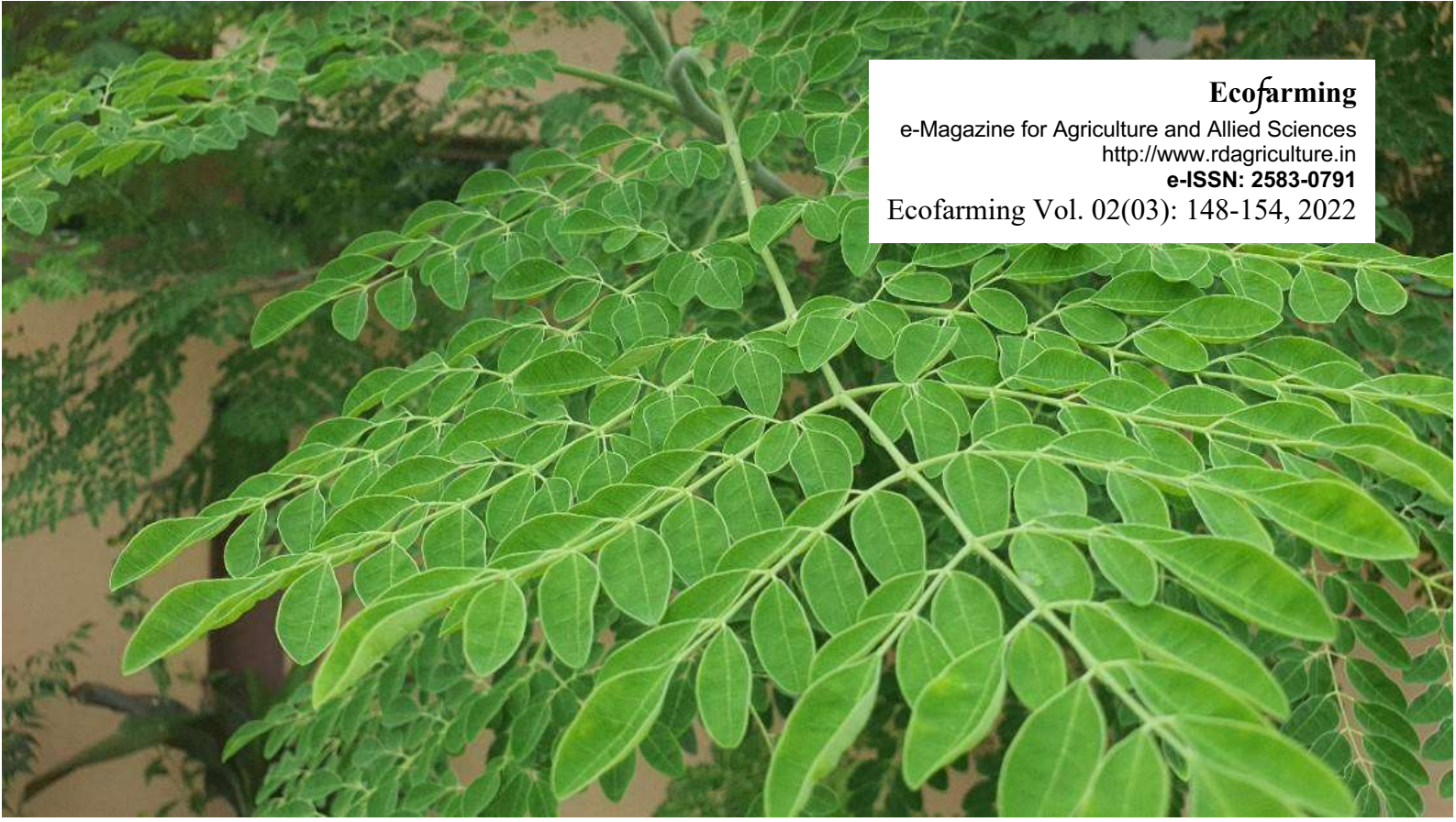


Ecofarming
e-Magazine for Agriculture and Allied Sciences
http://www.rdagriculture.in
e-ISSN: 2583-0791
Ecofarming Vol. 02(03): 148-154, 2022

