



Plant Archives

Journal homepage: <http://www.plantarchives.org>
DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2021.v21.no2.003>

VERSATILE PROFILE OF MORINGA AND ITS ROLE FOR GROWTH AS A FUNCTIONAL FOOD: A REVIEW

Prashant Kumar Srivastava*, Neetu Singh and Anukriti

Department of Foods & Nutrition, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow-226025, Uttar Pradesh, India

*Email: prashantks907@gmail.com

(Date of Receiving : 21-01-2021; Date of Acceptance : 10-04-2021)

ABSTRACT

"Drumstick" tree is native to India, usually mentioned in literature as MORINGA. *Moringa oleifera* is one of the most useful trees and it has an enormous number of benefits. All the recent research shows its multipurpose use. That is why it is cultivated across the tropical and subtropical regions of the world. Moringa has been used as a medicine since 150 B.C. by ancient kings and queens to ameliorate mental alertness and healthy skin. The Horseradish tree is one of the rich sources of vitamin A, B, C, D, E and K and it is also a good source of minerals like calcium, copper, iron, potassium, magnesium, manganese, and zinc. It also contains over 40 antioxidants that are naturally synthesized. Moringa is a very important food crop due to its high nutritive value, grows very fast, and it is also drought resistance. More than 80 countries (including India) use the tree's leaves, pods, seeds, bark, and flowers for their medicinal and nutraceutical properties to prevent mineral and vitamin deficiency, maintain a healthy cardiovascular system, regulate normal blood glucose levels, support the immune system, and have anti-inflammatory properties. Further, it neutralizes free radicals, which reduces the risk of cancer. It has potent benefits in reducing malnutrition, general weakness, menopause, depression and osteoporosis. It also contains antibacterial and anti-diabetics properties. It also improves eyesight, mental alertness and bone strength. The article with this review paper was keenly reviewed using an adapted version of established criteria to determine the adequate method for justifying the present aim of this study. This review paper will answer the following issues such as production, nutritional, functional property and utilization of moringa for human and animal consumption.

Keywords: Drumstick, *Moringa oleifera*, Nutraceutical, Medicinal, Cultivate, Vitamin.

INTRODUCTION

At the beginning, mankind used plants for their beneficial properties to cure or improve health conditions. In the last decade, many studies have been done on various plants according to their nutritional value for their therapeutic purpose, and it has led to discovering a newer and safer option for the treatment and fulfillment of nutritional and functional requirements at community level. *Moringa oleifera* is a plant which contains medicinal and nutraceutical properties. The scientific classification of *Moringa oleifera* is shown in table number: 01. *Moringa oleifera* is classified as tracheobionta in the kingdom Plantae. It is divided into divisions: spermatophyte and mag Moringa is native to India and India is its main producer. It's also popular in Ethiopia, Florida, the Pacific Islands, the Sedan Caribbean, the Philippines, South Africa, Asia, and America (Fahey *et al.*, 2005).

Scientific classification

Kingdome	:	Plantae
Sub-Kingdome	:	Tracheobionta
Super Division	:	Spermatophyte
Division	:	Magnoliophyte
Class	:	Magnoliopsida
Subclass	:	Differniidae
Order	:	Capparales
Family	:	Moringaceae
Genus	:	<i>Moringa</i>
Species	:	<i>oleifera</i>

According to research, the moringa family is divided into 33 species, with the most well-known being *M. arborea*, *M. borziana*, *M. concanensis*, *M. drouhardi*, *M. hildebrandtii*, *M. longituba*, *M. oleifera*, *M. ovalifolia*, *M. peregrina*, *M. pygmaea*, *M. rivae*, *M. ruspoli*. *Moringaoleifera* is found around the world with different

names, like in Latin-moringaoliefera, undefined Sanskrit-subhanjana, undefined Hindi-saguna, sanjna, Gujarati-suragava, Tamil-moringkai, Telugu- mulagana, munaga, Malayalam-murinna, sigru, Punjabi- sainjna, soanjna, Unani-sahajan, Ayurvedic-haritashaatikshnagandhaa, raktaka, akshiva, Arabian – rawag, French- moringe à graineailée, moring a, Spanish-Ángela, ben, moring a, Portuguese-moringa, moringueir o, Chinese- la ken, English-drumstick tree, Horseradish tree, ben tree etc. (Mishra *et al.*, 2013)

