

# Drumstick (*Moringa oleifera*): A review on a bank of nutritional properties for curing diseases in human

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**Abstract:** Drumstick (*Moringa oleifera*) is one of the most useful trees for tropical countries. Its different parts have enormous potential for benefiting humanity. According to Ayurveda (Ancient tradition), the extract from varied parts (like leaves, roots, flours etc.) can prevent approximately 300 diseases. In India because of high nutritional value the tree is mentioned as "Power house of minerals". Its leaves, fruits, flowers, barks and seeds have remarkable medicinal values; can prevent diseases like cancer and diabetics etc. and also known to be therapeutic diet. Drumstick parts are mostly used in Indian kitchens to prepare scrumptious delicacies. It is a staple vegetable for the people of rural and urban in India.

**Key words:** Drumstick, nutritional and medicinal value, disease and ayurveda

## 1. INTRODUCTION:

*Moringa sp.* parts like leaves, fruits, bark and roots etc. have varied organic and inorganic compound that is used medicinally by large number of people in India including both rural and urban. Drumstick contain high amount of vitamin C which can fights against a variety of illnesses like cold and flu; vitamin A which acts as a shield against diseases like skin disease, heart and gastrointestinal disorder; Calcium which firm strength to bones and teeth and helps prevent osteoporosis; Potassium, which is necessary for the functioning of the brain and nerves and Proteins which is very essential for building blocks of all our body cells. The leaves act as a tonic for infants and growing children. Juice extracted from leaves, filtered and mixed with milk. This mixture becomes an outstanding tonic for healthy and powerful bones and for purifying bloodstream. Fresh juice from drumstick leaves is extremely effective for the treatment of respiratory diseases like asthma. Drumstick soup made with leaves and flowers are highly valuable in preventing infections thanks to antibacterial properties. (Aman, 1985; Bakhru 2008; Jitendra 2014; Gandji *et.al.* (2018). Chopra *et al.*(1958) reported that all parts have been used as cardiac and circulatory stimulants.

Drumstick leaves are helpful in increasing breast milk within the breastfeeding months. Drumstick leaves are also rich sources of flavonols like kaempferol and quercetin. Quercetin has been found to inhibit the expansion of human prostate cancer cells and human carcinoma cells. Quercetin has antiviral activity against several kinds of viruses. The nutrients are vital for health and vitality. Because Drumstick contains numerous essential nutrients, virtually all the varied parts of the tree are becoming employed by locals in several countries for a selection of nutritional, medicinal, and purification purposes.

## 2. BIODIVERSITY:

*Moringa* belongs to the family Moringaceae. There are 13 (thirteen) species included in the genus *Moringa*; they are found in wide ranges of India. *Moringa* is deciduous tree or shrub with average height of 12 meters at maturity, with a soft and white wood and corky and gummy bark (Fuglie, 2002). The common known and generally found everywhere species is *Moringa pterygosperma* Gaerthn (syn. *Moringa oleifera* Lam). The tree of *Moringa sternopetala* grows wild at 1000-1800 metres in Ethiopia. *Morniga concanensis* Nimmo, grows abundantly within the area of the Salem district in Tamil Nadu of South India. *Moringa drouhardii* sumelle, grow well in Madagascar. It was highly valued in the ancient time. The people of Romans, Greeks and Egyptians extracted oil from the seeds and used it for perfume and skin lotion.

Drumstick have some special properties beside chemical like it can grow fast, highly tolerance in temperature in drought season and easily acclimatize to varied ecosystems and farming systems, due to these qualities tree occupies a unique position in the field of vegetable industry in Indian. In India cultivation of drumstick mainly occurs in the southern area of Tamil Nadu, Karnataka, Kerala and Andhra Pradesh state.

In the field of production India is the largest producer of drumstick. An annual production fruits is 1.1 to 1.3 million tonnes from an area of 38,000 ha. The hierarchy in both area and production of drumstick among the states in India, Andhra Pradesh (15,665 ha) is the leading state followed by Karnataka (10,250 ha) and Tamil Nadu (7,408 ha) (Ponnuswami, 2002).

Fuglie (1999) reported that the different parts of drumstick is used for animal forage, biogas, as domestic cleaning agent, fencing, fertilizer, foliar nutrient, manure, medicine (all plant parts), ornamental plantings, biopesticide, as wood fuel, rope from bark, tannin for tanning hides, water purification.

