Ethnobotany Survey on Potential Therapeutic uses of *Moringa stenopetala* among Traditional Healers of Southern Ethiopia

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ABSTRACT

Introduction: *Moringa stenopetala* (MS), known as Ethiopia cabbage tree, is an indigenous vegetable tree native to Ethiopia. There is scanty information on the actual therapeutic uses of the plant. For this, the present study aimed to assess the potential therapeutic uses of MS from traditional healers’ perspectives.

Methods: Pretested semi-structured questionnaire was applied to assess the nutraceutical potential of MS. The data was analyzed using IBM SPSS version 25. The findings were presented in descriptive tables and figures.

Results: Our results revealed that a total of 120 traditional healers with a mean age of 49.10 were recruited in the study. The majority of the participants 89(74.2%) were male and farmers 84(70%) by occupation and residents of Gamo Gofa Zone. All parts of MS have remarkable therapeutic uses. The leaf was highly accessed for nutrition. However, all parts of the plant were used to treat the common cold, malaria, asthma, hypertension, diabetes mellities, heart cases, kidney stone formation, purification of the uterus, gout, epilepsy, intestinal worms, liver dysfunction, pancreatitis, sexually transmitted diseases, urinary tract infections.

Conclusion: MS has a tremendous contribution to assure food and health security in the country. However, it has been given little research and development attention in the study area. Thus, appropriate measures should be done to overcome the growth constraints of the plant and to ensure full potential utilization.

Key Words: Ethiopia, Epilepsy, Liver dysfunction, Nutraceutical value, MS, Therapeutic use

INTRODUCTION

*Moringa stenopetala* (MS), commonly called Ethiopia cabbage tree, which belongs to the monospecific family *Morin-gaceae*, which comprises 14 species and is the most common edible species. It is a multipurpose tree originally native to the arid and semi-arid regions of the Horn of Africa, where it is grown in southern Ethiopia, Kenya, and eastern Somalia. In Ethiopia, the plant is widely distributed in the southwestern part of the country at an altitude range of about 350 to 1850 meters above sea level. The major hotspot areas include Gamo Gofa, Segen, and South Omo Zones of the southern regional state.

MS is a multipurpose nutritious vegetable tree with a variety of potential uses. The plant has remarkable morphological and biochemical variations which could contribute to its importance in nutraceuticals, agriculture, and medical applications. It is a multipurpose miracle tree with tremendous potential uses such as food for human beings, feed for livestock, medicine, dyes, perfume, skin lotions, lubricants, and water purification. Moringa leaves are nutritionally rich and an excellent source of concentrated proteins, vitamins, and minerals. In different parts of the Rift Valley of Ethiopia, the leaflets of moringa trees are used in the daily meal of the people. Leaflets are separated from the rachis, then stripped and plunged into boiling water with salt or sodium carbonate and cooked to be consumed as a vegetable combined with maize and sorghum flour to prepare the widely known local meals such as *kurkufa*, *fosessie*, and *shikerker*. It has also potential medicinal uses such as root bark is being used to kill different kinds of intestinal Worms, increase food appetite, protect abdominal constipation, cure for different kinds of respiratory diseases such as bronchitis and influenza and stem bark is being used to treat eye diseases,
and to decrease or neutralize the venom power of snake, bee, scorpion, and wasp. The leaves are also being used to cure wounds, to protect vomiting and facilitate digestion process, reduce hypertension, and solve diabetes, rheumatism, cold problems, goitre, liver, and pancreatic diseases. Notably, the smoke from burning roots are being used as a treatment for leprosy and the leaves are renowned for their effectiveness against diarrhoea.