All parts of the *Moringa longituba* contain beneficial phytochemicals, which are used for medicinal and nutraceutical purposes. When we compared moringa with other foods, it has seven times (7×) more vitamin c than orange, ten times (10×) more vitamin A than carrot, seventeen times (17×) more calcium than milk, nine times (9×) more protein than yoghurt, fifteen times (15×) more potassium than banana, and twenty five times (25×) more iron than spinach (Asante *et al.*, 2014).

Importance of Moringa commercially and nutritionally

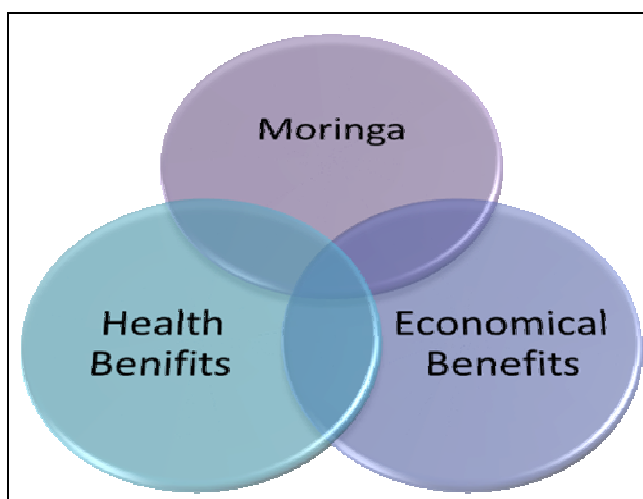


Fig. 1 : Importance of moringa commercially and nutritionally.

Moringa has been used to combat malnutrition in India and other countries such as Senegal and Benin due to its high nutritional value, which provides the body with high quality protein and minerals (Kasolo, 2010). It also provides economic benefits. It is grown commercially all over the world because it is easy to cultivate, grows quickly, and provides enormous benefits neutraceutically by generating a new product for the market, which helps farmers improve their economic conditions. *Moringa oliefera* contains phytosterols (e.g., stigmasterol, sitosterol, and kampesterol) that signal for hormones, those that increase estrogen production, and those that help start the proliferation of mammary gland ducts to secrete milk (Mutiaru *et al.*, 2013). According to a study done by Cohen-Zinder *et al.*, a significant increase in milk yield, milk fat and protein content is found in lactating cows offered *M. oliefera* in their diet (Cohen *et al.*, 2016). According to Nihad *et al.*, it was demonstrated in our study that when *Moringa oliefera* leaves were fortified with poultry food at 15 and 20% levels, it significantly increased the body weight and plasma biochemical level of broilers (Nihad *et al.*, 2016).

The article with this review paper was keenly reviewed using an adapted version of established criteria to determine the adequate method for justifying the present aim of this

study. This review paper will answer the following issues such as production, nutritional, functional property and utilization of moringa for human and animal consumption. In Figure no. 04 we clearly show the Moringa and its utilization pattern. The main objective of the review paper is

- To study Moringa as nutrient and medicinal profile
- To find out the efficacy as functional food
- To map out production and utilization pattern for promoting Moringa

The purpose of the study on Moringa was to show the health benefits, which made it a ‘miracle tree’ and it is a perfect example to show the goodness given by nature.

Geographical condition

Moringa longituba is native to the north Himalyan region of India (Leone *et al.*, 2015). The Horse raddish tree is easily grown naturally in other parts of India, Nepal, Bangladesh, etc. In Asia, it grows in South Africa, Egypt, West Africa, Brazil, the West Indies, Florida, and South America, Mexico, Peru, and Paraguay (Gupta, 2010).

