

# A Review on Nutritional and its Pharmacological Properties of *Moringa oleifera*

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**Abstract - *Moringa oleifera* is a valued medicinal plant in traditional folk medicine which belonging to family Moringaceae. The plant is native to India, grows in the tropical and subtropical regions of the world. It is commonly known as ‘drumstick tree’ or ‘horseradish tree’. This plant typically belongs to sub-himalayan Northern India, Pakistan, Bangladesh and Afghanistan. The Tropical and sub-tropical area of the world is suitable for the growth of this plant. Moringa can withstand both severe drought and mild frost conditions and hence widely cultivated across the world. With its high nutritive values. The leaves are rich in minerals, vitamins and other essential phytochemicals. It is used as potential antioxidant, anticancer, anti-inflammatory, antidiabetic and antimicrobial agent. The scientific effort of this research provides insights on the use of moringa as a cure for diabetes and cancer and fortification of moringain commercial products. Many pharmacological studies have shown various pharmacological properties such as analgesic, anti-inflammatory, antipyretic, anticancer, antioxidant, nootropic, hepatoprotective, gastroprotective, anti-ulcer, cardiovascular, anti-obesity, antiepileptic, antiasthmatic, antidiabetic, anti-urolithiatic, diuretic, local anesthetic, anti-allergic, anthelmintic, wound healing, antimicrobial, immunomodulatory, and antidiarrheal properties This review explores the nutritional value and pharmacological properties of *M. oleifera*. This review is a comprehensive summary of the pharmacological activities as well as nutritional properties and the traditional and therapeutic uses of this plant.**

**Index Terms - *Moringa oleifera*, pharmacological actions, Miracle Tree; Nutritional properties.**

## INTRODUCTION

*Moringa oleifera*, also known as drumstick tree, is indigenous to South Asia, mainly in the regions of Himalayas, India, and it has been grown and naturalized in other countries such as Afghanistan, Nepal, Bangladesh, Sri Lanka, South and Central America, West Indies, Philippines, and Cambodia. It

is short, easy to cultivate, grows quickly, and does not shed its leaves in dry season, and its leaves are highly nutritious and rich in amino acids, vitamins, minerals, and natural antioxidants. This was mentioned in *Charaka Samhita* and is well known in African folk medicine. This review focuses on the nutritional and pharmacological properties of this plant. *Moringa oleifera* belonging to the family of Moringaceae is an effective remedy for malnutrition. Moringa is rich in nutrition owing to the presence of a variety of essential phytochemicals present in its leaves, pods and seeds. In fact, moringa is said to provide more vitamin C, vitamin A, calcium, protein, potassium and iron.

## NUTRITIONAL PROPERTIES

*Moringa oleifera* is called a ‘Miracle Tree’ due to its multipurpose nutritional uses and capacity to cure many diseases. Every part of plant has reserved nutrients. The Leaves of *Moringa oleifera* are rich source of minerals like calcium, potassium, zinc, magnesium, iron and copper. The Leaves has low calorific value so can be used in the diet of obese. The leaves also contain all essential amino acids and are rich in protein and minerals. Pods contains around 46.78% fibre, 20.66% protein and are highly valued for curing digestive problem and colon cancer. Vitamins like vitamin A, Vitamin B, Beta-carotene, pyridoxine, nicotinic acid, vitamin C, Vitamin D and E also present in abundant amount in *Moringa oleifera*. *Moringa oleifera* also contains major phytochemicals such as: tannin, sterols, terpenoids, flavonoids, saponins, anthraquinones, alkaloids and reducing sugar is also present along with anti-cancerous agents like glucosinolates, isothiocyanates, glycoside compounds and glycerol-1-9-octadecanoate. Oligosaccharides and oxalate were reported as anti-nutrient factor in *Moringa* leaves. The Dried leaves (*M. oleifera*) retained 87.5% and 50% of

$\beta$ -carotene after 4- and 3-month storage, respectively, and could therefore be processed for convenient use.