Drumstick

A multipurpose and nutritive vegetable: Boon to the farmer

Rahul Kumar Verma[1], R.B. Verma[2], Vijay Kumar[3], Umesh Verma[4], S.P. Vishwakarma[5], Rajesh Kumar[6] and Shivam Singh[7]

[1]SMS, Krishi Vigyan Kendra, Madhepura, BAU, Sabour, Bhagalpur, Bihar
[2]Department of olericulture and floriculture, BAU, Sabour, Bhagalpur,

[3]Nalanda College of Horticulture, Noorsarai-803113, BAU, Sabour, Bhagalpur, Bihar
[4]DRMLAU, Ayodhya (U.P.)
[5]IRS, Madhepura (Bihar)

[6]Department of Horticulture, Sikkim University, 6 mile, Gangtok, Sikkim
[7]Department of Soil Science, SVPUA&T, Meerut (U.P.)

Received: June 22, 2022; *Revised:* June 24, 2022 *Accepted:* June 24, 2022

Introduction

Moringa oleifera Lam. commercially, a medium-sized tree is grown mainly for its pods, leaves and seeds. Moringa oleifera also referred as the horseradish tree, drumstick tree, Ben oil tree, miracle tree, and Mother's Best Friend, is known for its multi-purpose characteristics, wide adaptability, and ease of establishment.

Fig: Drumstick plant at KVK, madhepura

Any part of the tree, with its high nutritional values, is ideal for both dietary and marketable purposes. The leaves are rich in minerals, vitamins and other plant chemicals that are important. Leaf extracts are used to treat under nourishment and to get better breast milk in lactating mothers. It is used as an antioxidant, anticancer, anti-inflammatory, anti-diabetic and anti-microbial agent. M. oleifera seeds, a natural coagulant, are commonly used in the treatment of water. It is recognized in India, for instance, by different names in different languages: Soanjna (Hindi) Shigru (Sanskrit), Sohanjna (Punjabi), Murungai (Tamil), Sajna (Bengali) and Murinna (Malayalam). For human and animal consumption, the leaves, seeds, roots, flowers and pods of the Moringa are acceptable (Leone et al., 2016). It is used as a potential antioxidant, anti-cancer, anti-inflammatory, anti-hyperglycemic, anti-diabetic and antimicrobial agent (Abdull Razis et al., 2014; Arora et al., 2013). It is used in conventional and functional foods and also has a beneficial effect on digestion and is capable of preserving foods. Moringa is grown as a semi-arid crop all over the world. Each part of the Moringa tree has been used as a medicine and food product, which has gained tremendous attention as the 'tropical natural nutrition'. Moringa flowers provide a valuable source of nectar for honey bees with a subsequent increase in crop production through improved pollination. The seed is used in water purification due to its coagulant chemical properties similar to Aluminium sulphate. Moringa seed also lowers bacterial levels in drinking water since it has bactericidal properties. That concurs with WHO confirmed that dried and crushed seeds of Moringa lower concentration of bacteria and fungi in muddy and turbid water, making it suitable for drinking. The Sudanese Oleifera tree (Rawag) showed that the moisture content was 74.42 percent, 16.7 percent protein, 3.5 percent fiber, 8 percent ash and 1.7 percent oil. Furthermore, the mineral content was measured and the calcium content was found to be 0.20 mg/100g, 0.13mg/100g magnesium, 0.075mg/100g potassium and phosphorus. 0.031 mg/100g. The shells are usually cooked and eaten like green beans. All seeds were

also pink, roasted or powdered, and steamed in tea and curry (Fahey, 2005). The peels and seeds have a taste that varies from sweet to bitter and are most often eaten after frying to get a peanut-like taste, often referred to as Moringa grains.

Moringa leaf is a health food source and is an organic health supplement that has been used in many therapeutic ways (McBurney et al, 2004 and Fahey, 2005). Leaves that contain vitamins A, C and E are a very rich source of nutrients. Leaves that are rich in biologically active carotenoids, tocopherols and vitamin C promote the potential for a healthy diet and avoid free-radical damage which causes many diseases. Fine leaves are harvested daily for soups, sauces or salads. According to reports, fresh leaves can be frozen, reddened, or stored as a dry powder for several months without significant loss of nutritional value. Moringa is dried in the shade, ground to a powder, and then stored for later as a food scent or added in foods such as soups and stews (Lockett et al, 2000).

