of turnip leaves powder as compared to wheat flour. Turnip leaves powder had high level of calcium concentration; it was 4052.88 ppm. While calcium concentrate was found 217.37 ppm in wheat flour. Meanwhile phosphorus contents in wheat flour were higher than the turnip leaves powder. The data presented in Table 2 shows the Magnesium, iron, Manganese, Zinc contents of turnip leaves powder recorded relatively higher contents compared with wheat flour. These results were in the same line with Angela *et al* (2010) who mentioned that green leafy vegetables have high amount of minerals like Ca, Fe, Cu, P, Zn, Cl, and Na which are vital for growth and metabolism. These provide alkalizing effect to the acidity produced by other foods. Also, Joshi and Mathur (2010) reported that the cheapest sources of minerals especially iron were founded in green leafy vegetables.

Table 2. Minerals content of wheat flour and turnip leaves powder

Minerals (ppm)	Wheat flour 72%	Turnip leaves powder
Ca	217.37	4052.88
P	1224.03	1030.45
Mg	324.26	2881.01
Fe	30.35	355.92
Mn	42.45	96.81
Zn	35.22	58.44
Na	290.61	488.01
K	1317.57	5839.11

Potassium recorded relatively higher contents in turnip leaves powders (5839.11 ppm) compared wheat flour (1317.57 ppm). Meanwhile sodium content in wheat flour and turnip leave powder was found to be 290.61 and 488.01 ppm, respectively.

3. Antinutritional and phytochemical contents

Data in Table 3 represented that the effect of blanching process on phytic and tannic acid. There was decrease in the phytic acid content (0.47) after blanching of turnip leaves. Meanwhile the tannic acid value was decreased from 540 mg/100g in turnip leaves before blanching to 104.2 mg/100g in blanching turnip leaves. Total phenolic compound (TPC) of none and blanching turnip leave were 1120 and 1052mg/100g respectively. Meanwhile the total flavonoids were decreased from 815 mg/100g to 406 after blanching. Mathiventhan and Sivakaneshan (2013) mentioned that the major antioxidant constituents in herbs, vegetables and fruits are phenolic compounds and there are direct relationships between their antioxidant activity and TPC.

Table 3. Effect of blanching process on some antinutritional and phytochemical contents of turnip leaves

Compounds	Before blanching	After blanching
phytic acid(mg/100g)	2.27	0.47
Tannic acid(mg/100g)	540	104.2
TPC(mg GAE/g of sample)	1120	1052
TFC(mg CE/g of sample)	815	406

Where: (TPC) Total phenolic compound - (TFC) Total flavonoids content

Oxalic acid was found in trace amount in turnip leave powder. Levels tannic acid and phytic acid were reduced by blanching method while oxalic acid levels were not detected. Mosha *et al.* (1995) stated that, blanching considered the best treatment to reduce the antinutritional factors in green vegetables.

4. Chemical composition of noodles

Chemical composition of noodles fortification with turnip leaves powder was shown in Table 4. The content of moisture decreased from 10.2% in control noodles to 9.8% in noodles fortification with 6% turnip leaves powder. This could be due to the low moisture content of turnip leaves powder used in the formula. The moisture content of foods considered an indicator for food quality. Conversely there was increase in protein content from 10.63% in control noodles to 11.87% in noodles fortification with 6% turnip leaves powder. This could be due to fortification effect caused by the high protein content of turnip leaves powder (Table 1). These results were the same line with Khojah *et al.* (2017) who studied the fortification of instant noodles using broccoli and they found increasing in the chemical composition by increasing broccoli powder in instant noodles.

Ash and crud fiber content were significantly increased by the addition of turnip leaves powder with different levels (Table 4). This might be due to higher amount of ash and fiber in turnip leaves powder than wheat flour. Similar increment trend were observed in study conducted on noodles from (*Urtica simensis*) leaves and wheat flour blends (Alemayehu *et al.*, 2016). Thus, the incorporation of turnip leaves powder in the noodles formulas could improve the mineral intake, as ash is indicative of the amount of minerals contained in any food sample (Olaoye *et al.*, 2007). The content of total carbohydrate was ranged between 77.3 in control noodles to 75.69% in Tup_6. The increasing levels addition of turnip leaves powder resulted in decreasing the carbohydrate content of noodle samples.

