Bangladesh Pharmaceutical Journal ***24****(1): 54-60, 2021 (January)*

Nutritional Analysis and Mineral Content Determination of *Emilia sonchifolia* DC

Md. Masud Morshed[1,2], Md. Sohel Rana[1], Talha Bin Emran[2], Md. Didaruzzaman Sohel[3,4] and Mohammad Hassan Kawsar[3]

[1]Department of Pharmacy, Jahangirnagar University, Dhaka-1342, Bangladesh
[2]Department of Pharmacy, BGC Trust University Bangladesh, Chattogram-4381, Bangladesh
[3]Department of Pharmacy, State University of Bangladesh, Dhaka-1205, Bangladesh
[4]Quality Assurance Department, Incepta Pharmaceuticals Ltd., Dhaka-1341, Bangladesh

(Received: November 14, 2020; Accepted: January 14, 2021; Published (web): January 28, 2021)

Abstract

Now-a-days consumption of plant-based foods, including green leafy vegetables are being considered as part of a healthy diet and importance is given on this by almost all health regulatory bodies of the developed countries. The plant, *Emilia sonchifolia* belongs of the family, Asteraceae. Nutritional composition of the plant and presence of some essential major elements were analyzed by using standard methods. Freshly collected healthy plants were subjected to assessment for different parameters and nutritional content such as moisture, fat, ash, protein, crude fiber, carbohydrate and energy value as well as probable mineral contents. After nutritional assessment it was revealed that, the contents of total moisture, fat, ash, protein, fiber and carbohydrate were 83.18%, 0.938%, 2.84%, 3.11%, 2.84% and 7.042%, respectively. The total energy content of the plant was 52.624 kcal. The results of the nutritional assessment of *E. sonchifolia* were near to the popular edible spinach of *Amaranthus* which contained moisture 81.8 - 83.9%, fat 0.3 - 0.5%, ash 2.8 - 3.6%, protein 4.1 - 4.8%, carbohydrate 4.3 - 5.2%, and energy 47 - 51 kcal. Concentration of macro minerals calcium (Ca), potassium (K), magnesium (Mg) and sodium (Na) was found to be 310, 137, 119 and 55 mg/100g, respectively whereas the concentration of micro minerals iron (Fe), copper (Cu), zinc (Zn), manganese (Mn) and chromium (Cr) was observed as 29, 0.17, 1.21, 1.52 and 0.20 mg/100g, respectively which was between the recommended limit.

Key words: *Emilia sonchifolia*, Green Leafy Vegetables, AOAC (Association of Official Analytical Chemists), nutritional analysis and mineral content.

Introduction

Plants are very rich sources of essential biochemicals and nutrients such as carbohydrates, carotene, protein, vitamins, calcium, iron, ascorbic acid and palpable concentration of trace minerals (Prakash and Pal, 1991; Jimoh and Oladiji, 2005).

Beside therapeutic purposes, consumption of plant-based foods being a part of a healthy diet increasing day by day and importance are given by almost all health regulatory bodies in the developed world. It is now more evident that, the risk of many age-related diseases becomes low by maintaining traditional Mediterranean diet based on plant. Epidemiological studies have reported that, there is a consistent and strong inverse relationship between vegetable and fruit intake and the risk of some cancers and cardiovascular diseases (Steinmetz and Potter, 1996).

In human nutrition, a vital role played by green leafy vegetables (GLVs) from which people get sufficient amount of dietary fibers, minerals, vitamins and other nutrients (Mohammed and Sharif, 2011).

Corresponding author: Mohammad Hassan Kawsar; Email: hassankawsar@yahoo.com

DOI: https://doi.org/10.3329/bpj.v24i1.51636

These are potential sources of nutrients for the rural people where they contributes substantial amount of minerals, vitamins, fibers, proteins and other nutrients which are usually in short supply in their daily diets (Asaolu *et al*., 2012).

Vegetables are of different types and among which different parts like roots, stems, leaves, fruits or seeds may be edible with variety of benefits (Robinson, 2000).

Leafy vegetables are recommended for weight management, because of low energy content (Nwanekezie and Obiakor, 2014). Excessive cultivation of field crops, diminished the availability of native vegetables alarmingly. Teenagers are completely unaware about the importance of these nutritionally rich plants sources (Odhav *et al*., 2006).

Minerals cannot be synthesized by humans and animals thus must be provided through food and water. But, the supply of minerals is not enough to meet the dietary requirements of rapidly growing human population in the world (Mohammed and Sharif, 2011). Leafy vegetables are the sources of verity of minerals such as Ca, Cu, Fe, P, Cl, Zn and Na which are essential for both growth and metabolism. Green leafy vegetables are contain Ca, K, Fe and Na which provide alkalizing effect to the acidity produced by other foods, especially those of animal origin (Angela *et al*., 2010).