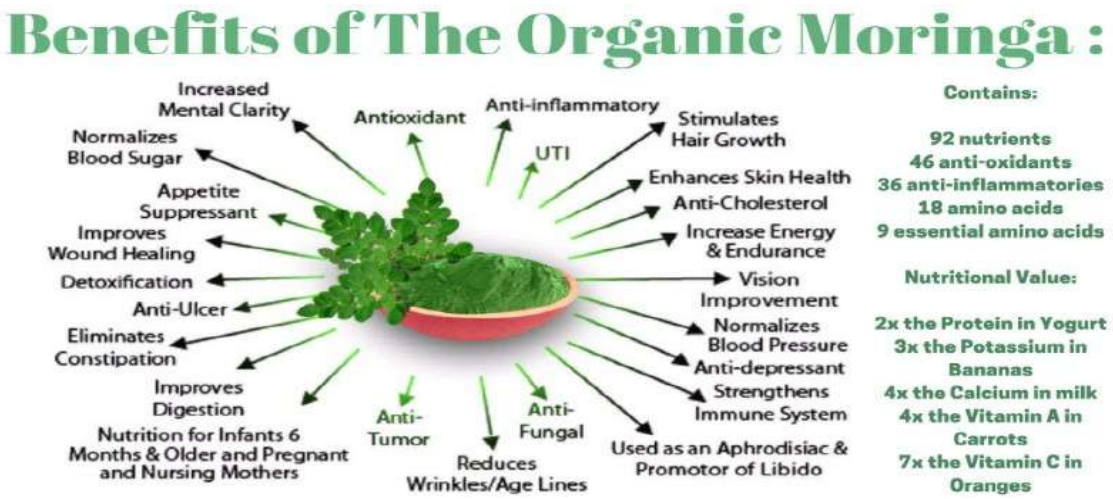
Farmers have given their leaves to livestock (Fahey, 2005) as well. In addition, the use of Moringa powder in aquatic culture systems such as fish feed and leaves are protein substitute for animals. Moringa's feed value has been reported to be comparable to soybeans and rapeseed meal. Pregnant women and lactating mothers use powdered leaves to stimulate the nutrition of their babies or children. In particular, mothers suffering from malnutrition from underdeveloped countries (McBurney et al., 2004; Lockett et al., 2000) suggested that Moringa oleifera leaves were healthy for human consumption because people did not observe any significant side effects. However, it was found that the toxicity of biologically active agents depending on the dosage and acute toxicity profile of Moringa oleifera leaves was studied. They concluded that Moringa oleifera ether, ethanol and water extracts contain phytochemicals that are relatively non-toxic when administered orally within 24 hours as a single dose to mice.

The Stem and Bark of Moringa oleifera, planted as a hedge in the yards, provides climbing garden plants with wind cover, shade and support. Moringa wood is relatively soft. Therefore, it is used in heavy construction. It gives 4600 kcal/ kg or more energy as a fuel. The fiber is used to make ropes from the bark.

Moringa flowers are pleasantly fragrant, yellowish-white in colour. Fresh or dried flowers are used for making teas (Ponnuswami, 2012) with hypecholesterolemic properties (Gopalakrishnan et al., 2016) and also contain Ca, Kandamino acids. The flowers are said to taste like mushrooms when fried. The flowers act as hypecholesterolemic, and the anti-arthritic agents can cure urinary problems and cold (Sutalangka et al., 2013). Flowers contain 9 amino acids, sucrose, D-glucose, traces of alkaloids, wax, quercetin and kaempferat; the ash is rich in K and Ca. They have also been reported to contain some flavonoid pigments such as alkaloids, kaempherol, rhamnetin, isoquercitrin and kaempferitrin.

Taste of the moringa root is like radish and it is common in East African food. Plant Growth Enhancer Laboratory studies showed that Moringa spray has a variety of beneficial effects on plant growth. The rapid growth of young plants has been proven by the effectiveness of the spray. Plants were more robust, more resistant to pests and diseases, longer life, heavier roots, stems and leaves, more fruit production, bigger fruit and 20- 35% yield increase. Even some of these discoveries could be replicated in the industry and could be of great help in increasing the food supply for millions of hungry people (Fahey 2005).