The leaves of MO are considered to be a rich source of vitamins and minerals and exhibits strong antioxidant activity, often attributed to the plants' vitamins and phenolic compounds such as quercetin and kaempferol. The leaves can be also taken as vegetable and processed into tea, powder and other pharmaceutical's purpose. Furthermore, juice can be extracted from fresh leaves and act like growth harm one and increase crop yield by 25-35%. According to Japanese study in 2009, leaves act as a good sink for carbon dioxide absorption and utilisation. The rate of assimilation of carbon dioxide by *Moringa* tree is 20 times higher than general vegetation. *Moringa* is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach.

The root bark of *Moringa* has potential to cure gastric ulcers and gastric mucosal lesions. It also decreases the acidity and increases the pH of gastric juice. Hence, MO possesses antiulcer and anti-secretory activity and hence, can be used as a source for antiulcer drugs in future.

*Moringa oleifera* seed contains a range of phytochemicals, including antioxidants such as vitamin C,  $\beta$ -carotene,  $\alpha$  and  $\gamma$ -tocopherol,  $\beta$ -sitosterol, vitamin A, the phenolic compounds quercetin and kaempferol, flavonoids, and anthocyanins, along with a few rare classes of compounds, including alkaloids, glucosinolates, and isothiocyanates. The mature seed of MO is rich in oil, containing between 22 and 40% crude fat. Examination of the oil composition indicates that the oil has a high proportion of monounsaturated fatty acids, particularly oleic acid. It has been demonstrated that a higher dietary intake of monounsaturated fatty acid (mainly oleic acid) is associated with decreased risk in coronary heart disease. The seed extract could be used to prevent some vectors such as for malaria *Anopheles stephensi* mosquitoes. The phytochemicals derived from MO seeds extracts are effective mosquito vector control agents and the plant extracts may be used for further integrated pest management programs.

#### MEDICINAL PROPERTIES

*Moringa oleifera* has several medicinal properties and has potentiality to cure many diseases. It is used to treat diseases such as diabetes, heart disease, anaemia, arthritis, respiratory problems, skin, liver problems, paralysis, sterility, rheumatism, digestive disorders and many more. In India, it was named the 'plant of the year' in 2008 by the National Institute of Health and Family Care. Several other countries like Africa, it is also used for the treatment of ascites, pneumonia and venomous bites. According to various research, the leaves are said to be anti-fungal, anti-viral, anti-abortifacient, and act as flocculating agent and stimulants. *Moringa* powder can be used as a substitute for iron tablet, hence a treatment for anaemia. The health benefits of this wonderful tree appear to be boundless. Apart from all the goodness discussed above, the regular intake of *Moringa* is said to help further.

#### PHARMACOLOGICAL PROPERTIES

##### Anti-inflammatory

The most promising uses of *Moringa* extract is in the treatment of many types of chronic and acute inflammations. Inflammation can lead to chronic diseases like diabetes, respiratory problems, cardiovascular disease, arthritis, and obesity. *Moringa* reduces inflammation by suppressing inflammatory enzymes and proteins in the body, and leaf concentrate can significantly lower inflammation in the cells.

##### Antioxidant Properties

The antioxidants are popular due to the fact as they fight against free radicals that cause oxidative stress, cell damage, and inflammation. In addition to this, *Moringa* contains antioxidants called flavonoids, polyphenols, and ascorbic acid in the leaves, flowers, and seeds which are beneficial in many ways. A study found that leaf extracts has higher antioxidant activity, free-radical-scavenging capacity, and higher inhibition of lipid, protein, and DNA oxidation than flowers and seeds. This means it prevents the damage and degradation that free radicals cause in the cells of different organs in the body, keeping them healthy and functioning at their best.

##### Anti-diabetic activity

*Moringa* has a huge role as a anti-diabetic. Its leaf powder is very effective at reducing lipid and glucose

levels as well as regulating oxidative stress in diabetic patients, which means it lowers blood sugar and cholesterol level and improves protection against cell damage. *Moringa* has been presented to cure both Type 1 and Type 2 diabetes patients suffering from nonproduction of insulin, called Type 1 diabetes. Insulin is a hormone that maintains the blood glucose level of body. Type 2 diabetes is one linked with insulin resistance. Due to beta cell abnormal function, the type 2 diabetes is likely to occur. In this type of disorder, beta cell fails to detect glucose levels, hence reduces the signalling to insulin ensuring high blood glucose levels. Several studies have been proven that, *Moringa* can act as an antidiabetic agent.

