

Promotion and Assessment of Socio-Economic Significance, Consumption Pattern and Indigenous Processing Practices of *Moringa Stenopetala* (Bak.F) Cuf at Benatsemay District of Southern Ethiopia

Research Article

Tamerat Gutema^{1*}, Belayneh Lamage² and Yidinekachew Alemayehu³

¹ Department of plant breeding, Southern Agricultural Research Institute, Jinka Agricultural Research Center, Ethiopia

² Southern Agricultural Research Institute, Jinka Agricultural Research Center, Natural resource Research Directorate, Agroforestry Research, Ethiopia

³ Southern Agricultural Research Institute, Areka Agricultural Research Center, Socioeconomic Research, Ethiopia

Received: June 01, 2023; **Accepted:** June 15, 2023; **Published:** June 16, 2023

***Corresponding author:** Tamerat Gutema, Department of plant breeding, Southern Agricultural Research Institute, Jinka Agricultural Research Center, Ethiopia

Copyright: © 2023 Tamerat Gutema, This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Moringa is miraculous trees are commonly used and among high value plants that belongs to the monogeneric family called Moringaceae which consists of 13 species and *Moringa stenopetala* is widely cultivated and distributed in the Southern Ethiopia. South omo zone is southwestern parts of Ethiopia have favorable agro-climatic conditions for cultivation of *moringa stenopetala* tree species. The objective of this study was to promote and assess a socio-economic significance, consumption pattern and indigenous processing practices of *moringa stenopetala* (Bak.f) Cuf in the area. Household interview followed by theoretical training with practical demonstration were carried out. Random sampling methods were used to select 80 agro-pastoralists, 4 kebele administrative and 4 DA's. Descriptive statistics was used for data analysis. The results showed that most of the households are illiterates. About 77.5% of respondents use *M. stenopetala* because the plant is easily available that means any poorer individual can buy the plant leaves in minimum cost or can get the plant from the back yard of any individuals. It was found that most of the local people use indigenous processing practices for leaf cooking but most of them did not know the *Moringa* leaf powder processing. The consumption status of *Moringa* was very low. About 6.25% of households were consuming *Moringa* as daily food. Therefore, training given on *moringa* processing and utilization will improve their consumption pattern in their daily diet. The finding showed that educational level of the households positively influences the consumption and indigenous processing.

Keywords

Consumption pattern; *Moringa stenopetala*; Processing; Promotion; Utilization

Introduction

Moringa is miraculous trees are commonly used and among high value plants that belongs to the monogeneric family called *Moringaceae* which consists of 13 species [1]. Among 13 *Moringa* species *M. stenopetala* is often named as African *Moringa* tree because it is native to southern Ethiopia, North Kenya and Eastern Somalia and is the most economically important species after *Moringa oleifera* [2,3]. It is smooth barked deciduous tropical plant and multipurpose tree with medicinal, nutritional, industrial and socioeconomic values [1].

Moringa stenopetala is widely cultivated and distributed in the Southern Ethiopia mainly in Gamo, Gofa, Wolayita, Konso, Burji, Sidama, Bale, Keffa, Borana, Debub Omo zones, Dherashe areas and the adjoining provinces [14]. In Gamo Gofa/Wolayita or Konso, immature leaves of *M. Stenopetala* are pan of the staple diet of the population [1]. The delicacy traditional meal among the population of Gamo Gofa/Wolayita is called "Fosses/Kurkurfa", which is prepared from the leaves of *M. stenopetala* and flour of maize/sorghum [5]. This miraculous tree has different name with respect to its ecological location, it is called Shiferaw in Amharic, Aleko/Halako in Gamo/Wolayita,

Shelchada in Konso people and Cabbage tree in English language [4,6].

