Effect of Different Drying Methods on Nutritional and Physical Parameters of Waterleaf (*Talinum triangulare*)

Sushmita Khatoniari, Mridula Saikia Barooah2 & Mamoni Das3

1Department of Food Science & Nutrition, College of Home Science, Assam Agricultural University, Jorhat, Assam, 785013
2, 3Department of Food Science & Nutrition, College of Home Science, Assam Agricultural University, Jorhat, Assam, 785013.

**Abstract:** The present study intends to investigate nutritional and physical characteristics of fresh and dehydrated Waterleaf by using four different drying methods, i.e. sun drying, shade drying, cabinet dryer drying and microwave oven drying. Three types of packaging material such as plastic bottle (TARSON), HDPE pouch (200 gauge) and PP pouch (100 gauge) were used to study their shelf life for a period of 6 months. The moisture content of the fresh leaves was 92.16 g/100g. Microwave and cabinet drying resulted in highest moisture reduction. Fresh Waterleaf contains 1.72 g/100g ash and 1.17 g/100g crude fibre. The calcium, iron, phosphorus and potassium content of fresh Waterleaf are – 227.26 mg, 4.34 mg, 112.35 mg and 121.34 mg per 100g respectively which increased on dehydration. Rehydration ratio was found highest in microwave dried leaves. HDPE pouch showed lowest moisture increment and highest retention of rehydration ratio during storage.

1. Introduction

Waterleaf (*Talinum triangulare*) is a wild, herbaceous, perennial and underutilized tropical leafy vegetable. It was originated from tropical Africa now is widely cultivated as a medicinal and food crop in West Africa, Asia, and South America. It is an excellent source of minerals, vitamins, especially vitamin C. The presence of minerals including calcium, magnesium and potassium, omega-3-fatty acid and vitamin C, E and beta carotene have been identified to be responsible for the antioxidant activity of the leaf [1].

In spite of an inexpensive source of vital nutrients, consumption of this green leafy vegetable was found to be less due to its mucilaginous nature. Dehydration can be a way to increase shelf-life of this green leafy vegetable and thereby increasing the rate of consumption. Hence, the present study is aimed to investigate nutritional and physical characteristics in fresh leaves and dehydrated leaves in different drying methods.

2. Materials and methods

2.1. Collection of sample:

The samples were collected from local market of Jorhat District and were placed in sterile poly-bag to prevent loss of moisture during transportation to the laboratory.

2.2. Preparation and analysis of sample

The collected samples were washed properly in running tap water and finally distilled water. They were drained completely and surface moisture was dried using filter paper. The samples were then dried using four different drying methods namely sun drying, shade drying, cabinet drying and microwave oven drying. Cabinet drying was done at 60° C using MEVISH cabinet dryer while microwave drying was done at 450w and 100% power using Samsung ce13501 model. For the drying curve, the weights of the samples were taken after definite interval. The dried samples were packed in 200 gauge high density polyethylene (HDPE) and 100 gauge polypropylene bags and stored at ambient conditions (21.0-36.5 °C and 76-90% RH) for 6 months. Samples were analyzed at 3 month intervals.

Moisture content of samples was obtained by drying at 105° C in an oven using method of AOAC (2000) [2]. Ash, crude fibre, calcium and potassium were estimated by methods of AOAC (2000). Iron and phosphorus content were estimated by methods described by Ranganna (1986) [3]. One gram of sample was soaked overnight in ethanol (20 ml) and non-enzymatic browning was expressed in terms of optical density values at 420 nm. The rehydration ratio of dehydrated GLVs was estimated as per methods of Patil et al., 1978 [4].
3. Results and Discussion

3.1. Effect of different drying methods on nutritional parameters

The moisture content of the fresh leaves was 92.16 g/100g. On dehydration, the moisture content was reduced up to 80-90%. Microwave and cabinet drying resulted in highest moisture reduction while during shade drying; moisture retention was found maximum which may be due to high humidity content in air of the region. The ash and crude fibre content of fresh Waterleaf are 1.72 g/100g and 1.17 g/100g respectively in fresh leaves. After dehydration, the ash and crude fibre content was found decrease increased in microwave drying and cabinet drying and lowest value was observed in sun drying. The mineral contents of fresh Waterleaf are – 227.26 mg/100g calcium, 4.34 mg/100g iron, 112.35 mg/100g and 121.34 mg/100g potassium. After dehydration, the mineral content was increased and maximum increment was observed in cabinet and microwave drying while sun drying showed minimum increment. Ascorbic acid content of Waterleaf decreased significantly on dehydration, where maximum decrease was observed in sun dried leaves.

Table 1. Effect of different drying methods on nutritional parameters (per 100g)

<table>
<thead>
<tr>
<th>Nutrient composition</th>
<th>Fresh</th>
<th>Sun drying</th>
<th>Shade drying</th>
<th>Cabinet drying</th>
<th>Microwave drying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (g)</td>
<td>92.16</td>
<td>5.16</td>
<td>6.55</td>
<td>4.74</td>
<td>4.55</td>
</tr>
<tr>
<td>Ash (mg)</td>
<td>1.60</td>
<td>8.82</td>
<td>9.37</td>
<td>10.22</td>
<td>9.96</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>4.34</td>
<td>25.36</td>
<td>25.48</td>
<td>28.20</td>
<td>27.95</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>227.26</td>
<td>1123.70</td>
<td>1176.54</td>
<td>1206.67</td>
<td>1186.92</td>
</tr>
<tr>
<td>Phosphorous (mg)</td>
<td>112.35</td>
<td>487.80</td>
<td>496.30</td>
<td>546.56</td>
<td>534.20</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>121.34</td>
<td>403.87</td>
<td>421.40</td>
<td>478.67</td>
<td>463.42</td>
</tr>
<tr>
<td>Ascorbic acid (mg)</td>
<td>44.37</td>
<td>8.74</td>
<td>11.34</td>
<td>12.48</td>
<td>13.96</td>
</tr>
</tbody>
</table>

