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STUDY OF PHYTOCHEMISTRY OF *MORINGA OLEIFERA* LEAVES (DRUM STICKS)


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ABSTRACT

Moringa oleífera commonly called Moringa, is a valuable tree whose fruits, roots and leaves have been advocated for traditional, medicinal and industrial uses. Moringa oleifera is an interesting plant for its use in bioactive compounds. The aim of the present study was to evaluate the chemical composition and nutritional values of dried M. oleifera leaf collected from market of Aurangabad. The phytochemical and nutritional properties of the dried leaf powder of M. oleifera used as nutraceuticals, dietary supplements, functional foods or a source of vegetable in meal preparation. The nutritional and natural products characterization of Moringa conducted in this study show that the leaves of this plant can contribute significantly to the daily recommended allowance needed for many vitamins and mineral needs as well as serve as a rich source of polyphenols, confirming the importance and role that Moringa can play to improve the health and nutrition particularly in malnourished populations.

Keywords: Moringa oleifera, phytochemical and nutritional properties.

Research Paper

Introduction: *Moringa oleifera* Lam. (Moringaceae) is one of the 14 species of family Moringaceae, native to India, Africa, Arabia, Southeast Asia, South America, and the Pacific and Caribbean Islands (Iqbal et al, 2006).. According to Muluvi et al (1999), the Moringa tree was introduced to Africa from India at the turn of the twentieth century where it was to be used as a health supplement. *Moringa oleifera* is a small, fast-growing evergreen or deciduous tree that usually grows up to10 to 12m in its height,open crown of drooping fragile branches, feathery foliage of trip innate leaves and thick corky whitish bark. When grown in well-drained soils(Vinoth, B., R. Manivasagaperumal and S. Balamurugan), 2012.

Almost all parts of the plant are used culturally for its nutritional value, purported medicinal properties and for taste and flavor as a vegetable and seed. The leaves of *M. oleifera* can be eaten fresh, cooked, or stored as a dried powder for many months reportedly without any major loss of its nutritional value (Arabshahi-D et al, 2007; Fahey, 2005). Studies have revealed that *M. oleifera* leaves are a good source of nutrition and exhibit anti-tumor, anti-inflammatory, anti-ulcer, anti-atherosclerotic and anti-convulsant activities (Chumark et al, 2008; DanMalam et al, 2001; Dahiru et al, 2006). 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. T. R. Mehta L. K., (2003) . . However, a recent study has shown that dried M. oleifera leaves contain lead at very high values of 352.0 mg/LA .According National Research Council (2006). Therefore, it is very important to identify the mineral composition of M. oleifera leaves that are widely consumed by humans and animals. Nutritionally, the leaves have been found to be a valuable source of both macro and micronutrients, rich source of -carotene, calcium and potassium. It also contain high content of highly digestible protein, carotenoids, minerals and vitamins especially vitamin C, hence it can be used as an ideal nutritional supplement which have been used to combat malnutrition, especially among infants and nursing mothers. The leaves and pods have also been indicated to be helpful in increasing breast milk in nursing mothers. In present case investigation of minerals and physicochemical properties of Moringa.oleifera.

MATERIALS AND METHODS

Collection of plant material

For the study the leaves of *Moringa oleifera* were collected from the matured tree in an orchard within the plantation of Himayat Bagh,.Aurangabad.

Preparation of Sample:

After collection, the leaves were removed from the branches, sorted out .Washed properly with sterile water and for drying spread on mesh tray. The leaves were shade dried for a period of 7- 10 days for proper drying in the laboratory, Upon drying, the leaves were pulverized under aseptic conditions using a grinder the fine powder sieved and stored in dry airtight glass jar for phytochemical and nutritional analyses.

Analysis of Sample: chemical analysis was carried out on the powdered of *Moringa oleifera* leaves to determine the presence ether extract (fat) , moisture content , protein,ash content crude fibre, carbohydrate (by difference) using standard analytical methods described by the Official Methods of Association of Official Analytical Chemists(AOAC)2000 . Minerals and vitamin such as iron, zinc, magnesium, calcium, potassium, phosphate, ascorbic acid, thiamine, niacin and riboflavin content of dried *Moringa oleifera* leaf was determined using the method described by the Official Methods of Association of Official Analytical Chemists.