Therefore, the fundamental target of this study was to evaluate the nutritional potential and probable mineral contents of an indigenous plant *E. sonchifolia* belongs to the family Asteraceae which grows in moist areas of Bangladesh especially Chattogram and adjacent regions. It is commonly known as 'Red tasselflower'; Bangali name- 'Sadimodi, Mechitra, Sadusi'. This plant also have some folklore value as traditional medicine.

Materials and Methods

Collection, identification and processing of plant samples: Plant samples were collected in two phases in the month of July-August, from the two distinct regions of Chattogram (Table 1). Identification of the collected plant sample was done by Bangladesh National Herbarium, Mirpur, Dhaka. A specimen voucher was preserved there for future investigation (Accession number: DACB 46086).

Table 1. Collection site of plant.

Plant Species	Common name	Planting season	Cultivation and collection site
Emilia sonchifolia	Red tassel flower	July-August	CU Campus Chattogram Cantonment Area

About 2 kg of fresh aerial part of *E. sonchifolia* plant was collected and air dried at room temperature (25 ± 2)° C. Healthy plants were removed and washed thoroughly with distilled water properly. Some plants were also dried using tray dryer for 3 h. Capped bottles were used to store the dried samples which were kept in a desiccator till further analysis (Sundarapandian *et al*., 2016).

Experimental animals: Swiss albino mice (both male and female) weighing 25-30 g were used in order to determine acute toxicity test. Experimental animals were housed in a 12 hrs light/dark cycle at room temperature. The animals were collected from Animal Resource Branch of the International Center for Diarrheal Disease Research (ICDDR, B). The experiment was conducted according to the international guideline presented in the Guide for the Care and Use of Laboratory Animals.

Acute toxicity test: Mice were divided into four groups- one control and three test groups to determined median lethal dose (LD_{50}) values. Each group contained five mice. The crude extract at the dose of 1000, 2000, and 3000 mg/kg body weight was administered orally to the mice of group-I, group-II and group-III, respectively and normal saline received by the group-IV. The experimental animals were observed for 72 hrs for any unusual

findings like hypersensitivity, mortality etc. (Walker *et al*., 2008).

Nutritional analysis: All Analysis was done by the methods described in Association of Official Analytical Chemists (AOAC, 2012). The work was done in the Institute of Nutrition & Food Science, University of Dhaka.

a) *Estimation of moisture content:* For the determination of moisture content, about 10 g of the material was weighed into a weighed moisture box followed by drying in an oven at the temperature of 100-105ºC and cooled in a desiccator. The process repeated until a constant weight achieved. The loss in weight was expressed as percentage moisture content.

$$\% \text{ Moisture} = \frac{M_{\text{INITIAL}} - M_{\text{DRIED}}}{M_{\text{INITIAL}}} \times 100$$

b) *Estimation of fat content:* Fat content was estimated as crude extract of the dry material. The dried sample (5-10 g) was weighed accurately in to a cotton plugged thimble. The thimble was then placed in a Soxhlet apparatus and extracted with anhydrous ether for about 16 hrs. The ether extract was filtered into a pre-weighed conical flask. The flask containing the extract was washed 4 to 5 times with small volumes of ether and the washings were also transferred. The ether was then removed by evaporation and the flask with the residue dried in an oven at 80-100ºC, cooled in a desiccator and weighed.

c) *Estimation of ash content:* Ash analysis was usually done to wash away organic matter leaving inorganic one which help to determine amount and type of mineral in food. About 5-10g of the sample weighed accurately into a porcelain crucible which had previously been heated to about 600ºC and cooled. The crucible was kept in a muffle furnace for about 3-5 hrs. at about 600ºC after heat the sample over a low flame till all the material was completely charred. Then cooled the sample in a desiccator and weighed. Again sample was heated in the muffle furnace for half an hour, cooled and weighed to ensure completion of ashing. Until two consecutive weights were same and the ash was almost turning white or greyish white in color, the process was repeated. Weight of ash was content of ash per 100 gm of sample.

d) *Estimation of protein content:* Content of protein was obtained by determining the nitrogen content of the material and multiplying the value with 6.25 which was regarded as crude protein content since the non-protein nitrogen (NPN) that are present in the material was not taken into consideration. True protein nitrogen could be estimated by subtracting NPN from the total nitrogen (Schonfeldt and Pretorius, 2011).