#### cardiovascular activity

*Moringa* leaf powder has heart-healthy benefits, particularly to control blood lipid, the prevention of plaque formation in the arteries, and reduced cholesterol levels. The great combination of diuretic along with lipid and blood pressure lowering components make this plant incredibly beneficial in cardiovascular disorders. *Moringa* leaf juice has very important role on stabilizing blood pressure. Mustard oil glycosides and thiocarbamate glycosides have been isolated from *Moringa* leaves, which had been observed to be responsible for lowering of blood pressure.

#### Supports brain health

*Moringa* strongly support for brain health and boost cognitive power due to its antioxidant and neuro-enhancer activities. It has shown several preliminary results as a treatment of Alzheimer's disease. The high amount of vitamin C and E helps to improve brain function and also normalize the neurotransmitters serotonin, dopamine and noradrenalin in the brain which play a key role in memory, mood, organ function, responses to stimulus such as stress and

#### Hepato protective activity

*Moringa* play very crucial role to protect liver against damage, oxidation, toxicity due to high concentrations of polyphenols in its leaves and flowers. *Moringa* oil can also restore liver enzymes to normal levels, reducing oxidative stress, and increasing protein content in the liver. The liver is responsible for blood detoxification, bile production, fructose metabolism, fat metabolism, and nutrient processing, and it can

only fulfil these functions with the aid of liver enzymes, so it's vital they stay at normal levels. For instance, lower levels of hepatic enzymes can impair its ability to filter the blood.

#### Antimicrobial and antibacterial

*Moringa* has antibacterial and anti-fungal properties that fight infections. It's been effective against types of fungi that cause infections on skin and strains of bacteria responsible for blood and urinary tract infections and digestive problems. Roots of *Moringa oleifera* have antibacterial property and are described to be rich in antimicrobial agents The bark extract of *Moringa* has been found to have antifungal activities while the juice of the bark and stem exhibit antibacterial effect against *Staphylococcus aureus*

#### Enhances wound healing

*Moringa* has blood-clotting properties in its leaves, roots, and seeds that benefit wound healing and can reduce clotting time, which means it reduces the time it takes for scratches, cuts, or wounds to stop bleeding. Antipyretic and wound healing properties from the ethyl acetate and ethanolic extracts of *Moringa oleifera* leaves were described by V.I. Hukkeri. The ethanolic and ethyl acetate extracts of seeds defines significant antipyretic activity in rats, where ethyl acetate extract of dried leaves presents wound healing activity (10% extracts in the form of ointment) on excision, incision and dead space (granuloma) wound models in rats.

#### Anticancer activity

Alcoholic and hydromethanolic extracts of leaves and fruits showed a significant growth delay in tumor kinetics in mouse melanoma tumor model studies. Extract of leaf also exhibited antiproliferative activity on A549 lung cells. Exploration of effects on prerequisites for cancer metastasis showed that the administration of leaf extract into chick chorioallantoic membrane led to an antiangiogenic effect, which was dose dependent, thereby showing their remarkable anticancer potential. Another study reported that pod extract suppressed azoxymethane and dextran sodium sulphate-induced colon destruction in male, Institute of Cancer Research (ICR) mice. An extract of root and leaf showed a cytotoxic effect against breast cancer, hepatocarcinoma, and colorectal cancer cells *in*

*vitro* and cisplatin-resistant ovarian cancer cells. Flower extract stimulated cell proliferation in normal cells but not in cancer cells, whereas leaf extract showed marked antitumor and hepatoprotective effects, these findings suggest the regenerative potential of MO besides its anticancer effects. Phytoconstituents such as niazimicin, carbamates, thiocarbamate, nitrile glycosides and others such as quercetin and kaempferol are responsible for the anticancer activity of this plant.