Determination of Moisture Content: Moisture content was measured by oven dry method .The oven was used to dry the samples till constant weight then removed and measured. The percentage of moisture content was calculated as:

$$\% \text{ moisture} = \frac{(1 \text{ moisture} \times 100)}{\text{weigh of sample}}$$

Determination of Ash Content: The ash content was determine by dry ashing method .. First, the crucible was measured; then, the weight of the sample + crucible was taken before the sample was incinerated in a Muffle furnace at 400°C. The remaining inorganic material was cooled in a desiccator, weighed and the ash content was determined

$$\% \text{ Ash} = \frac{\text{weigh of sample remaining}}{\text{weigh of original sample}} \times 100$$

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Determination of Crude protein :The crude protein was determined using the micro-Kjeldahl method (Fahey, 2005). The crude protein was calculated by multiplying Nitrogen by the conversion factor of 6.25 [P% = TN x 6.25].

Determination of Crude Fiber: The Crude Fiber was determined using the method of (AOAC, 2005).1g of sample (W2) was transferred directly to filter bag and sealed with a heat sealer. Sample and

blank bags were immersed in enough amount petroleum ether for 10 minutes to extract fat content from samples. All bags were air dried and transferred to a ANKOM 2000 Fiber Analyzer using H2SO4 and NaOH and the crude fiber was calculated according the following equation:

% Crude Fiber = 100 x (W3 - (W1 x C1))/W2

Where:

W1 =Bag tare weight

W2=Sample Weight

W3=Weight of Organic Matter (Loss of weight on ignition of bag and fiber)

C1=Ash corrected blank bag factor (running average of loss of weight on Ignition of blank bag/original blank bag)

Carbohydrate content: Carbohydrate content was determined by difference, that is, addition of all the percentages of moisture, fat, crude protein, ash, and crude fiber were subtracted from 100%. This gave the amount of nitrogen-free extract otherwise known as carbohydrate.

Carbohydrate (%)= 100 – [moisture (%)+ Fat (%) + Ash (%) + Crude Fiber (%) + Crude Protein (%)].

Fat Content: The fat content was estimated by Soxlhet apparatus extraction method.

Energy value: Energy value as proposed by (Martin and Coolidge, 1978) .The sample energy value was estimated (in KCal/g) by multiplying the percentages of crude protein, crude lipid, and carbohydrate with the recommended factors (2.44, 8.37, and 3.57, respectively).

Minerals determination: The mineral compositions of the samples determined by AOAC (2005) methods. One gram of sample was digested with nitric acid: perchloric acid: sulfuric acid mixture in the ratio 9:2:1, respectively, and filtered. The filtrate was made up to mark in a 5 ml volumetric flask. The filtered solution was loaded to an atomic absorption (Model 703; Perkin Elmer, Norwalk, CT). The standard curve for each mineral, that is, , magnesium, iron, aluminum, calcium ,lead, copper, manganese and zinc, was prepared from known standards and the mineral value of samples estimated against that of the standard curve. Values of potassium and sodium were determined using a flame photometer (FP 920, PG Instruments) using NaCl and KCl as the standard (AOAC, 2005), while by using the Vanodo-molybdate method phosphorus determined.

Vitamins determination:

Vitamins A and E were determined by (AOAC, 2005a,b). Vitamin B1 and B2 were determined by acid hydrolysis method of (Finglas and Faulks, 1984), B3 content of samples were determined by the (Ackurt *et al*. 1999).

Table no.1 Nutritional composition of *M. oleifera* leaf powder

Sr.no	Parameters Values	(Per 100g powder)
1	Moisture (g)	**7.60g**
2	Protein (g)	25.09g
3	Crude fiber (g)	11.21g
4	Ash (g)	12.51g
5	Fat (g)	10.20g
6	Total Carbohydrate (g)	60.96g
7	Energy value Calories (Kcal)	440.10g

Table no.2 Mineral Content of of *M. Oleifera* dried leaf powder

Minerals	Dried leaves (Per 100g powder)
Sodium	289mg
Potassium	1,324mg
Magnesium	368mg
Phosphorus	204mg
Iron	28.2mg
Copper	0.57mg
Calcium	2,003mg
Mangnese	5.21mg
Zinc	3.29mg