e) *Estimation of crude fiber content:* 5 gm of ground material was extracted with ether or to remove fat. If fat content was below 1%, extraction might be omitted. After extraction, boiling of 2.5g of dried material was done with 200ml of sulphuric acid for 30min which then filtered and washed with boiling water till the sample was no longer acidic. Then boiled the sample with 200ml of sodium hydroxide solution for 30min followed by filtration and washed with 25ml of boiling 1.25% sulphuric acid, three-50 ml of water and 25ml alcohol. The residue was removed and transferred to a pre-weighed ashing dish (W_1) and dried the residue for 2 hrs. at 130 ±2°C. The dish was cooled in a desiccator and weighed (W_2). Then the dish was ignited at 600 ±15°C for 30min followed by cooling in a desiccator and reweigh (W_3).

$$\% \text{ of Crude Fiber} = \frac{\text{Loss in weight on ignition } (W_2 - W_1) - (W_3 - W_1)}{\text{Weight of the sample}} \times 100$$

f) *Estimation of carbohydrate content:* The carbohydrate content was estimated by subtracting the sum of amount of moisture, total protein, ash, total fat and crude fiber from 100. The result was presented in percentage.

g) *Estimation of energy content:* The energy value was determined by multiplying the mean values of the crude fat, total protein, total carbohydrates and crude fiber by 9, 4, 4 and 0.5, respectively, then taking the sum of all.

Mineral content analysis: 0.5 g of sample was wet digested for 2-3 hrs. with mixture of HNO_3 and $HClO_4$ (2:1 ratio) on heating mantle (AOAC, 1984). Filtrated the digested samples using 0.45 µm pore size Milipore filter and made the volume 100 ml with distilled water. Concentration of Ca, Mg, Fe, Cu, Mn, Zn, and Cr were determined by Atomic Absorption Spectrophotometer (Hitachi Zeeman Japan Z-8000) equipped with standard hallow cathode lamps as radiation source and air acetylene flames, while Na and K concentration was determined on Flame Photometer.

Results and Discussion

Acute toxicity test: No toxicity and significant changes in the body weight between the control and treated group were observed after oral administration of *E. sonchifolia* extract at the doses of 1000, 2000 and 3000 mg/kg which indicative that the LD_{50} was higher than 3000 mg/kg.

Nutritional composition of the E. sonchifolia: Except moisture content, other parameters of nutritional assessment of *E. sonchifolia* were conducted on dry basis. The moisture content of the plant *E. sonchifolia* was found is about 83.18% which was comparatively higher in amount. Activity of water soluble enzymes and co-enzymes that are involved in metabolic activities of these leafy vegetables induced by high moisture content (Iheanacho and Ubebani, 2009). All the results are presented in Table 2.

The fat content of the plant *E. sonchifolia* was found is about (0.938 ± 0.12) which was lowest. This evidence revealed that, the leafy vegetables usually contain low fat and plays a significant role to avoiding or reducing obesity (Nisha *et al*., 2012).

The ash content of the plant *E. sonchifolia* was found is about 2.84%. The ash content is recognized as a measure of quality for the assessment of the functional properties of foods (Hofman *et al*., 2002). After combustion, the amount and composition of ash varies according to the part of the plant, treatment, age etc (Tambe and Kadam, 2012). Ash content of *E. sonchifolia* (2.84%) is higher than commonly consumed leafy vegetables *Amaranthus viridis* (1.85%) and *Alternanthera sessilis* (1.5%) is the indication of high mineral content of the studied plant. (Nisha *et al*., 2012; Gotruvalli *et al*., 2016).

This experiment showed that *E. sonchifolia* contained lower amount of protein (3.110±0.04 %) in comparison with some other leafy vegetables *Moringa oliefera* (20.72%) and *Momordica balsamina* (11.29 %) (Asaolu *et al*., 2012) which suggested that the experimented plant is a poor source of protein.

The result of crude fiber found to be for *E. sonchifolia* was about (2.89 ± 0.06) which was moderate enough. Presence of higher amounts of dietary fiber in food can reduce the risk of cardiovascular diseases by lowering the body cholesterol level (Hanif *et al*., 2006).

The resulted carbohydrate content of the plant *E. sonchifolia* was found about 7.042%. As soluble carbohydrate's main function is energy supply in the body and hence green leafy vegetables may not be an important source of carbohydrates because they are consumed along with other carbohydrate rich food such as cereals. The resultant values are lower than that of commonly consumed vegetables which makes the studied plant more valuable to add in main diet.

Table 2. Proximate nutrient composition in mg/100g of the plant *E. sonchifolia*.