Table 4. Chemical composition of noodles fortification with turnip leaves powder

Components (%)	Control	Tup_2	Tup_4	Tup_6
Moisture	10.2^{a}	9.9^{b}	9.9^{b}	9.8^{bc}
Protein	10.63^{d}	11.68^{c}	11.77^{b}	11.87^{a}
Fat	1.76^{c}	1.78^{bc}	1.81^{b}	1.86^{a}
Fiber	1.66^{d}	2.02^{c}	2.43^{b}	3.10^{a}
Ash	0.51^{d}	0.77^{c}	0.89^{b}	1.09^{a}
Carbohydrate	77.3^{a}	76.67^{b}	75.7^{c}	75.69^{cd}

In a row, means having the same superscript letters are not significantly different at 5 % level powder
Tup_4 = Noodles fortification with 4%Turnip leaves powder –
Tup_6= Noodles fortification with 6%Turnip leaves powder

5. Noodle quality

The effect of addition turnip leaves powder on the cooking quality of noodles was presented in Table 5. Cooking time refers to gelatinize the starch marked by disappearance of central white core in the noodles strand De pilli *et al.* (2013), the cooking time varied from 8.0 min for control sample to 6.0 min for noodles fortification with 6% turnip leaves powder. This might be due to dilution of gluten in dough. Gluten was a responsible for the development of starch/protein complex; which determined the cooking properties of noodles. The dilution of these components might be reducing the cooking time. Cooked weight, increase was a measure of the amount of water absorption product. As the percentage of turnip leaves powder in blends increased also, the cooked weight significantly decreased. The cooked weight was maximum for control sample (21.20 g) followed by noodles fortification with 2% turnip leaves powder (21.10 g), noodles fortification with 4% turnip leaves powder (19.9 g) and noodles fortification with 6% turnip leaves powder (19.08 g) as shown in Table 5.

Table 5. Cooking quality of noodles fortification with turnip leaves powder at different levels

Parameters	Control	Tup_2	Tup_4	Tup_6
Cooking time (min)	8.0^{a}	7.5^{b}	6.25^{c}	6.0^{c}
Cooking weight (g)	21.20^{a}	21.10^{a}	19.90^{ab}	19.08^{b}
Cooking loss (%)	2.37^{a}	2.89^{ab}	3.45^{b}	4.06^{c}
Swelling index (ml/g)	3.94^{a}	3.87^{a}	3.24^{b}	2.96^{c}
Water absorption (%)	109.01^{a}	101.34^{b}	96.89^{b}	85.52^{c}

In a row, means having the same superscript letters are not significantly different at 5 % level powder
Control = Control 100% wheat flour noodles
Tup_2 = Noodles fortification with 2%Turnip leaves powder
Tup_4 = Noodles fortification with 4%Turnip leaves powder
Tup_6= Noodles fortification with 6%Turnip leaves powder

Data from the same Table showed that the cooking loss of noodles containing turnip leaves powder was significantly increased. This may be due to weakening of the protein network by the percentage of turnip leaves powder and this may allow more solids to be leached out from the noodles into the cooking water. The results were the same line with Kamble *et al.* (2018) who reported that cooking loss of noodles was influenced by incorporation of drumstick leaf. As the addition of drumstick leaf powder increased the cooking loss compared to control. In this study, the noodles incorporated with turnip leaves powder can be regarded as high quality noodles.

Concerning swelling index the noodles samples with turnip leaves powder had slightly lower values compared to control noodles. The results can be interpreted in terms of competition between fiber and starch for water absorption means that starch components might have absorbed less water at optimum cooking time giving rise to lower swelling indices. Therefore increasing fiber contents generally results in lower swelling of starch and swelling index. Padalino *et al.* (2017) mentioned that spaghetti incorporated with tomato peel flour lead to decreasing the swelling index.

6. Color parameters

Color parameters of noodles fortification with turnip leaves powder at different levels are shown in Table 6 and Fig 1. The results showed that noodles fortification with turnip leaves powder get darker than the control sample. The darkness of the noodles fortification with turnip leaves powder was a product of the Maillard reaction between reducing sugars and proteins. The results in the same line with Khojah *et al.* (2017) who studied the color characteristics of noodles fortification with broccoli powder and found that, the amount broccoli powder increased the appearance of the noodles fortification with broccoli powder grew darker.