### 3. NUTRITIVE VALUE:

Drumsticks have been used as food among the infants and pregnant women to combat the malnutrition problems in different villages of India. In summer season when all other plant fight for growth due to high temperature but drumstick tree grow well and used as good source of green vegetable when little food is available (Folkard and Sutherland, 1998). Many investigators reported that leaves can be stored as dried power for long time without any treatment or procurement and also without any loss in the nutritional value, due to high level of inorganic compounds or mineral leaves of drumsticks used as food under starvation condition. In India many people used leaves as a food adding with other common food as an excellent nutritional supplement.

Leaves in the form of fresh, dried or cooked will provide considerable amount of Protein, Calcium, Magnesium, Potassium, Iron, Vitamin A and Vitamin C etc. Drumstick plant contains more than 46 antioxidants, 36 anti-inflammatory compounds, 18 amino acid and also rich in varied form Omega oils.

Especially in pregnant women and breast feeding women, regular consumption of drumstick leaves can preserve mother health (maintain nutritional level like calcium, iron, protein, copper, sulphur and B-vitamins) and also give strength to the growing foetus. Drumstick can improve the human health (under malnutrition condition), increase weight gain and milk production in livestock (cow, sheep and goat etc.) and also used as manure to give nutritionally required minerals to the growing crops in soil.

In India many people used drumsticks for the treatment muscles and joint pain (arthritis), reducing level of cholesterol & triglycerides (blood pressure), balancing level of blood sugar (diabetes), weight loss, anxiety, enhancing the power of immune system, allergy, gastrointestinal complications (digestive), asthma and tumours.

Drumstick contains flavonoids (Plant pigments like rutin and quercetin) and phytochemicals (like lutein, caffeoylquinic acids) are used against antioxidant, anti-aging and also protect tissues (like retina, liver, blood vessels) from age-related malfunctioning.

A wide range of phytochemicals unique compounds are present in drumstick tree. Compounds of drumstick like 4-(4'-O-acetyl- $\alpha$ -L-rhamnopyranosyloxy)benzyl isothiocy-anate (Abrams *et al.*, 1993), 4-( $\alpha$ -L-rhamnopyranosyloxy)benzyl isothiocy-anate (Abuye *et al.*, 1999), niazimicin (Akhtar and Ahmad, 1995), pterygospermin (Anderson *et al.*, 1986), benzyl isothiocyanate (Anwar and Bhangar, 2003), and 4-( $\alpha$ -L-rhamnopyranosyloxy) benzyl glucosinolate (Asres, 1995) have been reported to have anticancer and antibacterial activity. These compounds are unique to the moringa family (Fahey, 2005).

The drumstick leaves contain a nutritional substance like vitamins, minerals and amino acids (Teixeira *et al.*, 2014) and also contain antioxidant compounds like ascorbic acid, flavonoids, and phenolics (Alhakmani *et al.*, 2013; Vongsak *et al.*, 2014; Nishu and Chandrawati, 2018; Kumar *et al.*, 2019)

**Table-1 Nutritive value of Drumstick (per 100 grams)**

Mineral and Chemical		Fresh Leaves (Gopalan <i>et al.</i> 1989)	Dried Leaves (Fuglie, 2002)
Amino acid	Arginine	406.6 mg	1,325 mg
	Histidine	149.8 mg	613 mg
	Isoleucine	299.6 mg	825 mg

	Leucine	492.2 mg	1,950 mg
	Lysine	342.4 mg	1,325 mg
	Methionine	117.7 mg	350 mg
	Phenylalanine	310.3 mg	1,388 mg
	Threonine	117.7 mg	1,188 mg
	Tryptophan	107 mg	425 mg
	Valine	374.5 mg	1,063 mg
<b>Vitamins</b>	Carotene (Vit. A)	6.78 mg (carotene)	18.9 mg (beta-carotene)
	Thiamin (B1)	0.06 mg	2.64 mg
	Riboflavin (B2)	0.05 mg	20.5 mg
	Niacin (B3)	0.8 mg	8.2 mg
	Vitamin-C	220 mg	17.3 mg
<b>Minerals</b>	Calcium	440 mg	2,003 mg
	Carbohydrates	12.5 g	38.2 g
	Copper	0.07 mg	0.57 mg
	Fiber	0.90 g	19.2 g
	Iron	0.85 mg	28.2 mg
	Magnesium	42 mg	368 mg
	Phosphorus	70 mg	204 mg
	Potassium	259 mg	1,324 mg
	Zinc	0.16 mg	3.29 mg
	Protein	6.70 g	27.1g
	Carbohydrates	12.5 g	38.2 g
	Fat	1.70 g	2.3 g
	Calories	92 cal	205 cal
Source: Balbir S. Mathur: Trees for Life			

