

Pre-extension Demonstration of *Moringa* Preparation and Utilization Methods in East Shoa Zones of Oromia, Ethiopia

Gemeda Terfassa*, Desta Negeyo

Oromia Agricultural Research Institute, Adami Tulu Agricultural Research Center, Agroforestry Research Team, Batu (Ziway), Ethiopia

Email address:

gemedaterfassa@gmail.com (G. Terfassa), negayo.desta@gmail.com (D. Negeyo)

*Corresponding author

To cite this article:

Gemeda Terfassa, Desta Negeyo. Pre-extension Demonstration of *Moringa* Preparation and Utilization Methods in East Shoa Zones of Oromia, Ethiopia. *Journal of Biomaterials*. Vol. 4, No. 1, 2020, pp. 17-22. doi: 10.11648/j.jb.20200401.12

Received: February 6, 2020; **Accepted:** March 5, 2020; **Published:** August 27, 2020

Abstract: *Moringa* plants are among high value a tree belongs to Moringaceae family which consists of 13 species and they are highly distributed in Africa and southern Asia. Eastern Shoa zones of Oromia regional state in central part of Ethiopia have favorable agro climatic conditions for cultivation of *Moringa* tree species. However, there is a few numbers of local communities experiencing *Moringa* trees production and consumption in the area. Thus, the objective of this training and demonstration to promote, popularize and improve public awareness on *Moringa* on procedures of *Moringa* preparation for effective consumption and utilization in the areas. Household interview followed by theoretical training with practical demonstration were used for the demonstration. Random sampling methods were used to select 60 farmer households, 4 experts and 7 DA's. Descriptive statistics was used for data analysis. The results indicated that the interviewed farmers about 76% have no *Moringa* on their farm and as a result most of them cannot identify *Moringa* visually. Similarly, many local farmers have no trees on their garden, and almost all of them (84%) have no information about *Moringa* unless few farmers with a piece of information on its medicinal uses with little hint on its preparation and utilization techniques. Many of the farmers only use *Moringa* leaves when they sick, especially for blood pressure. However the farmers have a desire to plant *Moringa* trees where as 40% of have a worry to get *Moringa* seedlings availability to plant and they claimed that this causes absence of *Moringa* trees on our farm. About 40% of the respondents were stated that, they only use *Moringa* for medicinal purpose, and in the same way about 40% of them are not previously used *Moringa* at all, while the rest 20% of them used as both for its medicinal and food source for some food type supplementation. However, many locals have interested in getting *Moringa* trees to plant. Hence, Popularization of *Moringa* should have to get attention by concerned stakeholders, especially on organizing continuous seeds and /or seedlings sources for local communities.

Keywords: Miracle Tree, Nutrient Content, Farmers Research Group, Leave Powder, Drying Process, Healthy Leave

1. Introduction

Moringa plants are among high value trees, belongs to Moringaceae family which consists of 13 species and they are highly distributed in Africa and southern Asia. It is multi-purpose tree with medicinal, nutritional, industrial and socio-economic values [3]. These species of *Moringa* are widely distributed in the tropical regions especially *M. Oleifera* and *M. stenopetala* have wide geographic ranges. Considering their ecological nativities, *M. stenopetala* and *M. oleifera* often referred to as the African and Indian *Moringa* tree respectively. These two species have extraordinary nutritional and medicinal properties in various part of the world [6].

Moringa is one of the most useful tropical trees. The relative ease with which it propagates through both sexual and asexual means and its low demand for soil nutrients and water after being planted makes its production and management easy. Introduction of this plant into a farm which has a biodiverse environment can be beneficial for both the owner of the farm and the surrounding eco-system [1].

Moringa has lot of minerals that are essential for growth and development among which, calcium is considered as one of the important minerals for human growth. While 8 ounces of milk can provide 300–400 mg, *Moringa* leaves can provide 1000 mg and *Moringa* powder can provide more

than 4000 mg. Moring powder can be used as a substitute for iron tablets, hence as a treatment for anemia. Beef has only 2 mg of iron while *Moringa* leaf powder has 28 mg of iron. It has been reported that *Moringa* contains more iron than spinach [17]. A good dietary intake of zinc is essential for proper growth of sperm cells and is also necessary for the synthesis of DNA and RNA. *M. oleifera* leaves show around 25.5–31.03 mg of zinc/kg, which is the daily requirement of zinc in the diet [14].