Table 6. Color parameters of noodles fortification with turnip leaves powder at different levels

Samples	*L**	*a **	*b**
Control	65.21^a	5.46^a	23.05^a
Tup_2	49.41^b	2.70^b	16.39^b
Tup_4	47.54^c	2.42^c	15.15^c
Tup_6	47.37^c	2.41^c	15.03^d

In a column, means having the same superscript letters are not significantly different at 5 % level powder

L* (lightness) Value Whiteness 100 White / 0 Black - a* Value Positive Values (+) Red Color / Negative Values (–) Green Color - b* Value Positive Values (+) Yellow Color / Negative Values (–) Blue Color –

Control = Control 100% wheat flour noodles

Tup_2 = Noodles fortification with 2%Turnip leaves powder

Tup_4 = Noodles fortification with 4%Turnip leaves powder

Tup_6= Noodles fortification with 6%Turnip leaves powder

The addition of the turnip leaves powder at different levels increased green color to the noodles. The color of fortification noodles were significant changed compared with the control sample. There was a significant decrease ($p \leq 0.05$) in brightness, redness and yellowness parameters in supplemented with 2, 4 and 6% turnip leaves powders compared the control sample.

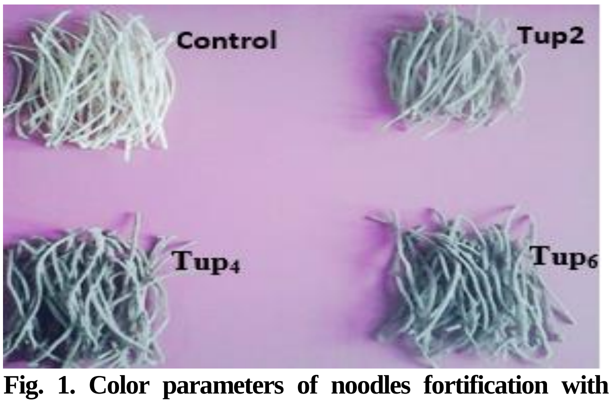

Fig. 1. Color parameters of noodles fortification with turnip leaves powder at different levels

7. Sensory evaluation

Sensory evaluation of noodles prepared by using turnip leaves powder was given in Table 7. The addition of turnip leave powder up to 6 % was acceptability of noodles and further increasing the levels affected the texture, color and overall acceptability.

Form the same table, statistically significant difference were observed in all parameters of sensory evaluation of noodles prepared from turnip leaves powder and control. The control sample had maximum mean sensory scores for all the sensory attributes compare to other fortification samples with 2, 4 and 6% turnip leaves powder. These results were agreement with Ramu *et al.* (2018) who mentioned that the instant noodles supplemented with spinach had a lower of sensory scores compared the control sample.

Table 7. Sensory evaluation of noodles fortification with turnip leaves powders at different levels

Parameters	Control	Tup_2	Tup_4	Tup_6
Color	8.8^a	8.1^b	7.8^c	7.1^d
Flavor	9.0^a	8.1^b	7.3^c	6.4^d
Taste	8.7^a	7.9^b	7.0^c	6.4^d
Texture	8.6^a	8.2^b	7.5^c	6.7^d
Overall acceptability	9.0^a	8.2^b	7.3^c	6.9^d

In a row, means having the same superscript letters are not significantly different at 5 % level. Control = Control 100% wheat flour noodles - Tup_2 = Noodles fortification with 2%Turnip leaves powder - Tup_4 = Noodles fortification with 4%Turnip leaves powder - Tup_6= Noodles fortification with 6%Turnip leaves powder

Sensory rating of noodles for color showed that the highest score of color was found in control samples (8.8) followed by the treatment Tup_2 (8.1) and Tup_4 (7.8) meanwhile the lowest score was found inTup_6 (7.1). The noodles color was turned from light green to dark green, leading to lower acceptance. The mean sensory score regarding overall acceptability of noodles were showed in Table 7 revealed that the mean sensory score for overall acceptability in control (9.0) was maximum while the noodles fortification with 6% turnip leaves powder (6.9) had lowest acceptability. The decrease in overall acceptability was due to decrease in sensory quality characteristics such as color, flavor, taste and texture scores of instant noodles. These results were agreement with Ramu *et al.* (2016) who found that, sensory scores revealed that noodles were accepted at different levels spinach paste incorporation.

CONCLUSION

Fortification of noodles using turnip leaves powder at 2%, 4% and 6% were studied. The protein, fiber and ash contents were increased compared to control sample. Control sample and noodles fortification with 2% turnip leaves powder were highly acceptable in terms of sensory evaluation. Cooking time was reduced with the increase of turnip leaves powder levels. Thus, the incorporation of turnip leaves powder in the noodles formulas could be improve the nutritional quality of noodles.

