Journal of Food and Nutrition Sciences
2016; 3(5): 187-190
Published online September 7, 2015 (http://www.sciencepublishinggroup.com/j/jfns)
doi: 10.11648/j.jfns.20150305.14
ISSN: 2330-7285 (Print); ISSN: 2330-7293 (Online)

Chemical Compositions and Nutritional Value of Moringa Oleifera Available in the Market of Mekelle

Teklit Gebregiorgis Amabye

Department of Chemistry, Mekelle University College of Natural and Computational Science, Mekelle, Tigray, Ethiopia

Email address:
teklitgeb@gmail.com

To cite this article:
Teklit Gebregiorgis Amabye. Chemical Compositions and Nutritional Value of Moringa Oleifera Available in the Market of Mekelle. *Journal of Food and Nutrition Sciences*. Vol. 3, No. 5, 2016, pp. 187-190. doi: 10.11648/j.jfns.20150305.14

Abstract: Moringaoleifera is a tree distributed in Ethiopian semiarid and coastal regions. M. oleifera is used in practice in the treatment of various diseases and is available without a medical prescription, often in the form of an herbal infusion for everyday use. The aim of the present study was to evaluate the chemical composition and nutritional values of dried M. oleifera leaf powder collected from supermarket in Mekelle. All samples of M. oleifera exhibited moisture levels varying from 3.06 to 3.34%, lipids from 10.21 to 10.31%, fiber from 7.29 to 9.46%, ashes from 10.71 to 11.18%, crude protein from 10.74 to 11.48%, and carbohydrates from 54.61 to 57.61%. The predominant mineral elements in the leaf powder according to ICP-MS were Ca (2016.5–2620.5 mg/100g), K (1817–1845 mg/100g), and Mg (322.5–340.6 mg/100g). We concluded that M. oleifera samples could be employed in edible and commercial applications.

Keywords: Mineral, Moringa Oleifera, Physico-Chemical

1. Introduction

Plants have been an important source of medicine for thousands of years. Even today, the World Health Organization (WHO) estimates that up to 80% of people still rely primarily on traditional remedies such as herbs for their medicines [1]. The medicinal value of these plants is due to the presence of a variety of phytochemicals and their elemental composition. The role of medicinal plants in disease prevention or control It is widely distributed throughout Africa, Saudi Arabia, Southeast Asia, the Caribbean Islands, and South America. Every part of M. oleifera has medicinal properties and is commercially exploitable for the development of medicinal and industrial byproducts [3].

Traditionally, the leaves, fruits, flowers, and immature pods of this tree are edible; they are used as a highly nutritive vegetable in many countries, particularly in India, Pakistan, the Philippines, Hawaii, and some African nations [4–6]. In developing nations, M. oleifera is used as an alternative to imported food supplements to treat and combat malnutrition, especially among infants and nursing mothers, by virtue of its chemical constituents [7].

Several valuable reviews of the ethno botanical uses of M. oleifera are available [8–11]. Moringa has been found to be a good source of polyphones and antioxidants [11]. Phytochemicals such as vanillin, omega fatty acids, and carotenoids, ascorbates, tocopherols, beta-sitosterol, moringine, kaempferol, and quercetin have been reported in its flowers, roots, fruits, and seeds. The leaves, in particular, have been found to contain phenolic and flavonoids [12, 13]; these compounds have various biological activities, including antioxidant, ant carcinogenic, immunomodulatory, antidiabetic, antiatherogenic, and heat to protective functions and the regulation of thyroid status [14–16]. Moreover, leaves contain trace elements that are essential to human health. For instance, magnesium, iron, selenium, and zinc play an important role in metabolism, and interest in these elements is increasing together with reports relating trace element status and oxidative diseases [17, 18]. However, a recent study has shown that dried M. oleifera leaves contain lead at very high values of 352.0 mg/L [19]. Therefore, it is very important to identify the mineral composition of M. oleifera leaves that are widely consumed by humans and animals.

In Ethiopia M. *oleifera* is widely cultivated in different zones of the country and is found in more the in Ormia and SNNP. Few studies have been conducted on nutritional and phytochemicals composition [20, 21]; however, to date, a detailed composition of the leaves of *M. oleifera* that is available in supermarket has not been reported yet. In addition, it is important to bear in mind that the mineral and phenolic contents present in leaves depend on several factors such as geographical area where the plant is cultivated, type of soil, water and fertilizers, industrialization process, and storage conditions. Taking these precedents into consideration, the aim of this study was to evaluate the phytochemicals constituents of methanol extracts and trace elements and nutritional values present in *M. oleifera* available in the supermarket of Mekelle.

2. Materials and Methods

A powdered form of Moringa is purchased from supermarket of Mekelle. All materials were air-dried and powdered and protected from light until further analysis.

2.1. Proximate Composition

The methods of the Association of Official Analytical Chemists (AOAC, 1990) were used for proximate analysis. A Moringa flour sample (5 grams) was used for determination of moisture content by weighing in crucible and drying in oven at 105°C, until a constant weight was obtained.