Most plants lose their nutritive properties when processed. When compared, the nutritive content of raw, germinated and fermented *Moringa* seed flour, it was found that phytochemicals were higher in raw seed flour and amino acid content was at its peak in fermented and germinated seed flour. This can be a result of the biochemical activities during germination and microbial activity during fermentation. However, a study reviewed the effect of boiling, simmering and blanching to see the retention of nutrient content of *Moringa* leaves. Interestingly, boiling was the most effective of all the techniques as it reduced the cyanide, oxalate and phytate contents, more significantly than the other two methods. The presence of phytate and other anti-nutrients can reduce the bioavailability of certain nutrients and processing can hence be done for maximum utilization of required nutrients from the seeds and leaves [11]. Yang and his colleagues [16] reported that boiling increased the availability of iron and antioxidant content. Hence, the processed *Moringa* seed flour can be used to treat malnutrition problems. Gopalakrishnan and his coauthors [13] designed *Moringa* noodles by three methods of cooking noodles, sautéing, steaming and boiling.

Most people in the world lack adequate access to vegetables even though they are essential for good health. Insufficient vegetable and fruit consumption causes 2.7 million deaths annually worldwide and belongs to the top 10 risk factors contributing to mortality. Therefore it is necessary to increase the utilization of *Moringa* leaves consumption by the different communities. The micro-nutrient 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) [4]. 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 dry and process of *Moringa* leaves for further uses.

The *Moringa* tree grows widely in Africa, where, up until recently, it was used solely around houses to form hedges or to give shade. Occasionally it was used for medicinal purposes or collected for food. It is now becoming an emerging wonder plant of discourse at both home and market place. Therefore, it is being realized that there is need for more exploration on how *Moringa* utilization can become ubiquitous and common. In Africa, tamarind is widely available in arid and semi-arid regions. Senegal and Benin of African countries treat their children with *Moringa* who are deprived of breast milk. To augment milk production, the

lactagogue, made of phytosterols, acts as a precursor for hormones required for reproductive growth and are generally prescribed to lactating mothers. It is rich in stigma sterol, sitosterol and kampesterol the phytosterols which increase the estrogen production, resulting stimulates the proliferation of the mammary gland ducts to produce milk. 3 About 6 spoonfuls of *Moringa* leaf powder can meet a pregnant woman's daily iron and calcium requirement. *Moringa* is really referred as panacea and can be used to cure numerous diseases. It has long been used in herbal medicine by Indians and Africans [17].

Furthermore, *Moringa* plants have scavenging activities against oxidative radicals; this all implies its potential applications of bioactive principle in the pharmaceutical industries for drugs developments [8]. *Moring* trees have been used to combat malnutrition, especially among infants and nursing Mothers. One rounded tablespoon (8 g) of leaf powder will satisfy about 14% of the protein, 40% of the calcium, and 23% of the iron and nearly all the vitamin A needs for a child aged 1-3. Six-rounded spoonful of leaf powder will satisfy nearly all of a woman's daily iron and calcium needs during pregnancy and breast-feeding. Three non-governmental organizations in particular trees for life, Church World Service and Educational Concerns for Hunger Organization have advocated *Moringa* as "natural nutrition for the tropics." Leaves can be eaten fresh, cooked, or stored as dried powder for many months without refrigeration, and reportedly without loss of nutritional value. *Moringa* is especially promising as a food source in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce. Leaves were also used for food Fortification [2].

Despite their nutritious edible parts, *Moringa* spp. are sometimes classified as "famine food", consumed by humans at times of food scarcity [12]. Similarly, preliminary information indicates that the human dietary usage of the edible parts of these species is limited. For example, in southern Ethiopia (S. ETH), *Moringa* tends to be cultivated by communities living in marginal environments, with small land holdings due to high population density [6].

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 east Shoa zone of Oromia. Formal studies/training linking *Moringa* uses and processes of consumptions and as well its popularization is lacking in the area. However, the areas have favorable agro climatic conditions for cultivation of different medicinal plant varieties like *Moringa* tree species. Few numbers of local communities are experiencing *Moring* trees production and consumption in the area. As a result, there is a lot of awareness gap regarding with this precious tree cultivation, and its preparation for utilization. Therefore, the objectives this training were [1] to explore knowledge and perception of local farmers' on *Moringa* uses and preparation processes, [2] to promote, popularize and improve public awareness on *Moringa* on procedures of *Moringa* preparation for effective

consumption, thereby to increase its production and utilization in the areas and [3] to promote *Moringa* production and utilization in the area.