REFERENCES

A.A.C.C. (2005). Approved methods of the American Association of cereal chemists. St paul Minnesota.

A.O.A.C. (2000): Official Methods of Analysis. 17th ed. of the association of official analytical chemists. Gaithersburg M D.USA.

A.O.A.C. 1984. Official Methods of Analysis, 14th Ed. Sidney Williams. Association of Official Chemists, Inc. Virginia, USA.

Alemayehu, D.; Desse, G.; Abegaz, K.; Berhanu, B.; Desalegn, B.B. and Getahun. D. (2016). Proximate, mineral composition and sensory acceptability of homemade noodles from stinging nettle (*Urtica simensis*) leaves and wheat flour blends. International Journal of Food Science and Nutrition Engineering, 6(3): 55-61.

Angela, C.; Rodica, C.; Andrea, M.Z.; Elena, T. and Camelia, G. (2010). Chemical Composition of Common Leafy Vegetables. University studies, Series of Life Sciences, 20(2): 45-48.

Armitage, P. and Berry, G. (1987). Statistical method in Medical Research- Blackwell, Oxford, UK, 93-213.

Chillo, S.; Laverse, J.; Falcon, P.M.; Protopapa, A. and Del nobile, M.A. (2008). Influence of the addition of buckwheat flour and durum wheat bran on spaghetti quality. Journal of Cereal Science, 47:144-152.

Chun, O.K.; Kim, D.O. and Lee, C.Y. (2003). Superoxide radical scavenging activity of the major polyphenols in fresh plums. Journal of Agriculture and Food Chemistry, 51, 8067-8072

Cleary, L. and Brennan, C. (2006). The influence of a (1→3) (1→4)-β-glucan rich fraction from barley on the physicochemical properties and *in vitro* reducing sugars release of durum wheat pasta. International Journal of Food Science and Technology, 41: 910–918

Collado, L.S. and Corke, H. (1996). Use of wheat-sweet potato composite in yellow alkaline and white salted noodles. Cereal chemistry, 73(4):439-444.

Deep, N.Y.; Sharma, M.; Chilkara, N.; Anand,T. and Bansal, S. (2014). Quality characteristics of vegetable blended wheat-pearl millet composite pasta. Agricultural Research, 3:263-270.

De Pilli, T.; Derossi, A. and Severini, C. (2013). Cooking quality characteristics of spaghetti based on soft wheat flour enriched with oat flour. International Journal of Food Science and Technology, 48(11):2348-2355.

Gad-El-Kareem M.A. (2006). Physiochemical and technological studies on bread containing mung bean flour. Ms. Thesis, Faculty of Agric. Minia University.

Hunt, R.W.G. (1991). Measuring color, 2nd ed., Ellis Horwood, New York, 75-76.

Javed, A.; Ahmad, A.; Nouman, M.; Hameed, A.; Tahir, A. and Shabbir, U. (2019). Turnip (*Brassica Rapus* L.): a natural health tonic. Brazilian Journal of Food Technology, 22, 1-9.

Joshi, P. and Mathur, B. (2010). Bioavailability of iron from the leaf powders of dehydrated less utilized green leafy vegetables. ASIAN J. EXP. BIOL. SCI, 1(4):845-854.

Kahkonen,M.P.; Hopia, A.I.; Vuorela, H.J.; Rauha, J.P.; Pihlaja, K.; Kujala, T.S. and Heinonen, M. (1999). Antioxidant activity of plant extracts containing phenolic compounds. J. Agric. Food Chem, 47: 3954.

Kamble, V.; Bhuvaneshwari, G.; Jagadeesh, S.L.; Ganiger Vasant, M. and Terdal, T. (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(2): 3642-3651.

Khojah Ebtihal, Y.; Hafez Dalia, A. and Ali Wafaa, Sh. (2017). Fortification of instant noodles using *Brassica oleracea* to high nutrition value and lowering diabetics in rats. Australian Journal of Basic and Applied Sciences, 11(5): 210-218.

Mathiventhan, U. and Sivakaneshan, R. (2013). Total phenolic content and total antioxidant activity of sixteen commonly consumed green leafy vegetables stored under different conditions. European International Journal of Science and Technology, 2(8): 123-132.

Mosha, T.C.; Gaga, H.E.; Pace, R.D.; Laswai, H.S. and Mtebe, K. (1995). Effect of blanching on the content of antinutritional factors in selected vegetables. Plant Foods for Human Nutrition, 47: 361-367.