#### 4. MEDICINAL USE FOR DISEASE TREATMENT

**Pharmaceutical Value:** Every part of the drumstick tree has beneficial properties. Medicinal importances of different parts of *Moringa sp.* are as follow:

##### 4.1 Leaves:

Leaves and fresh buds are used in headache. It is also very potential in reducing glandular swelling. It is considered that leaves have antihelminthic properties i.e. ability to kill intestinal worms. From ancient time in the different parts of India leaves (Juice) of drumstick is used to treat blood pressure and anxiety. In ayurvedic medicine, products of different parts of drumstick have uses for the treatment of liver disorder and as an antibiotic. Paste of leaves are also useful in expelling intestinal worms when applied on abdomen (Burkill, 1935) and are also shows positive sign when applied on the bites of invertebrates (insects) and vertebrates (dogs, monkeys, snakes) (Benthall 1946). Burning and blister on skin can reduce by use of leaves pastes on it (Manfred 1947).

The cytotoxic property of various extracts of leaves of *Moringa oleifera* was observed on human multiple myeloma cell lines by Parvathy and Umamaheshwari (2007).

The antiatherosclerotic and hypolipidaemic activity of *Moringa oleifera* leaves observed under experimental condition in which rabbit with hypercholesterol treated with leaves extract, it significantly reduce the cholesterol levels and the atherosclerotic plaque formation in rabbit (Chumark *et. al.* 2008).

The toxicity efficiency of a leaves extract (aqueous) of drumstick was examine *in vitro* condition in which human peripheral blood mononuclear cells were exposed to different concentration of doses of an aqueous extract (Asare *et.al.*, 2012). Zvinorova *et. al.* (2014) reported role of drumstick leaves in food as a dietary supplement for liver in rat. The hexane extract of *M. oleifera* leaves have effective on reproductive organs of male rats, reported by Cajuday and Pocsidio (2010).

The leaves of *Moringa oleifera* are effective against tumour (anticancer activity) due the presence of compounds thiocarbamate and isothiocyanate related compounds which are acting as inhibitors of tumour promoter cells Murakami *et. al.* (1998). Sreelatha and Padma (2011) reported a role of *M. Oleifera* leaves (an aqueous extract) in inhibiting hydrogen peroxide-induced DNA damage and lipid peroxidation in human

tumour cells. A significant role an aqueous extract of *M. oleifera* leaves in antineoplastic activity against a lung cancer cell line. The dose induced apoptosis, inhibited tumour cell growth and also reduces the internal level of oxygen in human lung cancer cells (Jung, 2014).

The set of rats with a high-fat diet treated with and without a methanol extract of *M. oleifera* at regular doses for 30 days shows reduction in serum lipids and plaque formation (Jain *et. al.* 2010). The antiproliferative activity of an aqueous extract of *M. oleifera* leaves against cancerous human alveolar epithelial cells observed by Tiloke *et. al.* (2013).

An aqueous extract of *M. oleifera* leaves protects liver from damage in reducing serum activities of marker enzymes aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase as well as reduced lipid peroxidation and increases in reduced glutathione in mice having high-fat diet (Das *et. al.* 2012).

Kumar *et. al.* (2013) reported retinoprotective effects of *M. Oleifera* extract in streptozotocin-induced diabetic rats. Regular treatment of rat with extract prevents dilation of retinal vessels and increase in inflammatory factors tumour necrosis factor- $\alpha$  and interleukin-1 $\beta$ . *M. Oleifera* also decreased the angiogenic factors vascular endothelial growth factor and protein kinase C- $\beta$ . Observation indicated that an extract of *M. Oleifera* may be play important role in preventing retinal dysfunction occur due to diabetes. The presence of N, $\alpha$ -L-rhamnopyranosyl vincosamide, an indole alkaloid compound extracted from *M. oleifera* leaves show cardioprotective effect in rat administrated for 7 days by reduction in cardiac necrosis; electrocardiographic changes, decreases in serum cardiac biomarkers; cardiac lipid peroxidation, increases in cellular antioxidants and antioxidant enzymes (Panda *et. al.*, 2012).