2. Materials and Methods

2.1. Description of the Study Area

Dude District is located in East Shewa Zone of Oromia Regional State. Geographically the District is located between 80 01'N to 80 10'North latitude and 380 31'E to 380 57'E longitude. The total area of the District is 959.45 km². The altitude of the District varies from 1600 meters to 2020 meters above sea level. The highest part of the District lies towards the West along the border of Gurage zone. Mount Bora is the highest peak of the District which is about 2020 meters above sea level. The average annual rainfall in the District was 671.8 mm in the past twenty years. In the past two decades the average maximum temperature of the District was 24.8°C and the average minimum temperature was 11.4°C. On average, this trend in temperature could be taken as suitable for crop production, animal husbandry and human habitation. Meki, the main capital of the District, is located 134 km to the South East of Addis Ababa on the main asphalt road to Ziway town.

Lumen district is located in East Shewa zone of the Oromia region, on a cross-road running from Addis Ababa to Djibouti, and Addis Ababa to southern part of Ethiopia. An old Ethiopia-Djibouti railway also crosses the District, which is located 70 km to the east of the national capital, Addis Ababa, and about 25 km to the west of Adami. It is located between 80 12' – 80 50' latitude north east and between 390 01' – 390 17' longitude east and has an altitude of 1500 – 2300 m asl. Ranges of rainfall and temperature are 700 - 800 mm and 18 - 28°C respectively (District Bureau of Agriculture and rural development, 2001 EC).

2.2. Techniques and Procedures Followed for *Moringa* Utilization Training

2.2.1. Farmer Selection

For this training two Districts, namely Dugda and Lume were selected randomly. Two kebeles (the smallest administrative units in Ethiopia) with 20 farmers (10 from each Kebele) (Bekele Girissa and Wolda Kalian) and (Joko Gudedo and Ejersa Joro) with 40 farmers (20 from each Kebele) were selected from Dugda and Lume district respectively using random sampling method.

2.2.2 Identification of Potential *Moringa* Tree Sites

Prior to standard *Moringa* utilization procedures, purposeful potential *Moringa* tree sites were identified. Then, young and old *Moringa* leaves were selected to make dried leaf powder of *Moringa* for effective *Moringa* nutrient contents consumption, and Morphology of leaf was identified as they are 20-70 cm long, grayish-downy when young, long petiole with 8-10 pairs of pinnae each bearing two pairs of opposite, elliptic or obovate leaflets and one at the apex, all

1-2cm long; with glands at the bases of the petioles and pinnae following [6]. Since *Moringa* leaves can easily lose moisture after harvesting; harvests were done in early morning and completed the initial phase of processing in the same day.

Generally the following procedures were performed following the above steps.

1. Selection of healthy leaves

Fungi like *Cercosporaspp* and *Septorialycopersic* causing brown spot in the leaves and further turning the leaves yellow and killing them. Apart from fungi, the most common pests on the leaves are grasshoppers, crickets and caterpillars [9]. Therefore diseased and damaged *Moringa* tree leaves were discarded, manually just after the collection of fresh leaves.

2. Washing

After we identified the health and potential biomass *Moringa* trees, we collect the leaf from the tree. Collected leaves were washed in running tap water until the removal of dirt. After this, leaves were soaked in 1% saline solution (NaCl) for 5 minutes to remove microbes. This step plays a substantial role in removal of dust, pathogens as well as microbes present on the leaf surface.

3. Draining

We wash the collected leaf and then we put it in the sun for short period of time until excess water removed by spreading the leaves in sunlight for a brief period till the removal of water present on the leaf surface.

4. Drying

It is estimated that only 20-40% of vitamin A will be retained if leaves are dried under direct.

Sunlight, but that 50-70% will be retained if leaves are dried in the shade. High temperature may lead down to the breakage of protein present in the leaves [5].

2.3. Data Management

Farmer's perception and feedback on the way of *Moringa* preparations and utilization was assessed. Photo and video was used during the demonstration. The assessment helps to get farmers feedback on *Moringa* use initiative as their food source and their interest to promote these trees on their farm.

2.4. Data Analysis

Descriptive analysis through (percentage, frequency, mean, range, and standard deviation) applied using IBM statistical package for social science SPSS version 20.0 for the data collected through household field survey.

3. Results and Discussion

3.1. Training Participants and FRG Establishments

Two farmers' research group /FRG/ containing ten (10) members in each (total of twenty farmers) were established in the two Kebeles from Dugda district (Bekele Girissa and) and trained on *Moringa* preparation and utilization. Similarly the training was given to farmer at Lume district. Accordingly, four FRG containing of 10 farmers members

containing of 40 farmers in a total at both kebeles (Joko Gudedo and Ejersa Joro) of the district were participated on training and demonstration at the district. In general 71 participants (60 farmers, 4 experts and 7 DA's) were trained and demonstrated on *Moringa* utilization and preparation method.