The medicinal and nutritional values of MS are remarkable, particularly in Southern Ethiopia. Traditionally, the leaves are boiled as tea or chopped and mixed with water to cure malaria, hypertension, asthma, diabetes, stomach pain, and sometimes to expel retained placenta. The ethanol extract of the leaves has also shown a dose-dependent anti-leishmanial effect against Leishmania Donovan promastigotes. The plant has prolific in that has minerals, vitamins, fibre, quality, flavour, protein, antioxidants, flavonoids, alkaloids, and various phenolics. Thus, the plant is highly valued and has a range of high nutritional and medicinal values for the local community. Different parts of the plant are found to be effective against various types of diseases like diabetes, cancers such as lung, breast, stomach, prostate, pancreas, colon, and rectum, and hypertension. It has a precursor of a wide range of bioactive compounds with demonstrated antibiotic, anticancer, and antioxidant properties. In addition, the plant owns a natural resistance against drought, pests, and other biotic variables and it has the potential to survive in harsh conditions. Commonly, it is cultivated through seed germination followed by careful transplantation for better survival.

Due to its potential to survive in different harsh environments and be used as a food-secured nature-gifted plant, the lives of the southern nation depend on it. To utilize the plant to its full potential for longer periods, exploring the potential of the plant from the farmer’s mimic perspective is an ideal approach. However, data on the part used, method of preparation of remedies, and methods of application are also necessary since they all affect the nature and quantity of any biologically active compounds. This phenomenon suggests a need to conduct ethnobotanical research and to document the medicinal plants and the associated indigenous knowledge. Hence, intensive documentation of medicinal plants is of paramount importance to mitigate the erosion of indigenous knowledge of traditional medicine. To this end, the present research was initiated to assess the potential therapeutic uses of MS among traditional healers of southern Ethiopia.

**MATERIALS AND METHODS**

**Description of the study area**

The study was conducted in hot spot Moringa growing areas of Southern nations including three zones, namely: Gamo Gofa, Sengen Area, and South Omo areas of the southern regional state, Ethiopia. The geographic coordination of each site was recorded using GPS (Garmin 72H) and the study map was generated as shown in figure 1.

**Selection of Study participant**

The key informants were identified with the help of Kebele leaders and knowledgeable elders. 120 traditional healers from each collection site were included to obtain pertinent information on the therapeutic uses of MS in their respective areas, while less than 30 age groups were considered to determine the status of knowledge transfer from elders.

**Data collection**

Ethnobotanical data were collected between May to June 2018 on round trips made to the hot spot growing areas of MS. Accordingly, semi-structured interviewees, observations, and guided field walk with informants were employed to obtain ethnobotanical data. A total of 120 informants participated in the study. The key informants were selected purposefully with the help of local administrators and local elderly people from selected areas in Gamo Gofa, Segen, and South Omo Zones of Southern Ethiopia. Experienced traditional healers were recruited to obtain the necessary information through a data extraction tool prepared in English and translated to the local language Amharic. The tool contains different parts. These are i) Sociodemographic characteristics of the participant ii) plant description iii) therapeutics of the plant includes information regarding methods and conditions of gathering, preparation, part(s) used, diseases treated, the dosage used, route of application, iv) environmental constraints (growth constraints, and management methods).

**Data analysis**

The data obtained from the survey were analyzed through IMB SPSS version 25.0 and the result was presented in figures and tables.
RESULTS

Socio-demographic characteristics of the participants

120 traditional healers with a mean age of 49.10 were participated to collect data on the overall therapeutic use and management of M. stenopetala plants in their respective areas. The majority of the participants 89(74.2%) were male and farmers 84(70%) by occupation and residents of Gamo Gofa Zone. Most of them are un attendants of formal schools as shown in Table 1.

Nutraceutical applications of MS

Results suggested that M. stenopetala has a remarkable contribution to nutrition and medicine. Moreover, the ecological service of the plant and its parts is valued in the study area. Notably, all most all parts of the part were used either in food remedies or the treatment of different ailments.

Nutritional value of MS

Leaves and the plant were highly accessed for their nutritional value in the study area. cooking as cabbage 90(75%), mixed with other food supplements 14(11.7%), and boiled with water 16 (13.3%) were the common ways of utilization. The leaves of the plant are used for the preparation of traditional foods such as Kurkufa, fosissie, and shikrkere. The plant is particularly important as a human food because the leaves, which have high nutritional value, persist throughout the year, including the dry season when few other sources of green vegetables are available. The seed was used as a source of edible oil in the South Omo Zone of the southern regional state as shown in Table 2.