Ecofarming
e-Magazine for Agriculture and Allied Sciences
http://www.rdagriculture.in
e-ISSN: 2583-0791



Varieties of Drumstick

Moringa has three varieties, Shyama (black variety), Shveta (Red variety) and Rakta (Red variety). On the basis of varieties developed by public sector, Moringa has KM1, PKM1, PKM2, GKVK1, GKVK2, GKVK3, Dhanraj, Bhagya (KDM1), Konkan Ruchira, Anupama and Rohit varieties.

Sowing and Land preparation and climatic condition

The Moringa/Drumstick plant grows best in well-drained sandy or loamy soil with a slightly acidic 6.2 to neutral pH 7.0. Moringa is a warm-season plant. So, its seeds are sown in late winters. (71%) of all farmers plant Moringa during the rainy season and the least (7%) during the dry season and 22% plant Moringa any time of the year. The 30 cm deep and 30 cm wide holes are dug and seeds are sown and then the remaining space in the holes can be filled with loose soil and manure. Seeds will start germinating 5-10 days of sowing. Drumstick plants do not need too much watering but during summers and dry conditions, it demands water regularly. It can survive in drought conditions with minimal water requirements. They can thrive in poor soils too. The hot and humid climate is suitable for growth and the dry climate is for flowering. The temperature of 25 to 30 0C is suitable for flowering in the drumstick. The seeds of the annual drumstick may be directly dibbled in the pit to ensure accelerated and faster growth of the seedlings. The best season for sowing the seeds in September under Southern Indian conditions.

Method of Sowing

Through seed

Trees can be seeded directly and grown any time during the year. The seeds of the annual drumstick may be directly dibbled in the pit to ensure accelerated and faster growth of the seedlings. The time of sowing has to be strictly adhered to because the flowering phase should not coincide with monsoon seasons, which results in heavy flower shedding. Plant spacing of 2.5 x 2.5 m between rows and seeds should be adopted, giving a plant population of 1600 plants/ha. Pits of 45x45x45 cm in size are dug out and then the seeds are sown in the center of the pit. The drumstick seed germinates 10 to 12 days after sowing. The seed requirement per hectare is 625g. When planted in single rows along with irrigation channels, a spacing of 2 m is sufficient. Treatment of drumstick seeds with Azospirillum cultures at the rate of 100 g per 625 g of drumstick seeds before sowing, resulted in early germination and increased seedling vigor, growth and yield.

Through cutting

Use hardwood, not green wood, for cuttings. Cuttings should be 45cm to 1.5 m long and 10 cm thick. Cuttings can be planted directly or planted in sacks in the nursery. When planting directly, plant the cuttings in light, sandy soil. Plant one-third of the length in the ground (i.e., if the cutting is 1.5 m long, plant it 50 cm deep). Do not overwater; if the soil is too heavy or wet, the roots may rot. When the cuttings are planted in the nursery, the root system develops slowly. Phosphorus is to be added in the soil if it is planted in the nursery, after 3 months the plants are planted in the main field.