An aqueous ethanol (hydroalcohol) extract of *M. oleifera* leaves was reported to prevent gentamicin-induced nephrotoxicity in rabbits by significantly decreasing histological changes, lipid peroxidation, and serum urea and creatinine levels (Ouedraogo *et. al.*, 2013).

Sudha *et. al.*, (2010) reported immunomodulatory effects of extracts (methanol) of *M. oleifera* leaves in mice, a specific oral dose stimulate both cellular and humoral immune responses. Also state that low dose is give better result than higher dose of extract.

In a wound healing experiment Muhammad *et al.* (2013) reported an aqueous extract of *M. Oleifera* leaves significantly increased cell proliferation. An aqueous extract contain vicenin-2 as well as quercetin and kaempferol, through which faster wound healing occur. The wound healing property of leaves of *Moringa oleifera* extract from the aqueous medium observed in albino mice (Rathi *et. al.* 2006; Anupriya, 2017).

*Moringa oleifera* leaves extraction through ethanolic medium shows alteration of brain monoamines (like norepinephrine, dopamine and serotonin) & EEG wave pattern in Alzheimer's disease in rats (Ganguly and Guha 2008). Sutralangka *et. al.* (2013) reported neuroprotective action of an aqueous *M. oleifera* leaf extract in dementia-induced rats; the extract was given as specific dose for 7 days which increases levels of antioxidant enzymes superoxide dismutase and catalase. Kirisattayakul *et al.* (2013) reported a hydroalcohol extract of *M. oleifera* leaves have significant effect on brain dysfunction and brain damage induced by cerebral ischemia. An ethanol extract of *M. oleifera* leaves possesses anticonvulsant activities and Central Nervous System (CNS) depressant in mice (Bakre *et. al.* 2013)). The neuroprotective properties of an ethanol extract of *M.oleifera* leaves was reported in incubated culture of hippocampal neurons. The extract produces significant increases in the number and length of dendrite and axonal branches (Hannan *et. al.* 2014).

Cáceres *et. al.* (1992) observed anti-inflammatory activity of flowers, leaves, roots, seeds and stalks or bark of drumstick in rats.

The freeze-dried leaves of *Moringa oleifera*, from which compound extraction done in water, aqueous methanol, and aqueous ethanol that show antioxidant property observed by Siddhuraju and Becker (2003). Due to presence of kaempferol in the leaves of *Moringa oleifera* show antioxidant property reported by Bajpai *et. al.* (2005). Verma *et. al.* (2009) reported the effect of *M. oleifera* leaves as antioxidant both in *in vitro* and *in vivo*. Due to antioxidant property of *M. oleifera* leaves, it attracts pharmacological industry to use as important medicine (Luqman *et.al.* 2012; Ratshilivha *et.al.* 2014 and Suphachai, 2014). Fahmy *et.al.* (2015) reported antioxidant properties of *Moringa Oleifera* leaf extract in rat.

The antimicrobial action of fresh leave juice on *Pseudomonas aeruginosa* and *Staphylococcus aureus* is reported by Cáceres *et. al.* in 1991. Renitta *et. al.* (2009) extract leaves compound in ethanolic medium reported its antimicrobial activity against microorganisms like *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Salmonella typhi* A, and *Streptococcus*. Alam *et. al.* (2009) investigated

antibacterial activity of leaf juice and extracts of drumstick against human pathogenic bacteria like *Shigella shinga*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus cereus* using disc diffusion and minimum inhibitory concentration (MIC) determination method.

In vitro, antifungal activity of ethanolic extracts of the leaves observed by Chen *et. al.* (2007) against dermatophytes like *Trichophyton rubrum*, *T. mentagrophytes*, *Epidermophyton Xoccosum*, and *Microsporum canis*.