Moringa stenopetala is fast growing tree well adapted to arid, semi-arid and semi-humid areas [7] It is quite drought tolerant and can grow at altitudes ranging from 390 to 2,200m above sea level, annual temperature ranging from 24-35°C can tolerate up to 48°C in the shade and survive light frost and annual rain fall ranging from 250-1500mm [2,7]. The Konso people intercrop *M. stenopetala* trees with agricultural crops in the country's marginally dry regions, and they use them as farm trees (home gardens) in South Ethiopia, where population density is nearly high [2]. In Southern Ethiopia, *M. stenopetala* is a multipurpose tree that is grown for agroforestry. It is used as living hedges (alley cropping) and windbreaks to slow down erosion. Occasionally, the trees are also used to partially shade crops like sorghum, and the leaves can also be utilized as green manure [7,8].

Moringa stenopetala is particularly significant as a human food because the leaves, which have high nutritional content, appear at the end of the dry season when few other sources of green vegetables are accessible [1,5]. Haleko leaves contain high contents of essential amino acids, protein, carbohydrates, minerals (Iron, Calcium and potassium) and vitamin (A, B and C) [1]. The micronutrient content in *Moringa* 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 yogurt) [1,9]. Compared to other fruit and vegetables rich in antioxidants, *moringa* has a high content of antioxidants [10]. It should be consumed either fresh or dry. Dried leaves can be stored for a long time and can be used regularly. So it is necessary to hygienically drying and processing of *Moringa* leaves for further uses. The fresh leaves are sold for vegetable use in the local markets in some part of the country, especially southern Ethiopia. The local peoples also use boiled leaves as tea and currently leaf powder and tea leaves were produced from this tree and available in the market through the country [11].

Moringa stenopetala is described as providing multifunction in nutrition through decrease hunger; improve health and human nutrition by supplying different food products as all parts of the tree are edible; it also described as Africa's solution to malnutrition and also called mothers' best friend [12]. A single plant of *M.*

stenopetala is able to support a large family for several years [4,5].

The seeds of *M. Stenopetala* contain edible oil and a good candidate of oilseeds like soybean, sunflower and cottonseeds that can be used for cooking and salad dressings [1,13]. Edible oil production from *Moringa* seeds have more advantageous than the conventional oilseeds in terms of oil content, costs and agronomic properties [14]. Besides, *M. Stenopetala* seeds have traditionally been used to purify turbid water in many tropical countries [15] like its asian counter parts *M. Oleifera* [16]. It was reported that *moringa stenopetala* seeds have better water purifying properties than *M. Oleifera* seeds [17]. Crude extracts from defatted seeds reported to exhibit antimicrobial effects [18,19] and thus could be used to preserve different food and non-food ingredients.

Despite of the importance of healthy life aspects and food security benefits of medicinal trees such as *Moringa* plants for human live, little is known about its uses and utilization processes in Ethiopia, Particularly in benatsemay woreda south omo zone, only the leafy part used in the form of cooked vegetable. Formal studies/training linking *Moringa* uses and processes of consumptions in various forms and as well its popularization is lacking in the area. As a result, there is a lot of awareness gap regarding with this precious tree cultivation, and its preparation for utilization in different value added food products. Therefore, the objectives of this study will be to asses' local farmers on *moringa stenopetala* uses and processing methods, to promote, popularize and improve public awareness on *moringa* processing for effective consumption, thereby to increase its production and utilization in the areas and to promote *Moringa* production and utilization in the area.

Materials and Methods

Description of the study area

The study was conducted on Benetsemay woreda (specifically: Luka, Alduba, enchete and Key afer), South Omo Zone, Southern Ethiopia. The Woreda lies between 5°1'–5°44' North and 36°23'–37°4' East, about 839 km from Addis Ababa. Elevations range from 567–1,800 m.a.s.l. With the average temperature ranging from 10.01° C- 27.5° C and the mean annual rain fall ranging from 400-1600 mm. All the metrological data a given above for the location are long term average.

Site and farmer selection

The training, survey and Demonstration were conducted in the area. Benetsemay woreda was selected purposively based on the area allocated for moringa stenopetala growing, number of moringa growers, accessibility and engagement in other research projects. Based on the above criteria 4 Kebeles (Luka, Alduba, Key afer and Enchete) from the Woreda were selected. Following the site identification, selecting the participating farmers at all sites was done. Selections of the farmers were based primarily on farmer’s land covered with moringa, production status and willingness to participate in the research.