3.2. Effect of different drying methods on physical parameters

Among the four drying methods, the time taken for drying was found maximum in shade drying while microwave drying took minimum time. The yield obtained after dehydration of 100g fresh leaves was maximum in shade drying and lowest yield was obtained during sun drying. Highest rehydration ratio was observed in microwave dried leaves, while sun dried leaves showed minimum rehydration. Similar results were reported by Rajeswari (2010) where microwave drying took minimum time as compared to cabinet drying [5]. The yield obtained by shade drying was highest whereas least per cent yield was observed by drying under sun among all the drying methods. In a study by Sakhale and Pawar (2007) it was found that the yield of dried curry leaves was maximum (44.40%) in shade drying with intermediate values in the sun and tray drying methods which is similar to the present study [6]. Variations in the yield were basically due to higher moisture content of shade dried leaves as compared to sun and tray dried leaves. Rehydration ratio indicates the capacity of dehydrated leafy vegetables to absorb the moisture. Lowest rehydration ratio was observed in shade dried leaves followed by sun drying. Karva et al. (2010) also reported that Amaranthus paniculatus leaves dried under sun exhibited lowest rehydration ratio of 4.10 followed by hot air oven (4.98). Rehydration ratio of microwave dried green amaranthus was found highest (5.29) [7].

<table>
<thead>
<tr>
<th>Physical parameters</th>
<th>Sun drying</th>
<th>Shade drying</th>
<th>Cabinet drying</th>
<th>Microwave drying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time required</td>
<td>4.03 hr</td>
<td>138.13 hr</td>
<td>3.25 hr</td>
<td>3.12 min</td>
</tr>
<tr>
<td>Yield (per 100g)</td>
<td>10.10 g</td>
<td>11.05 g</td>
<td>10.27 g</td>
<td>10.35 g</td>
</tr>
<tr>
<td>Rehydration ratio</td>
<td>3.75</td>
<td>3.62</td>
<td>4.56</td>
<td>4.72</td>
</tr>
</tbody>
</table>

3.3. Storage study of the dehydrated sample

The storage study of dehydrated T. triangulare leaves was done for cabinet dried samples. Though microwave dried samples showed similar retention of quality characteristics during drying, cabinet drying is more convenient as it allows bulk drying and cost effective. Sun dried and shade dried samples showed less retention in quality characteristics than the other two methods.

3.3.1. Moisture content during the storage period

After the storage period of 6 months (180 days) it was found that there was gradual increase in moisture content during the storage period. In the present study, the samples packed in HDPE pouch package showed less increment in moisture content than the two other packaging materials. The increase in moisture content across storage is showed in the Fig. 1. Similar study by Seevaratnam et al. (2012) reported that the moisture content of Alternanthera sessilis and Amaranthus polygonoides dried green leafy vegetable samples packed in different packaging materials increased gradually with
increase in storage period. The rate of increase in moisture was low in samples packed in HDPE followed by plastic bottle and PP pouches. This might be due to high porosity of PP pouches than HDPE pouches [8].

HDPE pouch packed samples (1.51 g/ml) and highest in PP pouch packed samples (1.72 g/ml). The increases of non-enzymatic browning values over storage period of 180 days were depicted in the Fig. 3.

3.3.2. Rehydration ratio during the storage period

The rehydration ratio of dehydrated green leafy vegetables decreased on storage and was also observed variation in different packaging materials. Highest rehydration ratio was observed in HDPE packaged dehydrated greens and lowest in PP pouch packaged greens. As more moisture permeates through PP pouches than HDPE pouches, this leads to decrease in rehydration ratio of the dehydrated greens. Singh and Sagar (2010) reported similar observation while studying rehydration ratio of dehydrated curry leaves and drumstick leaves during storage in different packaging materials. The rehydration ratio was more in leaves packaged in HDPE films as compared to PP which might be due to less absorption of moisture by HDPE films [9].

3.3.3. Non-enzymatic browning during the storage period

Packaging materials had a significant effect on browning of samples during storage in both cabinet and microwave drying methods. There was a steady increase in Non enzymatic browning (NEB) values which was more in samples packed in PP pouches. At the end of 6 months, the NEB value was lowest in PP pouch packed samples (1.51 g/ml) and highest in PP pouch packed samples (1.72 g/ml). The increases of non-enzymatic browning values over storage period of 180 days were depicted in the Fig. 3.

4. Conclusion

The present study revealed that among all the type of drying methods microwave drying requires minimum time and energy and is also good for domestic purpose, but it does not allow bulk drying so it is not feasible for drying in a large scale or for commercial purpose. Moreover, the other drying characteristics of cabinet dryer are found quite similar to that of microwave dried greens. Cabinet drying also permits large scale drying of green leafy vegetables. Dehydration also increases shelf-life of the greens. Hence, cabinet drying can be used for commercial purpose. Among the packaging materials, HDPE packaging was found better as it retained more quality parameters than other two packaging materials.

Thus from the above study it can be concluded that Waterleaf is rich in mineral content and its shelf-life can be increased by using cabinet and microwave drying technique up to 6 months. These dehydrated leaves can be rehydrated easily and thus can be incorporated into various preparations and also help to reduce micronutrient deficiency.

5. Acknowledgements

I am highly thankful to Dr. N.N. Sharma, Professor and Head, department of Agronomy for providing laboratory facilities and support during the research.

6. References