William *et. al.* (1993) reported type 2 diabetic subject feeding regular dose of *M. oleifera* leaf powder with a meal shows reduced level of blood sugar. A set of type 2 diabetic subjects were examined for 40 days with regular intake of drumstick leaf powder dose, in which subjects were shows lower level of blood sugar with cholesterol, triglyceride and lipoprotein after a period of time (Kumari, 2010). The leaves of *Moringa oleifera* significantly decreased the blood glucose level in rat (Suzuki *et. al.* 2007) and also prove effective in glycemic control, haemoglobin, total protein, urine sugar, urine protein and body Weight (Jaiswal *et. al.* 2009). Nambiar *et. al.* (2010) reported in his finding that intake of leaf powder of *M. Oleifera* as a tablet for 50 days, decreases level of plasma cholesterol in 35 type 2 diabetic subjects and confirm antidyslipidemic effects of *M. oleifera*. Ghiridhari *et. al.* (2011) noticed a decrease level of blood glucose and Haemoglobin (A1c) of glycosylation related to blood glucose after a meal due to regular intake of *M. oleifera* leaf powder as a tablets in 60 type 2 diabetic subjects for up to 3 months. There was no adverse effects were noticed by Kushwaha *et. al.* (2012) during examination of *M. oleifera* leaf powder on 30 postmenopausal women for 3 months. He reported the regular intake of leaf powder decrease blood glucose levels in fasting as well as an increase in haemoglobin. A significant increase in serum glutathione peroxidase, superoxide dismutase and ascorbic acid with decreases in malondialdehyde was observed (Stohs and Hartman, 2015).

Ndong *et. al.* (2007a) reported leaf powder of *M. oleifera* decrease blood glucose levels in rats. Similarly the extract of *M. oleifera* leaves in an aqueous medium decreased blood glucose levels in diabetic animals reported by Jaiswal *et. al.* (2009). An ethanol extract of *M. oleifera* leaves decreases the blood glucose levels in streptozotocin-induced diabetic rats' doses were given intraperitoneally (Tende *et. al.* 2011). The antidiabetic and antioxidant power of an aqueous extract of *M. oleifera* leaves was assessed in streptozotocin-induced diabetic rats, observations show decreases fasting plasma glucose and repair of damage islet cells (Yassa and Tohamy 2014). *M. oleifera* leaves extract (aqueous) express potential benefits using in antidiabetic treatment (Soliman, 2013; Bhupendra and Chase, 2015).

The ethanolic extraction of leaves of *Moringa oleifera* reduces the ulcerogenic effect in gastric tract (anti-ulcerogenic activity) and also reduces the level of acid-pepsin secretion in rats (Verma *et. al.*, 2012; Ahmad *et. al.*, 2014).

#### 4.2 Flowers:

Traditionally the flowers of drumstick are used to treat various medicinal complications in Indian villages. It is used as a tonic, diuretic and in abortion. It is very effective in curing inflammations, muscle diseases, tumours and also enlargement of the spleen. Its antihelminthic properties show positive results in patient. In India fresh flower juice (cough remedy) is used to reduce sore throat and snuffle (Burkill 1935; Benthall 1946). The flowers contain pterygospermin, a well known effective antibiotic (Watt and Brandwijk 1962) that shows highly effectiveness against in cholera disease reported by Lizzy *et. al.* 1968 whereas its high concentrations shows a fungicide properties (Anonymous 1962).

Kurma *et. al.*, (1998) reported the potential powder of fruits of *M. oleifera*, used traditionally to treat rheumatism, and liver and spleen diseases in India. Their anti inflammatory and hepato protective activities confirmed by experiment in albino rats. The flowers of Drumstick have some beneficial compound like sucrose, D-glucose, amino acids, alkaloid, wax, and also they are rich in calcium, potassium and some flavonoids (Ruckmani *et.al.*, 1998 and Anwar *et.al.*, 2007). The flowers also have some chemical which have the power to cure muscle diseases, inflammations and tumours and present compounds also decrease level of cholesterol, phospholipid and triglyceride (Siddhuraju and Becker, 2003). Feeding of drumstick flower extracts reported to reduces the lipid concentration in liver, heart and aorta in rabbit (Anwar *et.al.*, 2007). The flowers of drumstick are good source of pollen for honey production industry by honey bees and used as tonic and diuretic drink (Rolof *et.al.*, 2009). Regular drinking of flower juice of drumstick reported to improves the quality of milk for newborn baby in mother (Agbogidi and Ilondu, 2012; Bhupendra and Chase, 2015).

#### 4.3 Roots:

Roots as paste or juice or chew are used to treat scurvy. It is also effective against fevers, blister and ulcers also used as skin tonic. Root juices highly potential against gout, asthma, enlarged spleen or liver and deep inflammation etc. It is believed that spread of venom from snakebites can be preventing by chewed roots because of its rubefacient properties (Brown 1954; Quisumbing 1951). The root bark (outer coat) containing alkaloids, mainly moringinine, is used as an abortifacient mixed with black peppercorns in India, often with fatal subsequence's (Chopra *et. al.* 1958).