Moisture	Fat	Ash	Protein	Crude fiber	Carbohydrate	Energy
83.18%	0.938 ± 0.12	2.84%	3.110 ± 0.04	2.89 ± 0.06	7.042%	52.624 kcal

The results of the nutritional assessment of *E. sonchifolia* were nearer with popular edible spinach of *Amaranthus.* Spinach of Amaranthus contain Moisture 81.8 - 83.9%, Fat 0.3 - 0.5%, Ash 2.8 - 3.6%, Protein 4.1 - 4.8%, Carbohydrate 4.3 - 5.2%, Energy 47 - 51 kcal.

Estimation of mineral content: Among the macro minerals tested calcium (Ca) content was high (310 ± 0.11 mg/100mg) as compared to other macro minerals. Potassium (K) was the second most abundant mineral (137 ± 0.05 mg/100mg). Magnesium (Mg) was also found in appreciable amount (119 ± 0.16 mg/100mg). The Sodium content (Na) was lowest among the tested macro minerals with the value of 55 ± 0.09 mg/100g.

Deficiency of calcium along with phosphorus and vitamin D leads to the development of bone symptoms associated with rickets. Consumption of plants rich with calcium content can provide health benefit with reducing the risk of such disease.

Due to the reciprocal effects of Na and K, a diet rich in potassium and lesser in sodium (low urinary Na and K ratio) favors lower blood pressure (Fenn 1949). Chances of cardio vascular disease can be reduced by consumed low Na and high K diet (Luft 1990). The sodium requirement from plant source is not important due to its regular intake as NaCl salt through our daily foods.

Magnesium plays both vital structural and functional role of the human body. About 25 grams of magnesium contained by the adult human body among which more than 60% of all the magnesium found in the skeleton, 27% is found in muscle, and 6 to 7% is found in other cells, and less than 1% is found outside of cells (Shils 1998).

The concentration of the different micro minerals found in the plant *E. sonchifolia* is represented in the (Table 4).

Table 3. Macro mineral content in mg/100g of the plant *E. sonchifolia.*

Name of the Micro minerals	Ca	K	Mg	Na
Mineral content in *E. sonchifolia* (mg/100g)	310 ± 0.11	137 ± 0.05	119 ± 0.16	55 ± 0.09

Table 4. Micro mineral content in mg/100g of the plant *E. sonchifolia.*

Name of the Micro minerals	Fe	Cu	Zn	Mn	Cr
Mineral content in *E. sonchifolia* (mg/100g)	29 ± 0.02	0.17 ± 0.05	1.19 ± 0.02	1.55 ± 0.09	0.20±0.03

From the findings represented in Table 4, among the micro minerals tested Iron (Fe) concentration was the highest (29 ± 0.02 mg/100mg) and Chromium (Cr) concentration was the lowest (0.20 ± 0.03 mg/100mg). All the result found was also within the standard recommended dietary allowances, so no possibility of toxicity.

In humans, iron is an essential componemt of many proteins and enzymes and hence an essential element (Beard and Dawson 1997). Both for humans and animals, Copper (Cu) is an essential trace element. It plays key role in oxidation-reduction reactions and the scavenging of free radicals due to its ability to easily accept and donate electrons (Linder and Azam 1996).

As a constituent of some important enzymes and activator of other enzymes, manganese (Mn) plays a vital role in a number of physiological processes (Williams and Wilkins 1999).

Zinc plays an important role in the structure of proteins and cell membranes. Stabilization of the structure of a number of proteins done by finger-like

structure, known as a zinc finger motif and thus zinc plays a critical structural role (National Academy Press 2001, Washington, D.C.). Apart from the structural role, functions of cell membranes are also affected by zinc. Biological membranes viable to oxidative damage and impairment of its function due to loss of zinc (O'Dell, 2000).

A biologically active form of chromium takes part in glucose metabolism by boosting the action of insulin (National Academy Press 2001, Washington, D.C.).

Conclusion

From the nutritional and mineral content assessment, the nutritive value of the plant found which was nearer to the popular edible spinach of *Amaranthus.* On the other hand, significant amount of minerals were also present. It might be a promising food with an array of health benefits. Therefore, considering the nutritional value, the plant materials could be further studied extensively to find out their unexplored efficacy and to rationalize their uses as part of healthy diet.

.

References

Angela, C., Rodica, C., Andrea, M.Z., Elena, T. and Camelia, G. 2010. Chemical composition of common leafy vegetables. *University Studies, Ser. Life Sci.* **20**, 45-48.

AOAC (Association of Official Analytical Chemists, Washington, DC). 2012. *Official Methods of Analysis*. **15**.