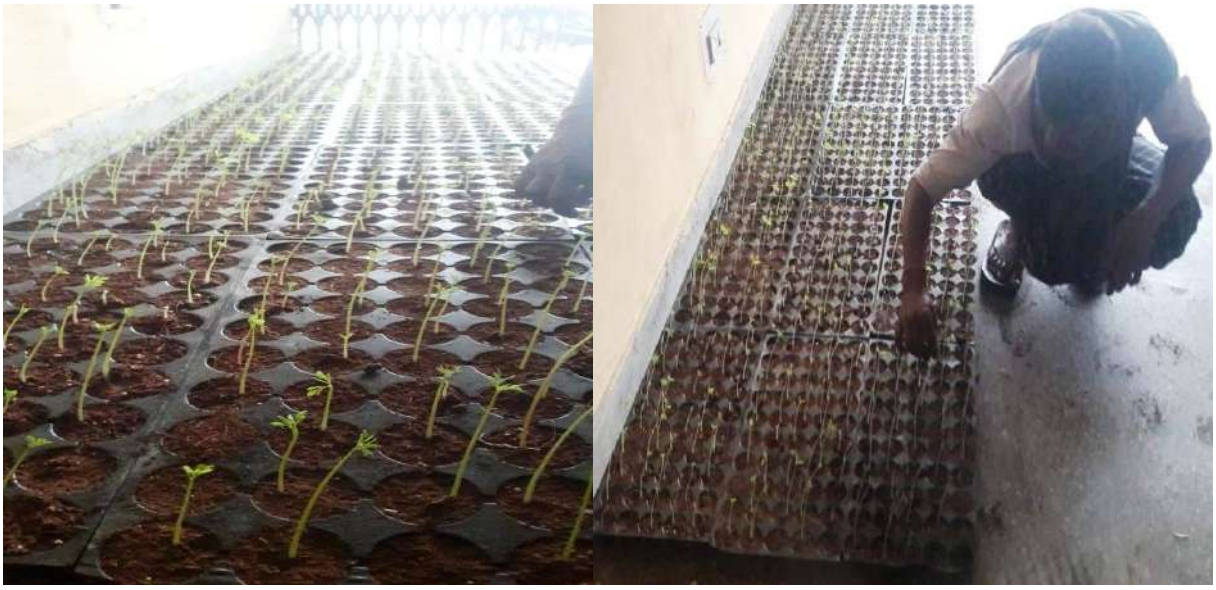


fig:2- Drumstick plant grow in pro tray through seed

Irrigation

Drumstick plants may require watering during hot weather when they may be irrigated once a week. 12 to 16 liters of water per tree should be given during summer and half of this rate during other seasons. Where water sources are scarce lifesaving irrigation or pot watering once in two weeks during a dry period will sustain the crop.

Fertilizer

Moringa trees generally require 8-10 kg Farmyard manure per plant, before planting seedlings, 50:50:50 kg NPK/ha should be added. Ring trenches are dug about 10 cm from trees during the rainy season and filled with green leaves, manure and ash, and then covered with soil. This is said to promote higher fruit yields. If fertilizers are applied, the crop requires 44: 16: 30 g NPK/ tree at the time of pinching (75 days after sowing). Nitrogen @ 44g/ tree must be applied as a top dressing at first flowering (150-160 days after sowing.

Pests and Treatment

Drumstick plants are obstructive to most of the pests but can be attacked by some pests such as hairy caterpillar, moringa worm, pod fly, leaf caterpillar, and bark caterpillar. To protect moringa from these pests, the following practices can be done-

- Sanitation and deep plowing in summer.
- Provide proper nutrients to moringa by spreading 7-8 kg of compost per hole.

- Remove previous crop residues and plan to grow legumes and ginger intercrops.
- Use light soil with proper drainage.
- Spray NSKE (Neem seed kernel extract) 5% during 50% plant growth and after 35 days to protect it from pod fly.

Harvesting and Yield of Drumstick

The Harvesting of drumstick pods should be done when pods are immature (1 cm diameter). Mature pods are also edible but they develop tough outer structures.

The leaves of the drumstick can be harvested when the plant reaches the height of 150 -200 cm, which takes about 3- 4 months in fertile soil. Annual moringa types are seasonal in terms of fruit-bearing. The crop sown during September is harvested after six months of sowing. Fruit of sufficient length and girth are harvested before they develop fiber. Harvest the pods before they split open and seeds fall to the ground. Seeds can be stored. This depends on the seed type/variety cultivated. The yield could be around 50 – 55 tones of pods per hectare (220 pods /tree/year).

Ratooning

Annual moringa, when the harvest is in the process, the trees are cut down to a height of one meter above ground level for ratooning. These ratoon plants develop new shoots and start bearing after four or five months of ratooning. During each ratooning operation, recommended levels of N, P and K nutrients along with 20-35 kg of FYM are applied to the plant.