Training: - Training manual was developed and practical training on processing and utilization of moringa stenopetala was given to 4 development agents, 4 Administrators and 80 model farmers comprising of 60 female and 20 male farmers.

Promotion: Promotional materials such as brochures on moringa usage, processing and preparation guidelines were prepared and distributed to farmers for promoting awareness about moringa utilization in the area.

Sampling Methods, Data Collection and Analysis

The study was carried out employing purposive sampling on four Moringa producing Kebeles of the benatsemay district of south omo zone in Southern Ethiopia. In order to have a fair representation of the study site, three stage sampling strategy was followed starting from Kebele, followed by village and household levels. Within the Kebeles, villages were purposively selected. Similarly, within the village random selection was employed to select target households. Finally, a total of 80 households, 20 from each of the four Kebeles were selected for the interview. In order to get general information about uses of *M. stenopetala* key informants were identified. A questionnaire was designed to collect information on households to address the objectives of the study. Identification of variables on Socio-economic characteristics of the households, knowledge and interest to produce moringa, purpose of growing moringa tree, consumption pattern and harvesting practices were included in the questionnaires. Both qualitative and quantitative data were collected using the questionnaire and analyzed using SPSS statistical software.

Results and Discussion

Socio-economic characteristics of the respondents

As indicated in Table 1, out of the total interviewed

farmers 75% of them are female and the rest 25% were male respondents. From the total respondents 71.25% were illiterate. This shows that most of the respondents had less information about the benefit of moringa. Education could assist the farmers by enabling him/her to be aware of the economic value of the Moringa crop, thereby enhancing their willingness to cultivate the crop not only for home consumption but also to generate income [20] Table 1.

Moringa Consumption Pattern

Reasons for Moringa consumption

As indicated in Table 2, in the study area 100% of the respondents know the plant as Haleko in the local language. This implies that the plant is familiar in the study area. As indicated in Table 2, 77.5% of the respondents use *M. stenopetala* because the plant is easily available that means any poorer individual can buy the plant leaves in minimum cost or can get the plant from the back yard of any individuals. About 30% of the respondents use the plants because of its nutritional value and 3.75% of respondents use the plant for medicinal value (for malaria treatment). This implies that some of the respondents are aware of the medicinal value of Moringa particularly for malaria treatment however; most of them use the plant without knowing the medicinal and nutritional value. The implication of this result is that majority of the respondents in the study area were not aware of these benefit of the plant. Besides these, they did not know other uses of

Table 1: Socio-economic characteristics of the respondent

Variables	Category	Frequency	Percentage (%)
Sex	Female	60	75
	Male	20	25
Level of education	Illiterate	57	71.25
	Primary school	16	20
	Secondary school	5	6.25
	College	2	2.5

Table 2:- Reason for moringa consumption

Reason for consumption	Frequency	Percentage (%)
For nutritional value	24	30
For medicinal value	3	3.75
It is easily available	62	77.5
Nutritional and medicinal purpose	18	22.5

Moringa like animal fodder, water purifying ability and oil content of Moringa seed. All of the respondent in study area do not process the Moringa leaf powder and store the Moringa and sell the Moringa leaf powder for consumers. This implies that most of the study area people do not know Moringa leaf powder processing and they do not use the processed products. Similar result was reported by [21] indicated that most of respondents do not know the Moringa leaf powder processing other than local leaf cooking Table 2.

As shown in the same Table, the local people use the plant for medicinal value. Some of the respondents use the plant to treat malaria, hypertension and diabetics condition. As the data obtained from interview the plant is used for many traditional medicines. It is used to expel retained placenta in humans and cattle. Similar study by [22] suggests that traditionally, *M. stenopetala* leaves are used to expel retained placenta from women and cows.