#### Neuropharmacological activity

Aqueous extract of leaves has shown protection against Alzheimer's disease in a colchicine-induced Alzheimer's model using behavioural testing (radial Y arm maze task). It protected against Alzheimer's disease by altering brain monoamine levels and electrical activity. Another study using toluene-ethyl acetate fraction of methanolic extract of leaf showed potent nootropic activity. Leaf extract contains vitamins C and E, which play a significant role in improving memory in patients with Alzheimer's disease.

Anticonvulsant activity of leaves was shown in both pentylenetetrazol and maximum electric shock models using male albino mice. Aqueous extract of root suppressed penicillin-induced epileptic seizures in adult albino rats.

Ethanol extract of leaves exhibited both central nervous system depressant and muscle relaxant activities in actophotometer and rotarod apparatuses, respectively, and also exhibited significant anxiolytic activity in staircase test and elevated plus maze test in a dose-dependent manner.

#### Effects on the reproductive system

Leaf extract showed a significant increase in the weight of testis, seminal vesicle, epididymis, and a higher score for epididymal maturity and lumen formation along with an increase in seminiferous tubule diameter (all doses).

Ethanol extract of leaf protected prepubertal spermatogonia cells in Swiss male albino mice in cyclophosphamide-induced damage model; the possible underlying mechanism may be upregulation of expression of c-Kit and Oct4 transcripts independent of p53-mediated pathway.

The abortive effect of leaf extract on rats after treatment for 10 days after insemination has been

reported. Extract showed a synergistic effect with oestradiol and an inhibitory effect with progesterone. Fresh leaves of MO contain approximately 11,300–23,000 IU of vitamin A, which has a major role in various anatomical processes, such as reproduction, embryonic growth and development, immunity development, and cell differentiation.

#### Anti-obesity activity

Significant reduction in body mass index was observed after oral treatment with leaf powder compared with that in obese control. Treatment of hypercholesterolemia rats with methanolic extract of MO leaf for 49 days showed a remarkable reduction in total cholesterol, triglycerides, and body weight, moreover, liver biomarkers, organ weight, and blood glucose levels were also decreased. Mechanisms include downregulation of mRNA expression of leptin and resistin and upregulation of adiponectin gene expression in obese rats.

#### Antiasthmatic activity

Extract of seeds showed protection against asthma as investigated in various models; the proposed mechanism for this effect was a direct bronchodilator effect combined with anti-inflammatory and antimicrobial actions and inhibition of immediate hypersensitive reaction. Ethanol extract of seeds tested against ovalbumin-induced airway inflammation in guinea pigs showed a significant increase in respiratory parameters and reduction in interleukins in bronchoalveolar lavage.

#### Hematological activity

A randomized, double-blind, placebo-controlled study was carried out on women who were anemic with hemoglobin levels between 8 and 12g/dL and were treated with aqueous extract of moringa leaf, the results showed an increase in mean hemoglobin and mean corpuscular hemoglobin concentration. Another study revealed that when moringa was given to healthy human volunteers for 14 days, a significant improvement in platelet count was observed.

#### Diuretic activity

Leaves, flowers, seeds, roots, and bark extracts increased urine output in rats, extract of leaf showed a dose-dependent diuretic action greater than control but less than hydrochlorothiazide. Campesterol,

stigmasterol,  $\beta$ -sitosterol, and avenasterol were responsible for this activity.

#### Anti-allergic activity

Ethanol extract of seeds inhibited passive cutaneous anaphylaxis induced by anti-immunoglobulin G (IgG) antibody and histamine release from mast cells; the mechanism underlying this action could be membrane-stabilizing action and also reduced scratching frequency in an Ovalbumin sensitization model.

#### Anthelmintic activity

This plant showed potent anthelmintic activity, it took less time to paralyze Indian earthworm *Pheretima posthuma*. In ovicidal assay, ethanolic and aqueous extracts showed 95.89% and 81.72% egg hatch inhibition, respectively, and in larvicidal assay, they showed 56.94% and 92.50% efficacy, respectively.