AOAC (Association of Official Analytical Chemists, Washington, DC). 1984. Sidney Williams, *Official Methods of Analysis*. **14**.

Beard, J.L and Dawson, H.D. 1997. In: *Handbook of nutritionally essential minerals* (O'Dell, B.L. and Sunde, R.A. Eds.), Marcel Dekker Inc., New York, USA, p. 275.

Gotruvalli, M.P., Chikkappaiah, L. and Shiddamallayya, N. 2016. Nutritional analysis of edible wild plants used by hakki pikki tribes of Hassan district, Karnataka, India. *Int. J. Pharm. Sci.* **8**, 390-393.

Hanif, L., Prakash, D., and Pal, M. 2006. Nutritional and anti nutritional comparison of vegetable and grain *Amaranthus* leaves. *J. Sci. Food Agric.* **57**, 573-585.

Hofman, P.J., Vuthapanich, S., Whiley, A.W., Klieber, A. and Simons, D.H. 2002. Tree yield and fruit minerals concentrations influence Hass avocado fruit quality. *Scientia Horticulturae.* **92**, 113-123.

Iheanacho, K. and Ubebani, A.C. 2009. Nutritional composition of some leafy vegetable consumed in Imo State, Nigeria. *J. Appl. Sci. Env. Manag.* **13**, 35-38.

Jimoh, F.O. and Oladiji, A.T. 2005. Preliminary Studies on *Piliostigma thonningii* seeds: proximate analysis, mineral composition and phytochemical screening. *Afr. J. Biotech*. **4**, 1439-1442.

Linder, M.C and Azam, M.H. 1996. Copper biochemistry and molecular biology. *Am. J. Clin. Nutr*. **63**, 797S-881S.

Luft F.C. 1990. In: *Present Knowledge in Nutrition* (Brown, M.L. Ed) Nutrition Foundation, Washington, D.C., Chapter 26, p. 233.

Mohammed, M.I. and Sharif, N. 2011. Mineral composition of some leafy vegetables consumed in Kano, Nigeria, *Nigerian J. Basic Appl. Sci.* **19**, 208-212.

Nisha, S., Gupta, P.C. and Rao, C.V. 2012. Nutrient content, mineral content and antioxidant activity of *Amaranthus viridis* and *Moringa oleifera* leaves, *Res. J. Med. Plants.* **6**, 253-259.

Nwanekezie, E.C. and Obiakor-Okeke, P.N. 2014. Mineral content of five tropical leafy vegetables and effect of holding methods and time. *Am. J. Exp. Agric.* **4**, 1708-1717.

O'Dell, B.L. 2000. Role of zinc in plasma membrane function. *J. Nut.* **130**, 1432.

Odhav, B., Beekrum, S. and Baijnath, H. 2006. Preliminary assessment of nutritional value of traditional leafy vegetables in KwaZulu-Natal, South Africa. *J. Food Com. Anal.* **20**, 430-435.

Prakash, D and Pal, M. 1991. Nutritional and antinutritional comparison of vegetable and grain Amaranthus leaves. *J. Sci. Food Agric*. **57**, 573-585.

Schonfeldt, H.C. and Pretorius, B. 2011. The nutrient content of five traditional South African dark green leafy vegetables – A preliminary study. *J. Food Compos. Anal*. **24,** 1141-1146.

Shils, M.E. 1998. In: *Handbook of nutritionally essential minerals* (O'Dell, B.L. and Sunde, R.A. Eds.), Marcel Dekker Inc., New York, USA, p. 117.

Sundarapandian, S.M., Amritha S, Gowsalya, L., Kayathri P, Thamizharasi M, Dar, J.A., Srinivas K., Gandhi D.S and Subashree K. 2016. Soil organic carbon stocks in different land uses in Pondicherry university campus, Puducherry, India. *Trop. Plant Res*. **3**, 10-17.

Steinmetz, K.A. and Potter, J.D. 1996. Vegetables, fruit, and cancer prevention a review. *J. Am. Dietetic Assoc*. **96**, 1027-1039.

Tambe S.S. and Kadam V.B. 2010, Determination of ash values of two endangered medicinal taxa of Marathwada Region. *J. Ecobiotech.* **2**, 25-28.

Robinson D.S. 1990. *Food biochemistry and nutritional value*. Longman Scientific and Technical Publisher, New York, USA.

Walker, C.I.B, Trevisan, G., Rossato, M.F., Franciscato, C., Pereira, M.E., Ferreira, J. and Manfron, M.P. 2008. Antinociceptive activity of *Mirabilis jalapa* in mice. *J. Ethnopharmacol.* **120**, 169-175.