3.2. Demonstration of *Moringa* Leaves Powder Making

Shade dry is used for the drying process. Spread the leaflets on the sterile clean green net in a well-ventilated room. Mosquito mesh wire was used for this purpose because these materials give a space between the floor and the leaves. This room was checked as it is free from insect, rodent and dust. It is possible to use a fan, but the air must not be directly oriented towards the leaves, as it can increase contamination with germs in the air. Leaves were completely dried within 4 days. The loading density was tinny layer to allow air movement freely. Dried leafs was grinded by mortar and pestles for fine grinding. As it is recommended 0.5 mm – 1.0 mm pore size screen was used for the separation of the fine grinded leaf powder.



Figure 1. Drying of Moringa leaves on mesh ware.



Figure 2. Grinding of dried Moringa leave by mortar and pestle.

We use locally available materials for crushing of dried *Moringa*, because this materials is simple available for the community and thy also familiarly with it to use. So the people can make or prepare *Moringa* powder easy at their home and use by adding in to different food types. In this training, women's are more emphasized especially practical exercise more encouraged the women's, because, food preparation for children and for the whole family done by women and women use this *Moringa* during pregnancy and feeding women for themselves as supplementary food. Therefore this training is good opportunity for the woman and they also very happy with given training as the heard or learned new ideas about *Moringa* and the way of preparing it. The practical exercise includes: drying, grinding, sieving and making tea from the powder. As it indicated in the following

figure grinded *Moringa* was sieved by mesh wire prepared by locally available materials and the powder was used for tea and all participants were tested the tea (see the following figure). In addition to using by tea, the powder could also added to different foods and can be used in daily meals.



Figure 3. Sieving of the grinded powder of Moringa.





Figure 4. Drinking Moringa Tea.

3.3. Community Perception on Moringa Before the Demonstration

Prior to the theoretical and practical training, there was an assessment on community perception on Moringa utilization and preparation methods. The assessments on local farmers' familiarity to the Moringa use indicate that about 68% of the farmer respondents have different trees planted on their backyard, whereas the rest have no any plants on their land. This could be probably because of the lack of access to seedlings and shortage of the land they have. Among the interviewed farmers about 76% have no Moringa on their farm consequently most of them cannot identify Moringa visually. There are also some farmers having Moringa on

their land and consider themselves as they have no Moringa as a result of lack of knowledge about Moringa and lack of knowing it visually and inability to identify Moringa from other trees. This inevitability indicates that the training and demonstration was crucial for local farmers to improve their understanding on Moringa preparation and utilization because of the importance of the trees for nutrition as food supplementation and the medicinal uses for the health benefits. Similarly, many local farmers have no trees on their garden, and amazingly almost all of them (84%) of the respondents have no information about Moringa at all unless few farmers with a piece of information on its medicinal uses alone. Regarding the frequency of their Moringa uses many of the farmers only use it when they sick, especially for blood pressure. Through the given training they were surprised with importance of Moringa and the way of preparation, how to use, with what food type could be added. However the farmers have interested to plant Moringa trees however, about 40% of them said that, Moringa seedling is not available to them to plant and this factor causes absence of Moringa trees on our farm. Regarding with its advantage, about 40% of the respondents were stated that, they only use Moringa for medicinal purpose, and about 40% of them are not previously used Moringa totally, while the rest 20% of them used for both medicine and as food source for some food type supplementation.

Table 1. Response of farmers about Moringa.

Variable	Frequency%		
	yes	no	Not sure
Have you planted trees on your garden/on farm	68	32	
Have you Moringa on your farm	24	76	
Have you information about Moringa	84	16	
Can you identify Moringa from other trees visually	40	60	
Have you used Moringa before	36	64	
Do you believe in healing power of Moringa	52	16	32
Have you interest to plant Moringa	80	4	16
Have you access of Moringa seedling	8	52	40

3.4. Conclusions and Recommendation

3.4.1. Conclusions

Moringa tree contains remarkable nutrient contents that are really important for human kind with a great potential to heal many diseases. However, less attention was given to encourage communities' to Moringa production, preparation and utilization by concerned stakeholders and concurrently lack of information exists on Moringa uses and its preparation ways for utilization in society. As a result few numbers of local communities have culture of consuming Moringa trees and little Moringa potential benefits exploited is in the districts of East Shoa zone. Thus, improving local people awareness should have to be enhanced through effective training and demonstration.