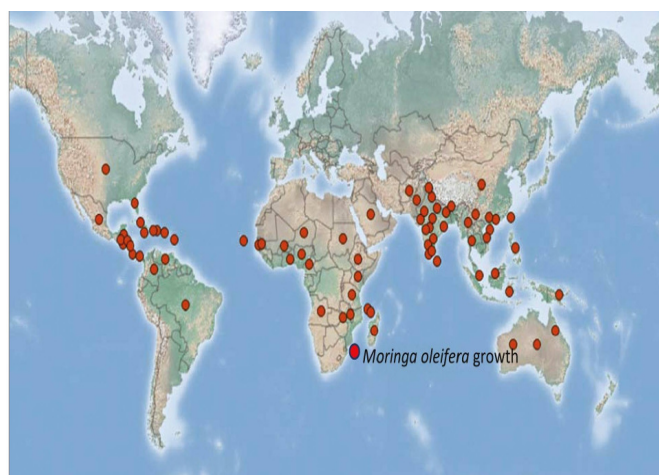


Fig. 2: Geographical distribution (<https://www.cabi.org/isc/datasheet/34868>)

In figure no. 03 we show the geographical distribution of Moringa around the world. When we compare moringa with other trees, it is a fast growing tree. It grows quickly and easily, reaching a height of 32 to 40 feet and a trunk diameter of 45 centimeters; full growth takes 6 to 8 months. In tropical and subtropical regions, moringa can grow at 25 to 35 °C. Normally, it grows in all soils but it prefers to grow effectively in sandy and loamy soil (slight alkali to slight acidic condition) and it requires rainfall for growth of around 250 to 3000 mm. Around the whole world, India is the largest producer of moringa (Leone *et al.*, 2015; Gupta, 2010; Fuglie, 2003) India produces around 1.1 to 1.3 million tonnes of moringa annually. (Parotta, 1993). It also grows naturally in West Bengal and close to Assam and India's peninsular states (Thurber, 2010). Soil and climate are critical for the growth of moringa, as they can have an impact on the nutritional value and durability of the plant. It shows that according to geographical condition, moringa nutrient content slightly changes. In Hawaii, 2010 *Moringa oliefera* grew commercially and scattered in different part of USA (Ted Radiovich C.V Elevitch *et al.*, 2011) it shows the importance of Moringa in future. *Moringa oliefera* gives goodness of nature, which makes it a “Miracle tree” (Yisehak *et al.*, 2011).

Nutritional profile of Moringa

Moringa is a storehouse of essential and non-essential nutrients and phytochemicals provided by nature. At the beginning, humans used moringa for its nutritional and medicinal purposes for maintaining health and reducing the risk of disease (Amaglo, 2006).