Table no.3 Vitamin Content of of *M. oleifera* dried leaf powder

Vitamin	Dried leaves (Per 100g powder)
Vitamin A	18.9mg
Vitamin E	15.10mg
Vitamin C	17.3mg
Vitamin B1	2.64mg
Vitamin B2	20.5mg
Vitamin B3	8.2mg

Result:

Proximate analysis

The leaves of *Moringa oleifera* were analyzed for proximate analysis and the results in Table no.1 showed that, the *Moringa oleifera* leaves were contained moisture about (7.60 g), total protein (25.09g) ,crude fiber (11.21g) fat (10.20g) and total carbohydrate (60.96g) and the total energy of 100 gram of leaves was (440.10g)

Mineral content

Mineral content of *Moringa oleifera* leaves was estimated and recorded in Table no.2. The results indicates that *Moringa oleifera* leaves are a promising source of essential minerals. The concentration of sodium was (289mg), potassium (1,324mg), magnesium (368mg), phosphorus (204mg), Iron (28.2mg), copper (0.57mg), calcium (2,003mg) and manganese (5.21mg) and zinc (3.29mg).

Vitamin content

The vitamin content of *Moringa oleifera* leaves revealed in Table no. 3. The concentration of detected vitamins were 18.9 mg of b-Carotene, 15.10mg. of Vitamin E, 17.3mg Vitamin C,

17.3 mg of Vitamin B1, 20.5mg of Vitamin B2 and 8.2mg of Vitamin B3.

DISCUSSION

The results of proximate analyses revealed that the *Moringa oleifera* leaves are an excellent source of nutrition and natural energy for human around the world who lack in many nutritional supplements such as protein , carbohydrate, lipids and fibers from (Table 1). 100g of *Moringa oleifera* leaves can provide about 17.5 g of daily requirement. Moisture in food determines the rate of food absorption and the keeping quality of food. The reported value

indicated that *Moringa oleifera* leaf protein might not be stored at room temperature for a long period. Ash in food determines largely the extent of mineral matters likely to be found in food substance, the reported value of ash indicated that moringa leaves are a good source of minerals. *Moringa oleifera* is a good source of fiber that might be taken as a part of diet to clean the digestive tract by removing potential carcinogens from the body and hence prevents the absorption of excess cholesterol. The fat and carbohydrate content is very valuable as a main source of energy for human body. The Moringa leaves mineral concentrations one of the important sources of essential elements for human body. Moringa leaves contained a high level of sodium (Table 2); while sodium is an important source of electrolytes within the body; potassium works with sodium to maintain the water balance in the body and lowering the blood pressure. Magnesium level in moringa leaves was that is extremely vital to health by stimulating

gastric motility and intestinal function; a high content of phosphorus is an important to serve as the main regulator of energy metabolism in cells. Iron is also very important element as a nucleus of hemoglobin that forms red blood cells in the body. Zinc can support the immune system and useful for normal growth and development during pregnancy. Copper plays a vital role in the synthesis and maintenance of myelin and as a cofactor for processes that neutralize the dangerous free radicals. Moringa leaves are a very good source of calcium that very useful for bones and teeth development. Manganese is very useful for activation of some enzymes that prevent tissue damage and used for digestion and utilization of foods. *Moringa oleifera* leaves contained a reasonable concentrations of both waters oluble vitamins such as B {Vitamin B1 (Thiamin) , Vitamin B2 (Riboflavin) , Vitamin B3- and fatsoluble vitamins like A and E respectively (Table 3). These vitamins could play an important role in improving human health. Vitamin A is a natural antioxidant to inhibit free radicals and very important for improving the immune system. Vitamin E is useful for enhancing the immune system function and skin repair. Vitamin C is very important for cardiovascular health and reducing free radicals in the cells. Vitamin B1 contributes in many cellular functions including carbohydrates metabolism. . From the present investigation results, it is clear that *Moringa oleifera* leaves are a powerful vitamin factory in reasonable concentrations for human requirements. *Moringa oleifera* could be used in curing many diseases like typhoid fever, diarrhea, high blood sugar, hypertension, and gastro-intestinal disorder. It is advised that this plant can be utilized in cooking and making other edible formulations (Olako, 2014).

CONCLUSIONS

Moringa oleifera is one of the most useful plant. Its use stretch from food and medicinal uses to biopesticide ,water purification and production of biodiesel. From the present investigation results, it is clear that *Moringa oleifera* leaves are a powerful vitamin factory in reasonable concentrations for human requirements.

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