#### Immunomodulatory activity

Methanolic extract of this plant stimulated both humoral and cellular immune response. In addition, extract showed an increase in optical density and stimulation index, indicating splenocyte proliferation.

#### Antidiarrheal activity

Extract of seeds showed significant reduction in gastrointestinal motility and were found to be effective in castor oil induced diarrhoea in male Wister rats. Antidiarrheal activity can be attributed to phytochemical ingredients such as tannins, saponins, and flavonoids.

### CONCLUSION

The objective of this review was to explore the pharmacological and nutritional values of *Moringa oleifera*. The studies revealed that this plant possesses analgesic, anti-inflammatory, antipyretic, anticancer, antioxidant, nootropic, hepatoprotective, gastroprotective, anti-ulcer, cardiovascular, anti-obesity, antiepileptic, antiasthmatic, antidiabetic, anti-urolithiatic, diuretic, local aesthetic, anti-allergic, anthelmintic, wound healing, antimicrobial, immunomodulatory, and antidiarrheal effects. These activities may be attributed to phytoconstituents present in its root, stem, bark, leaf, flower, pod, and seeds. *Moringa oleifera* offers high nutritional

properties, which can be used of drug supplementation, and should be the promotion of health. It may also be considered for the treatment of different diseases.

### REFERENCE

- [1] Anwar F., *et al.* "Moringa oleifera: A Food plant with multiple Medicinal uses". Wiley Inter science (2006).
- [2] Somali M., *et al.* "Chemical composition and characteristics of *Moringa peregrina* seeds and seeds oil". *Journal of American oil Chemist's Society* (1984): 85-86.
- [3] Leone A., *et al.* "Cultivation, Genetic, Ethnopharmacology, Phytochemistry and Pharmacology of *Moringa oleifera* Leaves: An Overview". *International Journal of Molecular Science* (2015).
- [4] Gopalkrishan L., *et al.* "Moringa oleifera: A review on nutritional importance and its medicinal application". *Food Science and Human Wellness* 8 (2016).
- [5] Freiburger C., *et al.* "Nutrient content of edible leaves of seven wild plants from Niger". In *Plants Food for human Nutrition* (1998): 57-69.
- [6] Glover AM and F M. "Nutritional evaluation of *Moringa oleifera* Leaves using three drying methods". *Journal of Resistant Biology* (2012): 469-473.
- [7] Daba, M. "Miracle tree: A review on multipurpose of *Moringa oleifera* and its Implication for climate change mitigation". *Earth Science Climate Change* (2016).
- [8] Ghazali H and AS M. "Moringa (*Moringa oleifera*) Seed oil: Composition, Nutritional Aspects and Health Attributes" (2011).
- [9] Silva F., *et al.* "The many health benefit of *Moringa oeilfera*". *Journal of Medical and Pharmaceutical Innovation* (2014).
- [10] Dixit S., *et al.* "Medicinal properties of *Moringa oleifera*: A Review". *International Journal of Education and Science Research Review* (2016).
- [11] Chaudhary K and Chaurasia, S. "Neutraceutical Properties of *Moringa oleifera*: A Review". *European journal of Pharmaceutical and medical research* (2017): 646-655.