Table 1: Sociodemographic characteristics of the participants during the study season, 2017/18

| Variable    | Frequency | Percent |
|-------------|-----------|---------|
| Sex         |           |         |
| Male        | 89        | 74.2    |
| Female      | 31        | 25.8    |
| Occupation  |           |         |
| Farmer      | 84        | 70.0    |
| NGO         | 24        | 20.0    |
| Employer    | 11        | 9.2     |
| Merchant    | 1         | 0.8     |
| Resident    |           |         |
| Gamo Gofa   | 97        | 80.8    |
| South Omo   | 20        | 16.7    |
| Segen       | 3         | 2.5     |
| Educational Status |    |         |
| Un educated | 88        | 73.3    |
| Primary     | 24        | 20.0    |
| Secondary   | 8         | 6.7     |
| Total       | 120       | 100.0   |

Table 2: Mode of the utilization of different parts of MS as nutrition during the study period, 2017/18

| Mode of preparation | Frequency | Percent |
|---------------------|-----------|---------|
| Plant parts used for nutrition |           |         |
| Leaf                | 84        | 70.0    |
| Root                | 27        | 22.5    |
| Stem                | 7         | 5.8     |
| pod/seed            | 2         | 1.7     |
| Mode of preparation |           |         |
| raw eating          | 90        | 75.0    |
| cooking as vegetables | 13      | 10.8    |
| mixed with other food supplements | 14 | 11.7    |
| boiled with water and drink | 3   | 2.5     |
| Total               | 120       | 100.0   |

Medicinal values of MS

The majority of the participants applied either part of moringa for the treatment of different ailments such as common cold, malaria, asthma, hypertension, Diabetes mellites, heart cases, and kidney stone formation and purification of the uterus through repelling of the placenta. The mode of preparation is nearly the same in these study areas. These include making syrup, mixed with other medicinal plants, boiled as a tea, and chopped. The targets of the disease differ with plant parts. Notably, the leaves were boiled as tea or chopped and mixed with water to cure malaria, hypertension, asthma, diabetes, stomach pain, and sometimes to expel the retained placenta. In addition, the root has traditionally been used to expel snakes from homesteads, root smoke is used as a treatment for epilepsy, chopped and mixed with water are also used for treating severe cases of malaria. The result confirmed that moringa seed has promising medicinal values; including treatment of wound infections, kidney and liver infection, and sexually transmitted diseases. Purification of water is another use of seeds of moringa. The findings of the current study on pods and pods bark of moringa showed that the pods and associated parts of moringa have incredible medicinal values including treatment of stomach infection, kidney, and pancreas infection.
Table 3: Summary of actual medicinal values of different parts of MS among traditional healers of Southern Ethiopia, 2017/18