3.4.2. Recommendations

Based on the training and demonstration, the following recommendations are suggested:

1) Attention should be given to make more familiarize

local peoples to Moringa production and utilization.

- 2) Popularization of *Moringa* should get attention by concerned local agricultural experts, especially for continuous seedlings sources for local communities and familiarizing them with standardized *Moringa* preparation and utilization techniques.
- 3) Further study is needed to identify Moringa utilization side effects.

References

- [1] Azharia, 2016. Moringa Seeds. Available at: <https://www.ahealthyleaf.com/product/moringa-seeds-pkml/>.
- [2] CSA-Fresh, L. and Produce, C. O., 2013. Community supported agriculture (CSA).
- [3] Hamza, T. A. and Azmach, N. N., 2017. The miraculous Moringa trees: From nutritional and medicinal point of views in tropical regions. *Journal of Medicinal Plants Studies*, 5 (4), pp. 151-162.

- [4] Mahatab, S. N., Ali, A and Asaduzzaman, A. H. M. (1987). Nutritional potential of sajna leaves in goats. *Live stock Advisor*, 12 (12): 9-12.
- [5] Martin, 2002. THE MORINGA TREE. Echo Technical Note. USA, (December), p. 4.
- [6] Morton, J. and Johnson, M. H., 1991. CONSPEC and CONLERN: a two-process theory of infant face recognition. *Psychological review*, 98 (2), p. 164.
- [7] Padayachee, A., Netzel, G., Netzel, M., Day, L., Zabaras, D., Mikkelsen, D. and Gidley, M. J., 2012. Binding of polyphenols to plant cell wall analogues—Part 2: Phenolic acids. *Food chemistry*, 135 (4), pp. 2287-2292.
- [8] Schaumberg, K. A., Antunes, M. S., Kassaw, T. K., Xu, W., Zalewski, C. S., Medford, J. I. and Prasad, A., 2016. Quantitative characterization of genetic parts and circuits for plant synthetic biology. *Nature methods*, 13 (1), pp. 94-100.
- [9] Singh, R. P., Shukla, M. K., Mishra, A., Kumari, P., Reddy, C. R. K. and Jha, B., 2011. Isolation and characterization of exopolysaccharides from seaweed associated bacteria *Bacillus licheniformis*. *Carbohydrate polymers*, 84 (3), pp. 1019-1026.
- [10] Zuberbier, T., Aberer, W., Asero, R., Bindslev-Jensen, C., Brzoza, Z., Canonica, G. W., Church, M. K., Ensina, L. F., Giménez-Arnau, A., Godse, K. and Gonçalo, M., 2014. The EAACI/GA 2 LEN/EDF/WAO Guideline for the definition, classification, diagnosis, and management of urticaria: the 2013 revision and update. *Allergy*, 69 (7), pp. 868-887.
- [11] Brockman, H., 2016. *Renewable chemicals and bioproducts: a potential for agricultural diversification and economic development*. Department of Agriculture and Food.
- [12] Formentini-Schmitt, D. M., Fagundes-Klen, M. R., Veit, M. T., Palácio, S. M., Trigueros, D. E. G., Bergamasco, R. and Mateus, G. A. P., 2019. Potential of the *Moringa oleifera* saline extract for the treatment of dairy wastewater: application of the response surface methodology. *Environmental technology*, 40 (17), pp. 2290-2299.
- [13] Glover-Amengor, M., 2015. *Moringa Oleifera Leaf supplementation on vitamin A Status of children in Ada-East District of Ghana* (Doctoral dissertation, University of Ghana).
- [14] Gopalakrishnan, L., Doriya, K. and Kumar, D. S., 2016. *Moringa oleifera*: A review on nutritive importance and its medicinal application. *Food science and human wellness*, 5 (2), pp. 49-56.
- [15] Oluwaniyi, O. and Bazambo, I. O., 2016. Nutritional and amino acid analysis of raw, partially fermented and completely fermented locust bean (*Parkia biglobosa*) seeds. *African Journal of Food, Agriculture, Nutrition and Development*, 16 (2), pp. 10866-10883.
- [16] Yang, R. Y., Tsou, S. C., Lee, T. C., Chang, L. C., Kuo, G. and Lai, P. Y., 2006. *Moringa*, a novel plant rich in antioxidants, bioavailable iron, and nutrients.
- [17] Udikala, M., Verma, Y. and Sushma, S. L., 2017. Phytonutrient and pharmacological significance of *Moringa oleifera*. *Int. J. Life. Sci. Scienti. Res*, 3 (5), pp. 1387-1391.