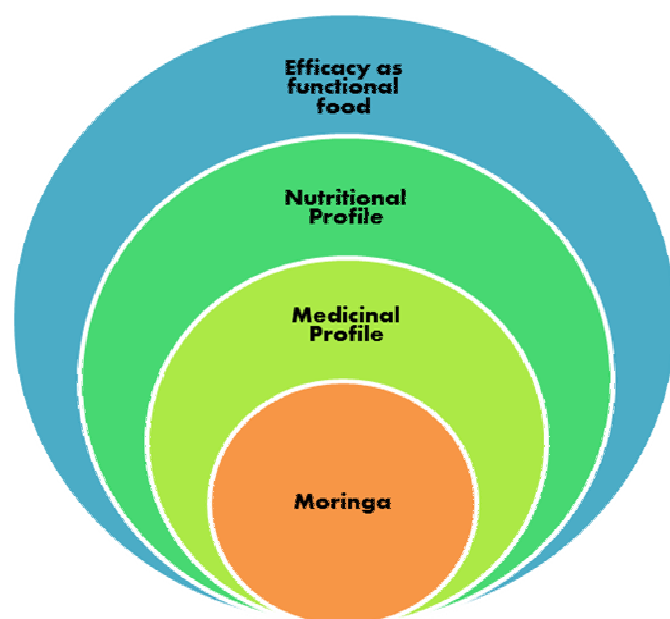


Fig. 3 : Moringa and its utilization pattern

Every part of the moringa contains a huge amount of beneficial compounds which further give medicinal and nutritional benefits. It is vital for humans and farm animals (Kou *et al.*, 2015). Leaves of *Moringa longituba* contain a high amount of protein, minerals, dietary fiber and vitamins. Moringa dry leaves contain seven times (7×) more vitamin C than orange, ten times (10×) more vitamin A than carrot, seventeen times (17×) more calcium than milk, nine times (9×) more protein than yoghurt, fifteen times (15×) more potassium than banana, and twenty five times (25×) more iron than spinach, four times (4×) more vitamin B than parch meat, six times (6×) more vitamin E than rapeseed oil, thirty six times (36×) more magnesium than egg and two times more protein than yoghurt/milk. *Moringa oleifera* also contains essential proteins that are not synthesized in our bodies, such as valine, lucine, isoleucine, histidine, and others, as well as amino acids containing sulfur). *Moringa oleifera* unripen pods contains enough amount of dietary fiber, which reduces the risk of constipation and it also reduces the transit time, which decreases the risk of colon cancer. It also reduces the obesity because it take in small amount, which fulfill all the nutritional requirement for daily life and it can also increase satiety value which also can reduce the risk of obesity (Mahmoud, 2010)

Nutritional Profile of *Moringa Oleifera*

Table 1: Nutritional Profile of *Moringa oleifera* (Source: Gopalakrishnan *et al.*, 2016 and Dhakar *et al.*, 2011, all values are in 100 g per plant material)

Nutrient	Constituent	Fresh leaves	Dehydrated leaves	Pods	Seeds
Macronutrient	Carbohydrate(g)	12.5	38.2	3.7	8.67
	Protein(g)	6.7	27.1	2.5	38.67
	Fat(g)	0.9	2.30	4.8	2.87
Micronutrient					
Mineral	Calcium(mg)	440	2003	30	45
	Phosphorous(mg)	70	204.0	110	75
	Iron(mg)	0.85	28.2	-	5.3
	Magnesium(mg)	42	368	635	24
Vitamins	Thiamin(mg)	0.06	2.64	0.05	0.05
	Riboflavin (mg)	0.05	20.5	0.07	0.06
	Niacin (mg)	0.8	8.2	0.2	0.2
	Ascorbic acid (mg)	220	17.3	120	4.5
	Tocopherol (mg)	448	-	-	751.67

In the new era of technology, "Hunger" is one of the serious issues which all countries are facing in the world. According to a new UNICEF/WHO/World Bank analysis, India is ranked 94th out of 107 countries in the GHI (Global Hunger Index), trailing only Bangladesh and Ethiopia. India was ranked 102nd out of 119 countries last year. Hunger is

directly associated with malnutrition, which is a major serious issue in developing countries like India. Moringa can help to overcome the hunger and malnutrition problem. *Moringa oleifera* is easily and cheaply available for those people, who can not afford high protein and minerals in their daily diet to fulfill the nutrient requirement.