Bitter flavour of roots act as a tonic for body, lungs, expectorant, mild and diuretic. The roots of *M. oleifera*, have been used to treat many medical complications including a stomachic, abortifacient, cardiac tonic and in paralytic conditions, rheumatism, liver disease, asthma in India. The roots powder extract shows their anti inflammatory and anti hepatotoxic activities in rats under experimental conditions (Rao and Mishra 1998). Mazumder *et. al.* (1999) reported that regular and prescribed dose of *M. Oleifera* roots affect kidney and liver function and also haematological parameter in mice, high dose increases WBCs count and decreases clotting time.

The effect of aqueous extract of *Moringa oleifera* roots on cell of the uterus during pre and post-implantation stages in rats show antifertility activity reported by Prakash *et. al.* (1987). The anti-implantation or antifertility activity of aqueous extract of *Moringa oleifera* roots was studies on genital tract of rat by Shukla *et. al.* (1989). The methanolic extract of *Moringa oleifera* roots have significant role on medical complication of liver and kidney in rat reported by Mazumder *et. al.* (1999).

An aqueous extract of root of *Moringa oleifera* used as standard drug effective in anti-inflammatory action in rats by Ndiaye *et. al.* (2002). The aqueous extract of *Moringa oleifera* roots have anticonvulsant action (suppress the excessive rapid firing of neurons) was studied in adult albino rats (Ray *et. al.* 2003). The aqueous and alcoholic extract from root-wood of *Moringa oleifera* has influence effect (antiurolithiatic activity) on calcium oxalate urolithiasis by reducing elevated urinary oxalate level in kidney of male albino rats reported by Karadi *et. al.* (2006).

In India ayurvedic pharmacology uses the root barks as drug in the treatment varied medical complications like goitre, glycosuria and lipid disorders (Khare, 2007; Garima Mishra *et al*, 2011)). *Moringa* root extracts contains an antibiotic, pterogosperrin that is very effective in the treatment of cholera (Roloff *et.al.*2009 and Omotesho *et.al.* 2013). The potential action of methanol extract of *M. oleifera* root was investigated by Paul and Didia (2012) on the liver and kidney of guinea pig.

#### 4.4 Root bark and stem bark:

Barks from roots and stems are used to increase digestive efficiency and also stimulate appetite (Kesharwani *et.al.* 2014; Kodia *et.al.* 2014). It is also used to treat kidney stone and cure eye diseases. Roots bark prevent enlargement or formation of tubercles glands of the neck, reduces tumours and also cure ulcers. Juice from root bark used as ear drops to relieve earaches. The bark is used for headache and other pains as it contain sitosterol and moringine. The barks alone in stronger doses act as an abortifacient (Burkill 1935; Kirtikar 1983). Shukla *et. al.*(1988) reported that barks and roots as abortifacient in their finding the bark of *M. pterygosperma* and the root of *M. concanensis*, prevented implantation when given orally after 7 days of pregnancy. The methanol extract of *Moringa oleifera* root bark show anti-inflammatory activity in mice and anaesthetic action in frog and guinea pig (Medhi *et. al.* 1996).

Karadi *et. al.* (2008) reported the extraction (aqueous and alcoholic) of the root bark of *Moringa oleifera* significantly reduced the retention levels of oxalate, calcium and phosphate and also reduces the elevated level of urea nitrogen, creatinine and uric acid in urinary tract and kidney. The extract of stem bark is used for the treatment of cardiac and circulatory disorders, as a tonic and for inflammation (Kesharwani *et.al.*, 2014; Kodia *et.al.*, 2014). The antiulcer property of root bark of *M. oleifera* extract with ethanol noticed in gastric ulceration rats. A specific dose for 15 days decreases ulcer (Choudhary *et. al.* 2013).

