Effect of Boiling, Simmering and Blanching on the Antinutritional Content of Moringa oleifera Leaves

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Article history: Received 7 August 2012, Received in revised form 23 August 2012, Accepted 24 August 2012, Published 26 August 2012.

Abstract: The effect of some food processing methods; boiling, simmering and blanching on some antinutritional contents of Moringa oleifera leaves was investigated. The results showed that boiling significantly (P < 0.05) reduced the cyanide content by 88.1% when compared with simmering 80.95% and blanching 61.9%. Similarly boiling significantly (P < 0.05) reduced the amount of oxalate, phytate and trypsin inhibitor by 85.3%, 85.44% and 78.8% respectively when compared with simmering which had 66.3%, 57.3% and 63.6% for oxalate, phytate and trypsin inhibitor respectively. However, blanching reduced the level of oxalate, phytate and trypsin inhibitor by 20.7%, 39.8% and 60.6% respectively. Thus among the three methods of processing investigated, boiling was found to decreased the levels of antinutritional factors significantly (P < 0.05) than both simmering and blanching. Therefore the result obtained shows that processing of Moringa oleifera leaves reduced the amount of these antinutrient with boiling being the most effective method.

Keywords: Moringa oleifera; antinutrients; processing; boiling; simmering; blanching.

1. Introduction

Moringa oleifera commonly referred to simply ‘Moringa’ belong to the family of Moringaceae (Makkar and Becker, 1998). Olugbemi et al., (2010) reported that Moringa is a good source of vitamins and amino acids in addition to essential nutrients and minerals. Plant oil from seeds and leaves of Moringa oleifera are in high demand for their medicinal value. Moringa oleifera was also reported to boost immune systems (Jayavardhanan et al., 1994; Fuglier, 1999; Olugbemi et al., 2010).
The leaves and green fresh pods are used as vegetables, and rich in carotene and ascorbic acid (vitamin C) with a good profile of amino acids (Makkar and Becker, 1996). Similarly the presence of flavonoids at all stages of maturity of *Moringa oleifera* may be responsible for the medicinal qualities accorded the leaves. They also induce mechanisms that may kill cancer cells and inhibit tumour invasion (Williams *et al*., 2004). Also Saponins have been shown to possess both beneficial (cholesterol lowering) and deleterious (cytotoxic; permeabilization of the intestine) properties (Price *et al*., 1987, Oakenful and Sidhu, 1989). The diet of many rural and urban dwellers is deficient in protein and high in carbohydrate. The implication is high incidence of malnutrition and increase in dietary disease; a situation in which children and especially pregnant and lactating women are most vulnerable. Moringa could be an extremely valuable food source because of its high nutrient profile (Fuglie and Lowell, 2001), and used in fortifying sauces, juices, spices, milk, bread and most importantly instant noodles. *Moringa oleifera* is considered one of the world’s most useful trees, as almost every part of the tree can be used for food or has some other beneficial property. The leaves, especially young shoots, are eaten as greens, in salads, in vegetable curries, and as pickles. The leaves can be eaten fresh, cooked, or stored as dried powder for many months without refrigeration, and reportedly without loss of nutritional value. The leaves are considered to offer great potential for those who are nutritionally at risk and may be regarded as a protein and calcium supplement (Rajangam *et al*., 2001). Moringa will be one of the alternatives to most, imported food supplies to treat malnutrition (Khawaja *et al*., 2010). It is a general belief that the stage of maturity of plant affects the concentration of nutrients of leaves, thus it is very important to choose a suitable stage of harvesting (Yu *et al*., 2004). It is available all year round, almost all parts are used as food and forage for livestock (Ram, 1994). The part (leaves, fruits, flowers and immature pods) are edible and form part of traditional diet in many countries of the tropics and subtropics (Odee, 1998). Majority of the food from plant source that we consume contain some amount of antinutrient in them and without processing the food properly, high content of these antinutrient will reduced the bioavailability and maximum utilization of the main nutrients that are of benefit in the food. Thus food processing is the set of treatments of food substances in such a manner to change its properties with a view to preserving it, improving its quality or making it functionally more useful. Different food processing methods have been employed in processing *Moringa oleifera* leaves but, yet the one that will reduce the level of its antinutrients more and at the same time enrich its nutritional value is not known. Therefore the present study was aimed to evaluate the effect of boiling, simmering and blanching (processing) on the antinutrient contents of *Moringa oleifera* leaves.

2. Materials and Methods

2.1. Chemicals
All chemicals used in the present study were of analytical grade and purchased from Sigma Chemicals Co. St. Louis, England.

2.2 Collection of Plant Materials

The leaves of *Moringa oleifera* were collected in polythene bags from Samaru area, Zaria Kaduna State, and identified at herbarium unit, Department of Biological Sciences, Ahmadu Bello University, Zaria, Nigeria, where a voucher specimen was deposited.

2.3. Preparation of Plant Materials

Freshly collected leave of *Moringa oleifera* were cleaned and dried under the shade at normal room temperature. After drying, the plant material was ground using pestle and mortar into smaller particles and then blended to powder using an electric blender. Ten grams of the powdered sample was then stored in airtight containers and kept under normal room temperature until required.