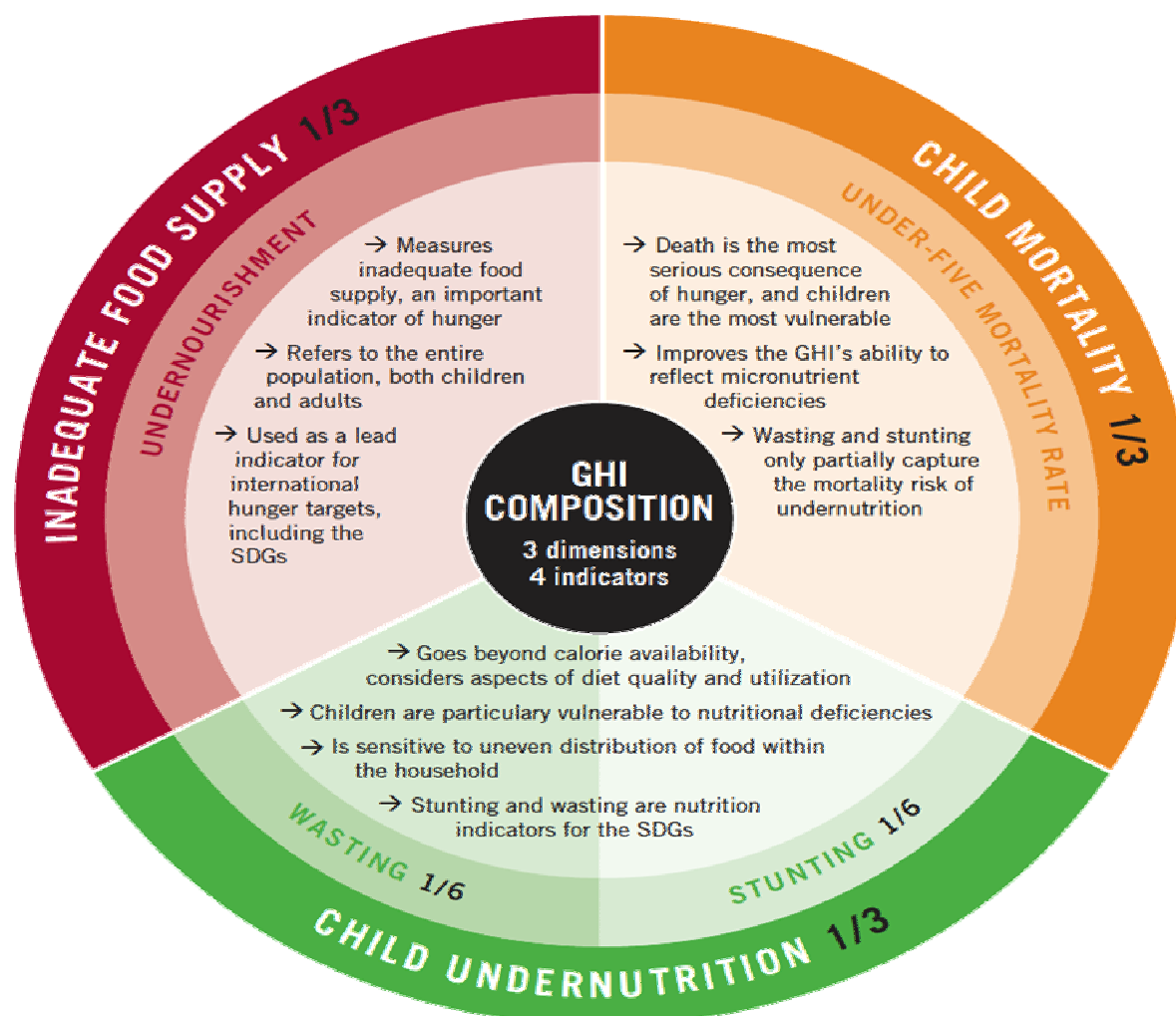


Fig. 4 : Source: Wiesmann *et al.* (2015).

Moringa oleifera is one of the great sources of linoleic acids, linolenic acids, palmitic acid, which are essential fatty acids (Machado *et al.*, 2010). In the future, *Moringa oleifera* seed oil could be used instead of olive oil, which is found on the market at a very high cost. Dry leaves of drumstick tree can also be used as a substitute for iron tablets for the treatment of anemia because they contain 14 times more iron than beef (Mbikay, 2012). *Moringa* can reduce the risk of the anemia disease naturally without the use of any synthetic supplement. *Moringa oleifera* is one of the important sources of zinc, which is also essential for good growth of sperm cells and zinc is also an important source for the synthesis of DNA and RNA. Drumstick leaves contain zinc 25.5 to 31.03 mg per kg (Fuglie, 2005) *Moringa oleifera* is high in PUFAs, which can help control bad cholesterol and lower the risk of cardiovascular disease by lowering LDL cholesterol (Barminas, 1998). According to Ymeogo, dry leaves of *Moringa oleifera* leaves contain 27.2% protein, 17.1% fat, 5.9% moisture and 38.6% carbohydrates. According to Anwar and Rashid's research, *Moringa* pods seeds contain 34.80% ether extract, 31.65% protein, 7.54% fiber, 8.90% moisture, and 6.53% ash (Lalas, 2002).