Determination of ash content was done by ashing at 550°C for 3h. The Kjeldah method was used to determine the protein content. The crude fiber content of the samples was determined by digestion method and the fat was done by Soxlhet extraction method. All determinations were done in triplicate.

2.2. Mineral Contents

Flour sample (0.5 g) was weighed into a clean ceramic crucible. A blank was prepared with empty crucible. The crucible was placed in a muffle furnace at 500 °C for 4 hr. The sample was allowed to cool down in the oven after which it was removed carefully. The ashed sample was poured into already labeled 50 ml centrifuge tube. The crucible was rinsed with 5 ml of distilled water into the centrifuge tube. The crucible was rinsed again with 5 ml of aquaregia. This was repeated to make a total volume of 20 ml. The sample was mixed properly and centrifuged (IEC Centra GP8) for 10 min at 301.86 g. The supernatant was decanted into clean vials for mineral determination. The absorbance was read on atomic absorption spectrophotometer (Buck Scientific Model 200A) at different wavelength for each mineral element (Zn-213.9 nm, Ca-422.7nm, Fe-248.3 nm, Mg-285.2 nm, Na-589 nm and K-766.5 nm) (Novozamsky et al., 1983.

2.3. Statistical Analysis

All analyses were carried out in triplicates. The mean and standard deviation of the data obtained were calculated.

3. Results and Discussion

3.1. Chemical Analysis

The proximate and nutrient analyses of *M. oleifera* play a crucial role in assessing its nutritional significance ($< ^{0.05}$). The proximate analysisfor the mean moisture, lipid, fiber, and ash values found in the present study are in agreement with the values reported with standard of WHO [28]. The result shows that Moringa found in the market of Mekellecontain crude protein (10.6%), crude fiber (about 8%), ash (about 11%), carbohydrates (about 56%), moisture (about 3.2%), and lipid (about 10.2%). Carbohydrates are the principal sources of energy. The ash content of about 11% indicates that the leaves are rich in mineral elements. The mean protein content found in the market of Mekelle samples ranged from 10.74 to 11.48%. The chemical composition values confirmed that *M. oleifera* leaves powders are an excellent food source, justifying its direct use in human nutrition or development of balanced diets for animal nutrition.

Table 1. *Nutritional composition of dried M. oleifera leaf powder.*

Elements	Value	WHO standard
Moisture (%)	3.34 ±1.36	7.4 ±2.89
Lipid (%)	10.31 ±1.2	6±2.5
Ash (%)	7.29 ±0.84	9 ±7.45
Protein (%	10.71 ±0.81	24±5.8
Carbohydrates (%)	57.61 ±2.19	17.6b
Energy value(Kcal/100 g)	366.2±4.23	36±9.2

N.B Values are mean ±SD, analyzed individually in triplicate, and are expressed as g/100 g leaf powder.

3.2. Elemental Analysis

Generally the micro nutrient of any plant depend up on the Different physical parameter of thesoils contain a particular of mineral elements qualities and quantities whose bioavailability depends on soil properties (pH, clay and humid complex and mineralogy) [32]. Six elements, including c such as calcium and sodium was determined.

Table 2. *Measured concentration in (mg/100 g) of trace element in the M. oleifera leaf powder.*

Elements	Value	standard
Calcium (Ca)	2016.5±22.6	1897 ±748.4
Magnesium (Mg)	322.5±0.0	473 ±429.4
Potassium (K)	1845 ±7.0	1467 ±636.7
Sodium (Na)	8.13 ±0.6	220 ±180
Iron (Fe)	19.37 ±6.6	32.5 ±10.78
Zinc (Zn	1.0 ±0.7	2.4 ±1.12
Copper (Cu)	1.03 ±0.47	0.9 ±0.48

Results are mean ±SD, analyzed individually in triplicate. Statistically significant differences between the means of both cultivars are denoted as $^{**}p<0.001$; $^{*}p<0.05$

The elements were determined byatomic absorption spectrophotometer (Buck Scientific Model 200A) at different wavelengthatomic absorption of wet digestion of the dried sample with concentrated nitric acid in closed PTFE vessels using a microwave oven. Ca, Mg, K, Fe, and Na were present at levels of mg/100 g dry matter, whereas Zn, Cu, andwere present at g/100 g levels, in close agreement with levels previously reported [30], and these values fall within the ranges reported (Table 2, reference column). The elemental analysis of our samples revealed high contents of Ca (2016 to 2620 mg/100 g), Mg (322 to 340.6 mg/100 g), and K (1817 to 1845 mg/100 g), while Zn, Cu, and Se were 1, 1, and 0.1 mg/100 g, respectively These values of *M. oleifera* samples found in Mekelle agree with those found in Burkina Faso and India [29, 30]. This sample could be recommended as a source of essential elements.

4. Conclusion

The result showed that the Ethiopian species of *M. oleifera found in the market of Mekelle* have nutritional potential because their leaves contain a high concentration of energy, nutrients, and minerals. Therefore, the therapeutic potential of *M. oleifera* may be due to the presence of these constituents. The presence of macro and micro elements s in M. *oleifera*powder appears to be within permissible limits, this suggests that quality assurance of metals are needed forplantsintendedforhumanconsumption.

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