| Moringa part | Medicinal usage | Mode of application |
|--------------|-----------------|---------------------|
| Leaf         | For headaches, anaemia | Orally, chopping with water, Mixed with tea drink |
|              | To prevent bleeding |                     |
|              | For skin infections |                     |
|              | To prevent stomach pain and diarrhoea |                     |
|              | Inflammation of the ears and eyes |                     |
|              | For the health and quality of our eyes |                     |
|              | For bone and tooth health |                     |
|              | To regulate the amount of fat in the blood |                     |
|              | To regulate the amount of sugar in the blood |                     |
|              | To lose weight to fight bacteria |                     |
|              | For the health and strength of our skin |                     |
|              | To keep our liver and kidneys working properly |                     |
|              | To increase appetite |                     |
|              | Diseases of the heart and blood vessels | Chowing, Boiled with water and drink |
|              | To prevent the formation of kidney stones |                     |
|              | For homosexuality |                     |
|              | For acne and gout, crush the roots and use a mixture of salt |                     |
|              | For asthma, urination can help lower blood pressure and remove unwanted remnants of the uterus. |                     |
|              | For gout, epilepsy | Smoke, crushed and added into water |
|              | To purify contaminated water |                     |
| Root, Stem Bark | For sexually transmitted diseases, urinary tract infections | Syrup, chopped with water, Mixed with tea drink |
|               | Increases milk production for breastfeeding mothers | Syrup, mixed with water, boiled as a tea |
|               | For kidney and urinary tract infections as well as bladder infections |                     |
|               | Stimulates liver function |                     |
|               | For homosexuality |                     |
| Flower       | To get rid of the intestinal worms |                     |
|              | To cure liver and pancreatitis |                     |
|              | To cure acne and gout |                     |
|              | To correct the abnormal body system that results from malnutrition |                     |
| Seed         | For gout, epilepsy | Smoke, crushed and added into water |
|              | To purify contaminated water |                      |
|              | For sexually transmitted diseases, urinary tract infections |                      |
| Pod, Pod bark| To get rid of the intestinal worms | Syrup, mixed with water, boiled as a tea |
|              | To cure liver and pancreatitis |                     |
|              | To cure acne and gout |                     |
|              | To correct the abnormal body system that results from malnutrition |                     |

Ecological services of MS

The majority of the participants confirmed that MShas remarkable ecological services. These include prevention of soil erosion and increment of soil fertility, 56(46.7%), shelter for different organisms. MS including humans especially during the hot season 48(40.9%) and water and environmental purification 3(10.8%) as shown in table 4. Our findings highlighted the major production constraints of MSin the study area including Moringa moth 67(55.8%), water loading 40 (33.4), and biomass production (requiring large space for cultivation represented 10.8% of the participants as described in Table 4.

Table 4: Ecological value and production constraints of MS in Southern Ethiopia during the study period 2017/18

| Traits | Frequency | Per cent |
|--------|-----------|----------|
| Major production constraints | Moringa moth | 67 | 55.8 |
| | Water loading during the rainy season | 40 | 33.4 |
| | Biomass production (need for large space) | 13 | 10.8 |
| Intercropping crop of the plant | Coffee | 71 | 59.2 |
| | Maize | 31 | 25.8 |
| | Teff | 18 | 15.0 |
| | Total | 120 | 100.0 |
| Ecological importance of the plant | soil erosion protection | 56 | 46.7 |
| | shelter for different animals in the dry season | 48 | 40.0 |
| | Water and environmental purification | 13 | 10.8 |
| | ecological balance | 3 | 2.5 |
| Local market access for the plant product | Yes | 30 | 25 |
| | No | 55 | 45.8 |
| | Poor | 35 | 29.2 |
| is the plant fully utilized | Yes | 24 | 20.0 |
| | No | 96 | 80.0 |
| Total | 120 | 100.0 |

DISCUSSIONS

MS is used to alleviate malnutrition and improve human health and plays a vital role in the day-to-day life of any person. All parts of the plant have remarkable nutraceutical val-
ues with the predominant of its leaves. The leaf contains a high amount of vitamin C, which fights a host of illnesses including colds and flu; vitamin A, which acts as a shield against eye disease, skin disease, heart ailments, diarrhoea, and many other diseases; calcium, which builds strong bones and teeth and helps prevent osteoporosis; potassium essential for maintaining brain and nerves function and proteins. These leaves could be a great source of all essential nutrients and vitamins such as arginine and histidine, two amino acids especially important for an infant’s growth. Micronutrient content is even more in dried leaves; ten times the vitamin A of carrots, 17 times the calcium of milk, 15 times the potassium of bananas, 25 times the iron of spinach, and nine times the protein of yoghurt as one rounded tablespoon (8 g) of leaf powder will satisfy about 14% of the protein, 40% of the calcium, 23% of the iron and nearly all vitamin.