Traditional use for human consumption

Moringa pods can be eaten raw or cooked as a vegetable in soups, stews, and curries. The young pods are nice, have very little amount of fiber, and can be cooked and eaten like green beans. The root may be dried and ground to use as a spice. The leaves of *moringa* can be eaten as salads,

boiled, fried, or used to season soups and stews. When the seeds are fresh, they can be harvested and boiled or fried like peas, roasted and eaten like peanuts, or ground into a powder for use as a dressing. *Moringa oleifera* flower and buds can be eaten by mixing them in different traditional dishes. Flowers can also be used to make tea. The resin from the trunk of the tree is useful for thickening sauces.

Medicinal benefits of Drumstick

In India and Africa, *moringa* is used traditionally as an herbal medicine and it can cure more than 300 diseases. *Moringa* is a plant that contains both essential and non-essential phytochemicals, making it an effective medicinal agent. In this section we review the medicinal importance of *Moringa*. Various parts of the *moringa* (leaves, flower, pods, seeds, root bark) contain large amounts of beneficial compounds that have anti-inflammatory, anti-cancerous, anti-diabetic, cholesterol lowering, and anti-microbial properties. Leaves can cure various types of disease like asthma, hyperglycemic, dyslipidemia, flu, heart burn, syphilis, malaria, pneumonia, diarrhea, headaches, eye and ear infection and it also reduces the risk of blood pressure and cholesterol. It is also as an anticancer, antimicrobial, antioxidant, anti-diabetic agent. Flavonoids found in *Moringa* leaves have anti-cancer and anti-diabetic properties. Isothiocyanate is an anticancer agent which is found in leaves. Leaves contain flavonoids (eg. Quercetin), which also act as an anti-proliferation agent. *Moringa* leaves also contain a high amount of vitamins and minerals, which boost our

immune system (Rockwood, 2013). Horseradish seeds can treat hyperthyroidism and Crohn's disease, and they also have antimicrobial and antiviral properties. It contains pterygosperrin, which is responsible for antimicrobial activity of Moringa seed. It can also cure antiherpes simplex virus arthritis, cramps and other sexually transmitted diseases. Moringa seeds also contain anti-inflammatory agents like flavonoids (Mbikay, 2012). Moringa root bark antiulcer, anti-inflammatory agent and cardiac stimulating agent. The alkaloid present in bark acts as an antiulcer agent, cardiac stimulant and also relaxes muscles (Ijarotimi *et al.*, 2013). Many studies show that the flower of moringa contains anti-arthritis, hypocholesterolemic compound and it also helps to treat urinary and cold problems (Choudhary *et al.*, 2013). Moringa pods are rich in dietary fiber and essential fatty acids. The presence of essential fatty acids (PUFA) in pods used to treat obesity in obese people and dietary fiber can aid in the treatment of diarrhea, liver and spleen problems, and joint pain.

Conclusion and Future perspectives

In this paper previously mention it nutritional and medicinal property which made it "Miracle Tree". This tree not only gives medicinal and nutritional benefits, it also gives economic benefits. In the future, *Moringa oleifera* will have an important role. In poor countries, malnutrition, poverty, hunger, disease, and unemployment are the biggest issues. We have to promote the cultivation of moringa, which helps to overcome all these problems. Many studies have proven that all parts of the *Moringa oleifera* contain beneficial compounds in excellent proportion. *Moringa oleifera* is a fast growing drought resistance tree, which contains high amounts of phytochemicals. It is a good alternative to providing good nutrition at a low price and it can also be used to cure and prevention of lots of diseases. *Moringa oleifera* is a plant which is inexpensive and easy to cultivate in a wide range of regions across the world with different soil conditions. So, we need to develop and design new units in poor malnutrition countries by creating a market for moringa, which provides dual profits: first, they help fight malnutrition in poor countries and second, they provide economic support by providing employment, which aids in the fight against hunger and poverty.