2.4. Extraction of Sample

Ten grams of ground sample was weighed and dispersed into 200 mL of 0.5 M NaCl solution. The mixture was stirred and agitated for 60 min at room temperature. The mixture was filtered through Whatman No.1 filter paper. The filtrate was kept until required.

2.5. Sample Processing

After sample extraction, the filtrate was divided into four portions. The first portion was left unprocessed and served as control, the second portion was processed by boiling in water at 100 °C for 15 min, the third portion was processed by simmering which involve placing the sample in hot water but below the boiling point (80 - 85 °C) for 15 min, and the fourth was processed by blanching which involved the treatment of sample with boiled water for 15 min, removed immediately and placed onto iced water, and used for the determination of antinutritional factors.

2.6. Determination of Antinutrients

The cyanide content was determined by the method of AOAC (1980). Phytic acid was determined according to the method of Major *et al.* (1990). Oxalate was determined according to the method described by Oke (1969), while the concentration of trypsin inhibitor was determined by the method of Kakade *et al.* (1979).

3. Results and Discussion
The effects of boiling, simmering and blanching (processing) on the level of (antinutrient contents) cyanide, oxalate, phytate and trypsin inhibitor in the leaves of *Moringa oleifera* are presented in Table 1. The result showed that boiling, simmering and blanching caused significant reduction in the level of cyanide by 88.10%, 80.95% and 61.90% respectively (Table 2). Therefore boiling appeared to have caused significant reduction (P < 0.05) compared with simmering and blanching. Similarly the effect of processing on the level of oxalate content revealed significant (P < 0.05) decreased by 85.32%, 66.30% and 20.65% for boiling, simmering and blanching respectively. Also boiling, simmering and blanching caused significant (P < 0.05) decrease in the level of phytate compared with control by 85.44%, 57.28% and 39.80% respectively. Trypsin-inhibitor was also significantly decreased (P < 0.05) by 78.79%, 63.64% and 60.61% for boiling, simmering and blanching respectively. Therefore based on the result obtained it was found that processing of leaves of *Moringa oleifera* caused significant (P < 0.05) decrease in the levels of cyanide, oxalate, phytate and trypsin-inhibitor. Furthermore, amongst the different processing methods investigated boiling appeared to be the most effective in reducing the levels of antinutrient compared to simmering and blanching. Simmering and blanching did not cause significant (P > 0.05) decreased in the antinutrients assessed compare to the unprocessed. The result obtained is in agreement with that of Nwaogu and Udebuani (2010), which implies that as the temperature is increased during boiling, oxalate, phytic acids and trypsing-inhibitor are denatured or inactivated by heat and tannin-protein complex is broken which increases the digestibility and palatability of the leave which appears to be in agreement with the result of Akinyele (1989).

### Table 1. Results for antinutrient contents of processed and unprocessed leaves of *Moringa oleifera*

<table>
<thead>
<tr>
<th>Samples</th>
<th>Cyanide (mg/100 g)</th>
<th>Oxalate (mg/100 g)</th>
<th>Phytate (mg/100 g)</th>
<th>Trypsin-inhibitor (mg/100 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unprocessed</td>
<td>0.42 ± 0.02</td>
<td>1.84 ± 0.02</td>
<td>1.03 ± 0.01</td>
<td>0.66 ± 0.02</td>
</tr>
<tr>
<td>Boiled sample</td>
<td>0.05 ± 0.01</td>
<td>0.27 ± 0.01</td>
<td>0.15 ± 0.01</td>
<td>0.14 ± 0.02</td>
</tr>
<tr>
<td>Simmered sample</td>
<td>0.08 ± 0.01</td>
<td>0.62 ± 0.02</td>
<td>0.44 ± 0.01</td>
<td>0.26 ± 0.02</td>
</tr>
<tr>
<td>Blanched sample</td>
<td>0.16 ± 0.01</td>
<td>1.46 ± 0.01</td>
<td>0.62 ± 0.02</td>
<td>0.24 ± 0.01</td>
</tr>
</tbody>
</table>

**Note:** The results are mean ± standard deviation of triplicate determination, and mean with different superscript letters down the group are significantly different at (p < 0.05) level of significance.

### Table 2. Percentage (%) reduction of antinutritional factors upon processing

<table>
<thead>
<tr>
<th>Samples</th>
<th>Cyanide (%)</th>
<th>Oxalate (%)</th>
<th>Phytate (%)</th>
<th>Trypsin-inhibitor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiled sample</td>
<td>88.10</td>
<td>85.32</td>
<td>85.44</td>
<td>78.79</td>
</tr>
<tr>
<td>Simmered sample</td>
<td>80.95</td>
<td>66.30</td>
<td>57.28</td>
<td>63.64</td>
</tr>
<tr>
<td>Blanched sample</td>
<td>61.90</td>
<td>20.65</td>
<td>39.80</td>
<td>60.61</td>
</tr>
</tbody>
</table>

**Note:** The results are mean ± standard deviation of triplicate determination.
4. Conclusions

The present study found that all the processing methods examined decreased the level of antinutrients investigated. Furthermore, boiling significantly decreased the levels of these antinutritional factors than both simmering and blanching, and was therefore the most effective method of processing the leaves of *Moringa oleifera*. Similarly this study has justified the traditional basis for boiling the leaves of *Moringa oleifera* before consumption by local communities in Zaria, Nigeria.

References