MS is used as a traditional medicine to treat different human ailments. These include anaemia, skin infections, anxiety, chest congestion, asthma, blood impurities, cholera, glandular, swelling, headaches, conjunctivitis, cough, diarrhoea, eye and ear infections, fever, abnormal blood pressure, hysteria, pain in joints, pimples, psoriasis, respiratory disorders, scurvy, semen deficiency, sore throat, sprain, tuberculosis, for intestinal, lactations, diabetes, 3,9,22. Besides its nutritional and medicinal applications, it is very useful as an alley crop in the agroforestry industry. It is useful not only for human beings but also for animals and in various industrial applications. Besides, the plant is processed into medicine contains acetone which can be prepared into a herbal formulation which is an effective anti-malaria bioagent. Such trees have the potential to be a source of new drugs. It is also an effective water clarifier for seed, thus providing millions of people with clean drinking water. MS leaves, pods, and roots are edible; and the seeds are powdered and used to purify water from muddy rivers. Its parts are actually and potentially useful to extract ingredients of medicinal value. It is truly known as “all in one” and mother’s best friend in rural parts of southern Ethiopia because it plays a vital role in the everyday life of many peasant farmers.

CONCLUSION

MS is drought-tolerance, fast-growing habits, high nutritional value, potential to alleviate malnutrition, and pharmaceutical barriers particularly in developing countries, and a multitude of other ecological uses. Despite the enormous economic and social values MS, has among the rural community in southern Ethiopia, it has been given little research and underutilization. Moringa moth is the major production constraint. Thus, appropriate measurements should be implemented to improve the productivity of plants.

Consent for Publication

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but the advancement of knowledge.

Availability of Data and Materials

The authors confirm that the data supporting the findings of this research are available within the request of the corresponding authors on a reasonable request.

Source of Funding

Arba Minch University founded this research and the founder has no role in study design, data collection, and management of all research activities.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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Authors’ Contribution

Authors are equally contributed to the research work and they approved the final version of the manuscript.

REFERENCES

1. Velazquez-Zavala M, Peón-Escalante IE, Zepeda-Bautista R, Jiménez-Arellanes MA. Moringa (Moringa oleifera Lam.): usos potenciales en la agricultura industrial y medicina. Rev Chap. Sci. 2016;22(2):95-116.
2. Bocarando-Guzmán MD, Rios-Corripio MA, Hernández-Cázares AS, Gómez-Merino FC, Servín-Juárez R. Characterization of the supply of moringa (Moringa oleifera Lam.) in Mexico. Agro. Prod. 2020;13(2).
3. Abuye C, Urga K, Knapp H. A compositional study of Moringa stenopetala leaves. East Afr Med J. 2003;80(5):247-252.
4. Fekadu N, Basha H, Meresa A, Dегu S, Girma B, Geleta B. Diuretic activity of the aqueous crude extract and hot tea infusion of Moringa stenopetala (Baker f.) Cufod. leaves for rats. J. Exp. Pharmacol. 2017;9:73.
5. Bedane TM, Singh SK, Selvaraj T, Negeri M. Distribution and
damage status of moringa moth (Noorda blitealis Walker) on Moringa stenopetala Baker (Cufod.) in Southern Rift Valley of Ethiopia. Journal of Agricultural Technology. 2013;9(4):963-985.

6. Edwards S, Tadesse M, Demissew S, Hedberg I. Flora of Ethiopia and Eritrea, Volume 2, part 1: Magnoliaceae to Flacourtiaceae. Addis Ababa, Ethiopia, and Uppsala, Sweden: The National Herbarium, Addis Ababa University. 2000.

7. Mekonnen Y, Gessesse A. Documentation on the use of Moringa stenopetala and its possible antileishmanial and antifertility effects. SINET: Ethio.J.Sci. tec. 1998;21(2):287-295.

8. Yisehk K, Solomon M, Tadelle M. Contribution of Moringa (Moringa stenopetala, Bac.), a highly nutritious vegetable tree, to food security in south Ethiopia: a review. Asian J Appl. Sci. 2011;4(5):477-488.

9. Debela E Tolera A. Nutritive value of botanical fractions of Moringa oleifera and Moringa stenopetala grown in the mid-Rift Valley of southern Ethiopia. Agrofor.Syst. 2013;87(5):1147-1155.