Nutritive value in moringa plant:

Table 1: Nutrients composition of leaf, seed and root (Igwilo et al., 2017)

Nutrition analysis	Pods (per 100 g)	Fresh leaves (per 100 g)	Dried leaf (per 100 g)
Moisture %	86.9	75	7.5
Calories	26	92	205
Protein (g)	2.5	6.7	27.1
Fat (g)	0.1	1.7	2.30
Carbohydrates (g)	3.7	13.4	38.2
Fiber (g)	4.8	0.9	19.2
Minerals (g)	2	2.3	–
Calcium (mg)	30	440	2003
Magnesium (mg)	24	24	368.0
Phosphorous (mg)	110	70	204.0
Potassium (mg)	24	24	1324
Copper (mg)	3.1	1.1	0.6
Iron (mg)	5.3	0.7	28.2
Oxalic Acid (mg)	10	101	0.0
Sulfur(mg)	137	137	870

Value-Added Product of moringa:

- Moringa Seeds and Seeds Oil
- Moringa Dry Leaf
- Moringa Organic Dry Leaves
- Moringa Drumstick Fruit, Pods
- Moringa Dry Leaf Powder
- Moringa Flowers and gum

Moringa is a versatile plant that has been used to enhance community health and nutrition, and it appears to be one of the most promising candidates for developing specific bioactive nutraceuticals that can help India to develop economically

beneficial crops and to reduce poverty. Moringa, with emerging awareness regarding it, appears to be a potential crop, as found from various studies in the past years. Besides, its role in agriculture, as animal feed, forage crop, natural plant growth enhancer and bio-pesticide has also been established. As discussed in the light of scientific findings, Moringa can be a potential multipurpose crop to utilize marginal and degraded lands and also to use the unused space in perennial plantations. However, concerted efforts are needed to harness its potential completely.

References

- Abdull Razis A.F., Ibrahim M.D. and Kntayya S.B., (2014). Health benefits of Moringa oleifera, Asian Pac J Cancer Prev 15:8571-8576.
- Arora D.S., Onsare J.M. and Kuar H., (2013). Bioprospecting of Moringa (Moringaceae): microbiological perspective. J. Pharmacog Phytochem, 1:193.
- Dongmeza E., Siddhuraju P., Francis G. and Becker K., (2006). Effects of dehydratedmethanol extracted Moringa (Moringa oleifera Lam.) leaves and three of its fractions on growth performance and feed nutrient assimilation in Nile tilapia (Oreochromis niloticus (L.)). Aquaculture., 261, 1:407-422.
- Elkhalifa A.O., Ahmed S.A. and Adam S., (2007). Nutritional evaluation of Moringa Oleifera leaves and extracts. Ahfad Journal 24:113 -122.
- Fahey J.W. (2005). M. oleifera: A Review of the Medical Evidence for Its Nutritional, Therapeutic, and Prophylactic properties. Part 1. Trees for Life Journal, 1:5.
- 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 5:49-56.
- Igwilo I.O., Okonkwo J.C., Ugochukwu G.C., Ezekwesili C.N. and Nwenyi V., (2017). Comparative studies on the nutrient composition and antinutritional factors in different parts of Moringa oleifera plant found in awka, Nigeria. The Bioscientist 5:1-12.
- Leone A., Spada A., Battezzati A., Schiraldi A., Aristil J. and Bertoli S., (2016). Moringa oleifera seeds and oil: Characteristics and uses for human health. Int J Mol Sci 17:21-41.
- Lockett C.T., Calvert C.C., Grivetti L.E. (2000). Energy and micronutrient composition of dietary and medicinal wild plants consumed during drought. Study of rural Fulani, northeastern Nigeria. Int. J. Food Sci. Nutr., 51:195-208.
- McBurney R.P.H., Griffin C., Paul A.A., Greenberg D.C. (2004). The nutritional composition of African wild food plants: from compilation to utilization. Journal of Food Composition and Analysis.17:277-289.
- Ponnuswami V. (2012). Advances in Production of Moringa, All India Co-ordinated Research Project- Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulam 625 604, Tamil Nadu.
- Sutalangka C., Wattanathorn J., Muchimapura S. and Thukhammee W. (2013). Moringa oleifera mitigates memory impairment and neurodegenerationin animal model of age-related dementia Oxid Med Cell Longev 1-9.