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. Tup0 (Noodles fortification with 0% turnip leaves powder), Tup2 (Noodles fortification with 2% turnip leaves powder) and Tup6 (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.
samples in HNO₃: HClO₃ (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 Zee man Japan Z-8000. Atomic Absorption Spectrophotometer equipped with standard hollow 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 FeCl₃ 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 (Kalkonen 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 Olajaye 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.

**Swelling index**

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

**RESULTS AND DISCUSSION**

1. **Chemical Composition**

Table 1 shows the turnip leaves powder had the highest values in crude protein (16.44%), (18.23%) and ash content (12.12%) 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>
<thead>
<tr>
<th>Components (%)</th>
<th>Wheat flour 72%</th>
<th>Turnip leaves powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>11.91</td>
<td>9.6</td>
</tr>
<tr>
<td>Protein</td>
<td>11.00</td>
<td>16.44</td>
</tr>
<tr>
<td>Fat</td>
<td>1.61</td>
<td>1.69</td>
</tr>
<tr>
<td>Fiber</td>
<td>0.61</td>
<td>18.23</td>
</tr>
<tr>
<td>Ash</td>
<td>0.66</td>
<td>12.12</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>74.72</td>
<td>41.92</td>
</tr>
</tbody>
</table>

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 very much amount of minerals like Ca, Fe, Cu, P, Zn, Fe, and Na which are vital for growth and metabolism. These provide alkalinizing effect to the acidity produced by other foods. Also, Joshi and Mathur (2010) reported that the cheapest sources of minerals especially iron were found in green leafy vegetables.
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 leaves 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 leaf were 1120 and 1052mg/100g respectively. Meanwhile the total flavonoids were decreased from 815 mg/100g to 406 after blanching. Mathiventhan and Sivakanesan (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

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Before blanching</th>
<th>After blanching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phytic acid (mg/100g)</td>
<td>2.27</td>
<td>0.47</td>
</tr>
<tr>
<td>Tannic acid (mg/100g)</td>
<td>540</td>
<td>104.2</td>
</tr>
<tr>
<td>TPC (mg GAE/g of sample)</td>
<td>1120</td>
<td>1052</td>
</tr>
<tr>
<td>TPC (mg CE/g of sample)</td>
<td>815</td>
<td>406</td>
</tr>
</tbody>
</table>

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 crude 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 (Olaiye et al., 2007). The content of total carbohydrate was ranged between 77.3 in control noodles to 75.69% in T

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

<table>
<thead>
<tr>
<th>Components (%)</th>
<th>Control</th>
<th>Tp2</th>
<th>Tp4</th>
<th>Tp6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>10.2a</td>
<td>9.9b</td>
<td>9.9b</td>
<td>9.9c</td>
</tr>
<tr>
<td>Protein</td>
<td>10.63a</td>
<td>11.68b</td>
<td>11.77b</td>
<td>11.87c</td>
</tr>
<tr>
<td>Fat</td>
<td>1.76a</td>
<td>1.78b</td>
<td>1.81b</td>
<td>1.86b</td>
</tr>
<tr>
<td>Fiber</td>
<td>1.69a</td>
<td>2.02</td>
<td>2.43</td>
<td>3.10</td>
</tr>
<tr>
<td>Ash</td>
<td>0.51a</td>
<td>0.77a</td>
<td>0.89a</td>
<td>1.09a</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>77.3a</td>
<td>76.6b</td>
<td>75.7b</td>
<td>75.69d</td>
</tr>
</tbody>
</table>

In a row, means having the same superscript letters are not significantly different at 5 % level 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.
Combining 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. Pudalino 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

<table>
<thead>
<tr>
<th>Samples</th>
<th>L*</th>
<th>a*</th>
<th>b*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>65.21a</td>
<td>5.46a</td>
<td>23.05a</td>
</tr>
<tr>
<td>Tup 2</td>
<td>49.41b</td>
<td>2.70b</td>
<td>16.39b</td>
</tr>
<tr>
<td>Tup 4</td>
<td>47.54c</td>
<td>2.42c</td>
<td>15.15c</td>
</tr>
<tr>
<td>Tup 6</td>
<td>47.37c</td>
<td>2.41c</td>
<td>15.03d</td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>Tup 2</th>
<th>Tup 4</th>
<th>Tup 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>8.8b</td>
<td>8.1b</td>
<td>7.8b</td>
<td>7.1b</td>
</tr>
<tr>
<td>Flavor</td>
<td>9.0c</td>
<td>8.1c</td>
<td>7.3c</td>
<td>6.4d</td>
</tr>
<tr>
<td>Taste</td>
<td>8.7d</td>
<td>7.9d</td>
<td>7.0d</td>
<td>6.4d</td>
</tr>
<tr>
<td>Texture</td>
<td>8.6a</td>
<td>8.2a</td>
<td>7.5a</td>
<td>6.7d</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>9.0b</td>
<td>8.2b</td>
<td>7.3b</td>
<td>6.9d</td>
</tr>
</tbody>
</table>

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 in Tup 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 improve the nutritional quality of noodles.

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**J. of Food and Dairy Sci., Mansoura Univ., Vol. 11 (7) 2020**