Olaoye, O.A.; Onilude, A.A. and Oladoye, C.O. (2007). Breadfruit flour in biscuit making: effects on product quality. African Journal of Food Science, 20-23.

Padalino, L.; Conte, A.; Lecce, L.; Likyova, D.; Sicari, V. and Pellicanò, T.M. (2017). Durum wheat whole meal spaghetti with tomato peel: How by-products particle size can affect fine quality of pasta. J Food Technol, 6(10):500-505.

Pallavi, J. and Beena, Mathur. (2010). Preparation of value added products from the leaf powders of dehydrated less utilized green leafy vegetables. Journal of Horticulture and Forestry, 2(9):223-228.

Ramu, L.; Basha, S.J. and Bhasker, V. (2018). Physio-chemical analysis of spinach paste fortified instant noodles. International Journal of Chemical Studies, 6(5): 2373-2381.

Ramu, L.; Jyotikiran; Maloo, S. and Ramugolla (2016). Physical, chemical and sensory properties of spinach paste fortified instant noodles. (IJITR) International Journal of Innovative Technlogy and Reserch, 4(6): 5318-5322.

Rekha, M.N.; Chauhan, A.S.; Prabhashankar, P.; Ramteke, R.S. and Venkateswara Rao, G. (2013). Influence of vegetable paste on quality attributes of pastas made from bread wheat (T. Aestivum) Cyta. Journal of Food 11:142-149.

Schonhof, I.; Krumbein, A. and Bruckner, B. (2007). Genotypic effects on glucosinolates and sensory properties of broccoli and cauliflower. Nahrung, 48: 25–33.

Van-Burden, T.P. and Robinson, W.C. (1981). Formation of complexes between protein and Tannic acid. Journal of Agricultural Food Chemistry, 1:77.

World Instant Noodles Association, (2016). http//instant noodles. /noodles/report, tm.

Zeinstra, G.G.; Koelen, M.A.; Kok, F.J. andde Graaf, C. (2010). The influence of preparation method on children likes for vegetables. Food Quality and Preference, 21(8):906-914.

Zhishen, J.; Mengcheng, T. and Jianming, W. (1999). The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals. Food Chemistry, 64:555–9.

خصائص الشعرية المحسنة بمسحوق اوراق اللفت

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تم دراسة التركيب الكيميائي وخصائص جودة الطبخ واللون والتقييم الحسي للشعرية المدعمة بمسحوق اوراق اللفت. و قد تم تطوير الشعرية باستخدام مسحوق أوراق اللفت بنسب مختلفة Tup_2 (الشعرية المحسنة بمسحوق اوراق اللفت بنسبة 2٪)، Tup_4 (الشعرية المحسنة بمسحوق اوراق اللفت بنسبة 4٪) وTup_6 (الشعرية المحسنة بمسحوق اوراق اللفت بنسبة 6٪). ولوحظ ارتفاع نسبة البروتين والألياف والرماد والكالسيوم والمغنسيوم والحديد والمنجنيز والصوديوم والبوتاسيوم في مسحوق أوراق اللفت. كما أنه غني بمضادات الأكسدة. وتشير نتائج خصائص الجودة الكيميائية والغذائية للشعرية أن هناك فروق معنوية لوحظت بين العينة الكنترول والشعرية المضاف إليها مسحوق أوراق اللفت حيث كان البروتين والألياف والرماد أعلى في الشعرية المدعمة بمسحوق أوراق اللفت مقارنة بالعينة الكنترول. وعند تقدير خصائص جودة الشعرية ادت زيادة مسحوق أوراق اللفت من 2 إلى 6٪ الي ارتفاع فقد الطهي وتقليل مدة الطهي ووزن الطهي و القدرة علي امتصاص الماء واللمعان. وكان هناك انخفاض بسيط في التقييم الحسي من حيث اللون والنكهة والطعم والقوام والقبول العام بزيادة نسب اضافة مسحوق أوراق اللفت الي 6 ٪. وتشير نتائج التقييم الحسي الي أن الشعرية المدعمة بنسبة 2 ٪ مسحوق اوراق اللفت كانت أفضل عينة في القبول العام وكانت قريبه من العينة الكنترول وتدعم نتائج هذه الدراسة بقوة أن أوراق اللفت يمكن دمجها بنجاح في الشعرية حيث أنها تعزز الجودة التغذوية للشعرية.