Also, we can create a moringa fortified products, which can also easily increase the availability in the market at lower price. In this review paper we show all the medicinal and nutritional property of the drumstick tree, we also highlight the economic importance which also create new options for the farmer to create self-employment in the agricultural area. "Miracle plant" *Moringa oleifera* truly suggested, that have enormous benefits for humankind and it also should be taken as "Goodness of Nature" at very low price.

REFERENCES

- Alfarra, S.R.; Yusoff, M.M. and Rahman, M.L. (2015). Environmentally Friendly Biosorbent from *Moringa oleifera* Leaves for Water Treatment. *IJESD* 6: 165-169.
- Anwar, F.; Latif, S.; Ashraf, M. and Gilani, A.H. (2007). *Moringa oleifera*: a food plant with multiple biochemical and medicinal uses. *Phytother Res.*, 21: 17-25.
- Arora, D.S.; Onsare, J.G. and Kaur, H. (2013). Bioprospecting of *Moringac* (Moringaceae): Microbiological perspective. *J Pharmacog and Phytochem* 1: 193-215.
- Asante, W.J.; Nasare, I.L.; Tom-Dery, D.; Ochire-Boadu, K.; Kentil, K.B. (2014). Nutrient composition of *Moringa oleifera* leaves from two agro ecological zones in Ghana, *African J. Plant*, 8: 65-71.
- Barminas, J.T.; Charles, M.; Emmanuel, D. (1998). Mineral composition of non-conventional leafy vegetables, *Plant Foods Hum. Nutr.* 53: 29-36.
- Choudhary, M.K.; Bodakhe, S.H. and Gupta, S.K. (2003). Assessment of the antiulcer potential of *Moringa oleifera* root-bark extract in rats, *JAMS J. Acupunct. Meridian Stud.* 6: 214-220.
- Cohen-Zinder, M.; Leibovich, H.; Vaknin, Y.; Sagi, G.; Shabtay, A.; Ben-MEIR, Y.; Nikbachat, M.; Protnik, Y.; Yishay, M.; Miron, J. (2016). Effect of feeding lactating cows with ensiled mixture of *Moringa oleifera* wheat hay and molasses, on digestibility and efficiency of milk production. *Anim. Feed Sci. Technol.*, 211: 75-83.
- Dahot, M.U. (1988). Vitamin contents of flowers and seeds of *Moringa oleifera*. *Pak. J. Biochem.* 21: 21-24.
- Dakar, S.; Ashfaq, M.; Basra, S.M.A. and Ashfaq, U. (2012). *Moringa*: A miracle plant of agroforestry. *J Agriculture and Social Science* 8: 115-122.
- Duke, J.A. (1987). Moringaceae: Horseradish- tree, benzolive - tree Drumstick-tree, sohnja, moringa, murunga-kai, malunggay, p. 19 -28. In: Bengé M (ed.)
- Fahey, J.W. (2005). *Moringa oleifera*: A review of the medical evidence for its nutritional, therapeutic and prophylactic properties. *Trees for Life Journal*; 1: 5
- Fuglie, L.J. (2003). The *Moringa* trees a local solution to malnutrition.
- Fuglie, L.J. (2005). The Moringa Tree: A local solution to malnutrition Church World Service in Senegal.
- Fuglie, L.J. (2005). The Moringa Tree: A local solution to malnutrition Church World Service in Senegal.
- Fuglie, L.J. (2005). The Moringa Tree: A local solution to malnutrition Church World Service in Senegal, 2005.
- Gupta, R.K. (2010). Medicinal and aromatic plant, CBS publisher and distributor, 151-152.
- Ijarotimi, O.S.; Adeoti, O.; Ariyo, O. (2013). Comparative study on nutrient composition, phytochemical, and functional characteristics of raw, germinated, and fermented *Moringa oleifera* seed flour, *Food Sci. Nutr.* 1: 452-463.
- Jung, I.L. (2014). Soluble extract from *Moringa oleifera* leaves with a new anti-cancer activity, *PLOS ONE*, 9: 1-10.
- Kasolo, J.N.; Bimenya, G.S.; Ojok, L.; Ochieng, J.; Ogwalokeng, J.W. (2010). Phytochemicals and uses of *Moringa oleifera* leaves in Ugandan rural communities, *J. Med. Plants Res.*, 4: 753-757.
- Koul, B. and Chase, N. (2015). *Moringa oleifera* Lam.: Panacea to several maladies. *Journal of Chemical and Pharmaceutical Research* 7: 687-707.
- Lalas, S. and Tsaknis, J. (2002). Characterization of *Moringa oleifera* seed oil variety Periyakulam-1, *J. Food Compos. Anal.* 15: 65-77.
- Mahmoud, K.T.; Mugal, T. and Haq, I.U. (2010). *Moringa oleifera*: a natural gift- A review *J Pharm Sci Res.*, 2: 775-781.