#### 4.5 Seed and Seed oil (Ben oil):

The paste of seed is spread on warts. It is mainly used against fever. In home remedies seed also used treat abdominal tumours. In different parts of India oil extracted from seed is used to relieve from any pain, swelling (gout or rheumatism) and also to treat skin diseases (Omotesho *et.al.* 2013). Oil also useful against

prostrate and bladder troubles. Guevara *et. al.* (1999) were isolated seven compounds from *Moringa oleifera*, 4(alpha-L-rhamnosyloxy)-benzyl isothiocyanate, niazimicin, niazirin, beta-sitosterol, glycerol-1-(9-octadecanoate), 3-O-(6'-O-oleoyl-beta-D-glucopyranosyl)-beta-sitosterol, and beta-sitosterol-3-O-beta-D-glucopyranoside. *In vitro* experiments niazimicin was reported to have potent antitumour-promoting activity in the 2-stage carcinogenesis, from these results, niazimicin is proposed as a potent chemo preventive agent in chemical carcinogenesis. After frying or roasting raw seeds are consumed; taste like peanuts (Burkill, 1935). The methanol extract of *Moringa oleifera* root bark show anti-inflammatory activity in mice (Medhi *et. al.* 1996).

The anti-arthritic activity and anti-inflammatory activity of ethanolic extract from seeds of drumstick was studied in wistar rats by Mahajan *et. al.* (2007). The Anti-allergic Activity of ethanolic extract *Moringa oleifera* seeds on systemic and local anaphylaxis reported by Mahajan and Mehta (2007). The antimicrobial action of seed (*Moringa oleifera*) extraction was evaluated by Jamil *et. al.* (2008) against different strains of bacterial and fungus. The anti-inflammatory activity the extraction of seeds of *Moringa oleifera* from the n-butanol medium show anti-inflammatory activity in guinea pigs (Mahajan *et. al.* 2009). The aqueous extract of *M. oleifera* seed was noticed to have genotoxicity property under experimental condition in rat (Rolim *et. al.*, 2011). The methanol extracts of seeds of *M. oleifera* are used for acute and subacute toxicity investigation in rats and also safe for nutritional use (Ajibade *et. al.*, 2013).

The seed extract (both in aqueous and alcohol) of drumstick possess potential antimicrobial activity against large number of bacterial and fungal species (Oluduro *et.al.* 2010). Oluduro *et.al.* 2010 and Jeon *et.al.* 2014 reported that a number of phytochemical compounds present in seeds of drumstick are able to restrict the proliferation or growth of some pathogenic microorganisms that responsible for death causing human infections. An ethanol extract of *M. oleifera* seeds has no positive effect in minimizing or reducing the growth of breast and colorectal tumour cells reported by Asmari *et.al.* 2015. Some latest observations give good information that *M. oleifera* oil possesses cytotoxic effect on several cancer cell lines (Elsayed *et.al.* 2015). Malki and Rabey, 2015 reported the antidiabetic properties of *M. oleifera* seeds extract. *M. oleifera* seed powder through oral administration for 8 weeks with dose reduces heart rate in night and also improve cardiac diastole in rat. The seed powder reduces the thickness of left ventricular wall and interseptal at diastole and also reduction in fibrosis in left ventricular. There was no alternation noticed in Blood pressure during treatment due to seed powder (Randriamboavonjy *et.al.* 2016). Maiyo *et.al.* 2016 observe the antitumor property of *M. Oleifera* seeds due to presence of bioactive compound. (Leone *et.al.* 2016; Kumar *et.al.* 2019)

## 5. CONCLUSION:

Drumstick is a very useful and miraculous tree in both rural and urban areas due to presence of large number of bioactive inorganic and organic compounds. In India, ancient ayurvedic information reveals drumstick uses for curing medical problems in human.

There are several investigation conducted from different parts of *M. oleifera* like leaves, flowers, fruits, seeds, roots and barks (extraction through aqueous and alcoholic medium) on different animal groups (like rats, guinea pigs etc.) in *in vitro* and *in vivo*, significantly reveals the medicinal property of *M. oleifera* and also suggested its uses as drug for a number of medical complication in humans like anti-hyperglycemic, anti-dyslipidemic, antioxidant, tissue protectant (liver, kidneys, heart, and eyes), immunomodulatory, radioprotective, antihypertensive, cardioprotective and neuroprotective. The exact potential nature of different part of *Moringa oleifera* is still under observation, a very little well documented information is available, with some other medical complication also observed. It is little bit effective in treating hyperglycemia and dyslipidemia especially in people with type2 diabetes, as per recorded information. Still investigation for more accurate information is needed on drumstick for its commercial and common approaches to large numbers of population as a drug in India.

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