Frequency of moringa consumption as a food

As indicated in Table 3, the respondents of the study area use the plant in different pattern. About 6.25% of the respondents use the plant daily and 21.25% of the respondents use it twice a week, 38.75% of the respondents use Moringa as food weekly and 30% use it monthly and 3.75% of the respondents do not use the plant. Some people in the study area do not use the plant because of the negative perception of the plant in the area. That means they think that the plant is the food of economically low level people and they assume that it is the food of drought and hunger.

Cooking method of Moringa leaf in the study area

Fossese food making process

Fossese is the most often consumed food in the Dehub Omo area, according to my own observation and interview. Picking moringa leaves from the tree’s branches and adding them to boiling water were the first steps in making Fossese. After a few minutes of boiling, some water is filtered out. Maize flour was combined with a small amount of neutral water to create a dry dough-like consistency. The boiling Moringa leaf is then mixed with this dry, powdery batter. To fully combine the ingredients, add the chopped onion, garlic, pepper, and salt. The food is served for consumption at the end (personal communication and observation).

Table 3:- Frequency of moringa consumption

Consumption as a food	Frequency	Percentage (%)
Daily	5	6.25
Twice a week	17	21.25
weekly	31	38.75
Monthly	24	30
Never use	3	3.75

Table 4: Knowledge and interest to produce moringa plant in large

Attributes	Frequency	Percentage (%)
Knowledge on the marketability potential of the plant	68	85
Level of awareness on processing of moringa leaves into different food products	14	17.5
Level of awareness on the benefit of moringa for child nutrition and lactating women	9	11.25

Kurkufa

Kurkufa is the second most commonly consumed food in the study area. To make Kurkufa, Moringa leaves are picked from the branches and added to boiling water. Next, maize flour was mixed with water to make the dough, and the dough was shaped into a small ball and added to the boiling Moringa leaf. All ingredients were added after a few minutes and stirred thoroughly to make it uniform. It is then served for eating. It can be concluded that discarding a portion of the boiling water before adding the maize dough reduces the Moringa leaf’s nutrient content (personal communication and observation).

Kita be Haleko

Another often-consumed traditional meal in the research area is kita be Haleko. It was necessary to prepare the bread first for the final dish, “Kita Be Haleko,” which translates to “bread with Moringa leaf.” To make bread, water, and maize flour were combined to create a dough that was then folded into bread, or’ kita. To prevent burning while baking over a fire, the dough for “kita” was placed on hot baking clay called mitad and baked for about five minutes on each side. While the bread was baking, the Moringa leaves were picked using the same method described in the descriptions of the previous two recipes. After baking, the bread was placed alongside the Moringa

dish (Personal communication and observation).

Knowledge about other uses of Moringa and interest to produce moringa plant

As indicated in table 4, 100% of the respondents replied “No” for the question do you know benefit of moringa seed used for water purification. This indicated that in the study area people do not know about the water purification of the Moringa seed. In the same Table indicated that 85% of respondents have awareness on marketability potential of the plant whereas only 27.5% of the respondents have awareness on processing of moringa leaves into different food products. The moringa leaves eaten in study area only in the boiled form. This indicated that almost all respondents suggest that they do not process moringa leaves into powder and use for different food preparation. As we gathered information from interview the local people do not know the use of Moringa leaf powder for tea preparation. In addition, only 11.25% of the respondents have the awareness on the benefits of moringa for child nutrition and lactating women. This indicated that majority of people in the study area do not know about moringa based complementary food.

Harvesting of *Moringa stenopetala* leaves

In the study area, *M. stenopetala* produces leaf harvest after one year if vegetative propagated or after three years if raised from seed and gathered over a number of years. Farmers gather Moringa leaves whenever they require them for personal use or for sale. Thus, throughout the year, it is picked twice a month. However, it is heavily gathered during the dry months when there isn't another source of vegetables available in these places. When the tree is big enough, typically after about three years, the leaf harvest begins [23]. The leaves are gathered by utilizing a long pole with a sickle-like blade attached at the end of a wooden stick, and this task is primarily done by women and children. According to [23], which is consistent with the current finding, the leaves are collected by hand, using wooden sticks that have been hooked, or with a 2-2.5 m long stick that has an iron hook on one side (Shenqera). According to the information collected from the respondents, neither gender nor age has an impact on the responsibility of collecting leaves.