- Mahmoud, K.T.; Mugal, T. and Haq, I.U. (2010). *Moringa oleifera*: a natural gift- A review. *J Pharm Sci Res.*, 2: 775-781.
- Mbikay, M. (2012). Therapeutic potential of *Moringa oleifera* leaves in chronichyperglycemia and dyslipidemia: a review, *Front. Pharmacol.* 3: 1–12.
- Mbikay, M. (2012). Therapeutic potential of *Moringa oleifera* leaves in chronichyperglycemia and dyslipidemia: a review, *Front. Pharmacol.* 3: 1–12.
- Mishra, G. *et al.* “Traditional uses, phytochemical, pharmacological properties of moringa plant, *Scholars Research Library*, 3(2): 141-164.
- MutiaraTiti, T.; Estiasih, E.S.W. (2013). Effect lactagoguemoringa leaves (*Moringa oleifera* Lam) powder in rats, *J. Basic Appl. Sci. Res.*, 3: 430–434.
- Nadkarni, K.M. “Indian MateriaMedica” Bombay popular Prakashan volume 1, page No. 811.
- Nihad, A.A.; Alnidawi, Hanaa, F.M.; Ali, S.; Abdelgayed, S.; Fatma, A.A.; Farid, M. (2016). *Moringa oleifera* Leaves in Broiler Diets: Effect on Chicken Performance and Health, *Food Science and Quality Management*, 58: 2016.
- Rockwood, J.L.; Anderson, B.G.; Casamatta, D.A. (2013). Potential uses of *Moringa oleifera* and an examination of antibiotic efficacy conferred by *M. oleifera* seed and leaf extracts using crude extraction techniques available to under-served indigenous populations, *Int. J. Phytotherapy Res.* 3: 61–71.
- Sánchez-Machado, D.I.; Núñez-Gastélum, J.A.; Reyes-Moreno, C.; Ramírez-Wong, B.; López-Cervantes, J. (2010). Nutritional quality of edible parts of *Moringa oleifera*, *Food Anal. Methods*, 3: 175–180.
- Thurber, M.D. and Fahey, J.W. (2010). Adoption of *Moringa oleifera* to combat under-nutrition viewed through the lens of the diffusion of innovations theory, *Ecol. Food Sci. Nutr.*, 48: 1–13.
- Yisehak, K.; Solomon, M. and Tadelle, M. (2011). Contribution of *Moringa (Moringa stenopetala, Bac.)*, a Highly Nutritious Vegetable Tree, for Food Security in South Ethiopia: A Review. *Asian J. Applied Sciences*, 4: 477-488.