10. Duke JA. Moringaceae: Horseradish-tree, benzolive-tree, drumstick-tree, sohnja, moringa, murunga-kai, malunggay. Moringa: A multipurpose vegetable and tree that purifies water Int J Curr Res. Biosci. Plant Biol. 2017;4(8):52-66.

11. Desalegne FH, Ayele ZY, Wasse AE. Effect of tree age on nutritional, anti-nutritional, and proximate composition of Moringa stenopetala leaves in Southwest Ethiopia. Afr J Food Sci. 2019;13(7):129-134.

12. Ololo YF, Goroya KG. Determination of Heavy Metals in Young, Matured and Aged Leaves of Moringa setenopetala Tree Using Flame Atomic Absorption Spectroscopy in South Ethiopia. Phys Sci Int J. 2018:1-8.

13. Jiru D, Sonder K, Alemayehu L, Mekonen Y, Anjulo A. Leaf yield and nutritive value of Moringa stenopetala and Moringa oleifera accessions: Its potential role in food security in the constrained dry farming agroforestry system. Proceedings of Moringa and other highly nutritious plant resources: Strategies, standards, and markets for a better impact on nutrition in Africa, Accra, Ghana. 2006:16-18.

14. Tenaye A, Geta E, Hebana E. Multipurpose cabbage tree (Moringa stenopetala): production, utilization, and marketing in SN-NPR, Ethiopia. 2008.

15. Kumssa DB, Joy EJM, Young SD, Odee DW, Ander EL, Broadway MR. Variation in the mineral element concentration of Moringa oleifera Lam. and M. stenopetala (Bak. f.) Cuf.: Role in human nutrition. PloS one. 2017;12(4):175-8.

16. Hagos Z, Yirga Brhane M, Zenebe Teka M, Krishna Chaithanya K, Gopalakrishnan VK. Proximate analysis of the methanolic and aqueous leaf extracts of Moringa stenopetala. Drug Invent Today. 2018;10(12).

17. Udofia NE, Misoche OJ, Mworia M, William N, Apiri MG. Chemical Composition of Moringa oleifera Lam. and Moringa stenopetala Bac. Leaves from Kenya. East Afr Med J. 2003;60(5):247-252.

18. Němec P, Ungrová M, Alem S, Novák J, Habrová H. Biomass production of a young plantation of Moringa stenopetala (Baker f.) Cufod. and Moringa oleifera Lam. in southern Ethiopia. S Afr J Bot. 2020:463-470

19. Melesse A, Bulang M, Kluth H. Evaluating the nutritive values and in vitro degradability characteristics of leaves, seeds, and seedpods from Moringa stenopetala. J Sci Food Agric. 2009;89(2):281-287.

20. Al-Thobaiti S, Zeid A. Medicinal properties of Moringa (Moringa stenopetala): an overview. Global Jour Pharm. 2018;12(1):01-12.

21. Seifu E. Actual and potential applications of Moringa stenopetala underutilized indigenous vegetables of Southern Ethiopia: a review. Int J Res. agric 2015;3(4).

22. Mikore D, Mulugeta E. Determination of proximate and mineral compositions of Moringa oleifera and Moringa stenopetala leaves cultivated in Arbaminch Zuria and Konso, Ethiopia. Afr J Biotechnol. 2017;16(15):808-818.

23. Oliveira JTA, Silveira SB, Vasconcelos IM, Cavada BS, Moreira RA. Compositional and nutritional attributes of seeds from the multiple purpose tree Moringa oleifera Lamark. J Sci. Food Agric. 1999;79(6):815-820.

24. Govindarajan M. Mosquito larvicidal potential of medicinal plants. In: Herbal Insecticides, Repellents and Biomedicines: Effectiveness and Commercialization. Springer; 2016:25-61.

25. Melesse A. Comparative assessment on chemical composition and feeding values of leaves of Moringa stenopetala and Moringa oleifera using in vitro gas production method. Ethiop J Sci. technol. 2011;2(2):29-38.