Conclusion

The following conclusions were drawn based on the findings of the study after data on the socioeconomic

importance, consumption trends, and indigenous processing methods of *Moringa stenopetala* were analyzed.

- The traditional food types (Kurkufa, Fosese, and kita be Haleko) are enjoyed by those who are economically less fortunate.
- All of the respondent in study area do not process Moringa leaf powder and store the Moringa and sell the Moringa leaf powder for consumers. This implies that most of the study area people do not know Moringa leaf powder processing and they do not use the processed products.
- Most of the consumers of Moringa are economically low level individuals and well educated people (people with awareness of Moringa benefit).
- Education or knowledge about Moringa is significant factors and positively influence the consumption of Moringa in the study area
- Local people use the plant for medicinal value. Some of the respondents use the plant to treat malaria, hypertension and diabetics condition.
- The local communities use *M. stenopetala* for food value; however they do not know other benefits (water purification, animal fodder and seed oil) of the plant.
- The local government plays a smaller role in raising public awareness of the cultivation and consumption of this wonder tree.

Recommendation

Based on the results of this investigation, the recommendations listed below were made.

- The traditional food types (Kurkufa, Fosese, and kita be Haleko) are enjoyed by those who are economically less fortunate.
- All of the respondent in study area do not process Moringa leaf powder and store the Moringa and sell the Moringa leaf powder for consumers. This implies that most of the study area people do not know Moringa leaf powder processing and they do not use the processed products.

- Most of the consumers of Moringa are economically low level individuals and well educated people (people with awareness of Moringa benefit).
- Education or knowledge about Moringa is significant factors and positively influence the consumption of Moringa in the study area
- Local people use the plant for medicinal value. Some of the respondents use the plant to treat malaria, hypertension and diabetics condition.
- The local communities use *M. stenopetala* for food value; however they do not know other benefits (water purification, animal fodder and seed oil) of the plant.
- The local government plays a smaller role in raising public awareness of the cultivation and consumption of this wonder tree.

Acknowledgements

The authors express their gratitude and thank for Southern Agricultural Research Institute (SARI) for financial support of the study. In addition, we extend our thanks for study participants who give response for interviews.

Authors' Contributions

TG: collected data, analyzed data and wrote research work, BL: conceived the research idea, designed the study, supervised research work, drafted the manuscript and reviewed the manuscript, YA: edited the manuscript. The authors read and approved the final manuscript.

Funding

This study was funded by Southern Agricultural Research Institute of Ethiopia

Reference

1. Hamza TA, Azmach NN. The miraculous Moringa trees: From nutritional and medicinal point of views in tropical regions. *Journal of Medicinal Plants Studies*. 2017; 5: 151-162.
2. <https://pubmed.ncbi.nlm.nih.gov/21786162/> ru D, Sonder K, Alemayehu L, Mekonen, Anjulo A. Leaf yield and nutritive value of Moringa stenopetala and Moringa oleifera accessions: Its potential role in food security in constrained dry farming agroforestry system. *Proceedings of the Moringa and other highly nutritious plant resources: Strategies, standards and markets for a better impact on nutrition in Africa, Accra, Ghana*.2006; 16-18.
3. Gebregiorgis F, Negesse T, Nurfeta A. Feed intake and utilization in sheep fed graded levels of dried moringa (*Moringa stenopetala*) leaf as a supplement to Rhodes grass hay. *Tropical Animal Health and Production*. 2012; 44: 511-517.
4. Yisehak K, Solomon M, Tadelle M. Contribution of Moringa (*Moringa stenopetala*, Bac.), a highly nutritious vegetable tree, for food security in south Ethiopia: a review. *Asian Journal of Applied Sciences*. 2011; 4: 477-488.
5. Abuye C, Urga K, Knapp H, Selmar D, Omwega AM, Imungi JK, Winterhalter P. A compositional study of Moringa stenopetala leaves. *East African Medical Journal*. 2003; 80: 247-252.
6. Eyasu Seifu. Physicochemical properties of moringa stenopetala (Haleko seed). *Journal of biological sciences*. 2012; 12: 197-201.
7. Assefa A, Emiru B, Tewodros T, Kiros MH. Moringa stenopetala Tree Species Improved Selected Soil Properties and Socioeconomic Benefits in Tigray, Northern Ethiopia. *Science Technology and Arts Research Journal*. 2015; 4: 68-78.
8. Schneemann J. Moringa (stenopelata) production and use for water purification in Ethiopia. Final Report Commissioned by ICCO Fair Climate Program in December. 2011.
9. Gemed Terfassa, Desta Negeyo. Pre-extension Demonstration of Moringa Preparation and Utilization Methods in East Shoa Zones of Oromia, Ethiopia. *Journal of Biomaterials*. 2020; 4: 17-22.
10. Yang RY, Tsou SC, Lee TC, Chang LC, Kuo G, Lai PY. Moringa, a novel plant rich in antioxidants, bioavailable iron, and nutrients. 2006.
11. Ghebreselassie D, Mekonnen Y, Gebru G, Ergete W, Huruy K. The effects of Moringa stenopetala on blood parameters and histopathology of liver and kidney in mice. *Ethiopian Journal of Health Development*. 2011; 25: 51-57.

12. Fuglie LJ. The Moringa tree a local solution to malnutrition. Dakar, Senegal. 2003.
13. Lalas S, Gortzi O, Tsaknis J. Frying stability of Moringa stenopetala seed oil. *Plant Foods for Human Nutrition*. 2006; 61: 93-102.
14. Nadeem M, Imran M. Promising features of Moringa oleifera oil: recent updates and perspectives. *Lipids in Health and Disease*. 2006; 15: 1-8.
15. Kalogo Y, Rosillon F, Hammes F, Verstraete, W. Effect of a water extract of Moringa oleifera seeds on the hydrolytic microbial species diversity of a UASB reactor treating domestic wastewater. *Letters in applied microbiology*. 2000; 31: 259-264.
16. Fahmi MR, Najib NWAZ, Ping PC, Hamidin N. Mechanism of turbidity and hardness removal in hard water sources by using Moringa oleifera. *Journal of Applied Sciences*. 2011; 11: 2947-2953.
17. Sharma P, Wichaphon J, Klangpetch W. Antimicrobial and antioxidant activities of defatted Moringa oleifera seed meal extract obtained by ultrasound-assisted extraction and application as a natural antimicrobial coating for raw chicken sausages. *International Journal of Food Microbiology*. 2020; 332: 108770.
18. Teshome D, Tiruneh C, Berihun G. Toxicity of methanolic extracts of seeds of Moringa stenopetala, Moringaceae in rat embryos and fetuses. *BioMed Research International*. 2021; 1-8.
19. Ketema P, Haji P. Multipurpose Cabbage Tree (Moringa stenopetala) Based Agroforestry Practice, Market Participation Decisions and its Impact on Farm Households' Welfare in Segen Hizboch Area Zone of Southern Ethiopia (Doctoral dissertation, Haramaya University). 2021.
20. Reta Azge. Consumption pattern and indigenous processing practices of Moringa stenopetala (Bak.f.) Cuf. : A case of Demba Gofa District in SNNPRS of Ethiopia. M.Sc.Thesis. Arba Minch University, Ethiopia. 2016.
21. Yalemtehay Mekonnen. "The multi-purpose Moringa tree: Ethiopia". 2003.
22. Birhanu L, Fitamo D. Socio-economic, cultural, food and Medicinal Significance of Moringa stenopetala (bak. f) cuf.: A case of Konso Special Woreda, Snnprs, Ethiopia. *research journal of Social Science and Managment*. 2015; 55-70.