- [12] Khor Z., *et al.* “The in- vivo and in-vitro anticancer properties of Moringa”. *Hindawi* (2018).
- [13] CN K., *et al.* “Nutritional evaluation of indigenous foods and potential food based solution to alleviate hunger and malnutrition in kenya”. *Journal of Applied Biosciences* 67 (2013).
- [14] Fuglie L. “The Moringa tree: A local solution to malnutrition church world service in Senegal” (2005).
- [15] Braminas JC and Emmanuel D. “Mineral composition of nonconventional leafy vegetables”. *Plant Foods Human Nutrition* (1996): 29-36.
- [16] Durgesh KD, Jyotsna D, Anil K, Ratan KG. A multipurpose tree—*Moringa oleifera*. *Int J Pharm Chem Sci.* 2013; 2:415–23. [Google Scholar]
- [17] Bhattacharya A, Naik MR, Agrawal D, Rath K, Kumar S, Mishra SS. Anti-pyretic, anti-inflammatory, and analgesic effects of leaf extract of drumstick tree. *J Young Pharm.* 2014; 6:1–5. [Google Scholar]
- [18] Amrutia JN, Lala M, Srinivasa U, Shabaraya AR, Semuel MR. Anticonvulsant activity of *Moringa oleifera* leaf. *Int Res J Pharm.* 2011; 2:160–2. [Google Scholar]
- [19] Saini RK, Shetty NP, Giridhar P. Carotenoid content in vegetative and reproductive parts of commercially grown *Moringa oleifera* Lam. cultivars from India by LC–APCI–MS. *Eur Food Res Technol.* 2014;238:971–8. [Google Scholar]
- [20] Saini RK, Shetty NP, Prakash M, Giridhar P. Effect of dehydration methods on retention of carotenoids, tocopherols, ascorbic acid and antioxidant activity in *Moringa oleifera* leaves and preparation of a RTE product. *J Food Sci Technol.* 2014;51:2176–82. [PMC free article] [PubMed] [Google Scholar]
- [21] Amaglo NK, Bennett RN, Lo Curto RB, Rosa EAS, Lo Turco V, Giuffrida A, *et al.* Profiling selected phytochemicals and nutrients in different tissues of the multipurpose tree *Moringa oleifera* L. grown in Ghana. *Food Chem.* 2010; 122:1047–54. [Google Scholar]
- [22] Coppin JP, Xu Y, Chen H, Pan MH, Ho CT, Juliani R, *et al.* Determination of flavonoids by LC/MS and anti-inflammatory activity in *Moringa oleifera*. *J Funct Foods.* 2013; 5:1892–9. [Google Scholar]
- [23] Saini RK, Manoj P, Shetty NP, Srinivasan K, Giridhar P. Relative bioavailability of folate from the traditional food plant *Moringa oleifera* L. as evaluated in a rat model. *J Food Sci Technol.* 2016; 53:511–20. [PMC free article] [PubMed] [Google Scholar]
- [24] Saini RK, Shetty NP, Giridhar P. GC-FID/MS analysis of fatty acids in Indian cultivars of *Moringa oleifera*: potential sources of PUFA. *J Am Oil Chem Soc.* 2014; 91:1029–34. [Google Scholar]
- [25] Bhattacharya A, Ghosh G, Agrawal D, Sahu PK, Kumar S, Mishra SS. GC-MS profiling of ethanolic extract of *Moringa oleifera* leaf. *Int J Pharm Bio Sci.* 2014; 5:263–75. [Google Scholar]
- [26] Bennett RN, Mellon FA, Foidl N, Pratt JH, Dupont MS, Perkins L, *et al.* Profiling glucosinolates and phenolics in vegetative and reproductive tissues of the multi-purpose trees *Moringa oleifera* L. (horseradish tree) and *Moringa stenopetala* L. *J Agric Food Chem.* 2003;51:3546–53. [PubMed] [Google Scholar]
- [27] Nwosu MO, Okafor JI. Preliminary studies of the antifungal activities of some medicinal plants against *Basidiobolus* and some other pathogenic fungi. *Mycoses.* 1995; 38:191–5. [PubMed] [Google Scholar]
- [28] Bhattacharya SB, Das AK, Banerjee N. Chemical investigation on the gum exudates from Sajna (*Moringa oleifera*) *Carbohydrate Res.* 1982;102:253–62. [Google Scholar]
- [29] Mensah JK, Ikhajiagbe B, Edema NE, Emokhor J. Phytochemical nutritional and antibacterial properties of dried leaf powder of *Moringa oleifera* (Lam) from Edo Central Province, Nigeria. *J Nat Prod Plant Resource.* 2012; 2:107–12. [Google Scholar]
- [30] Siddhuraju P, Becker K. Antioxidant properties of various solvent extracts of total phenolic constituents from three different agroclimatic origins of drumstick tree (*Moringa oleifera* Lam.) leaves. *J Agric Food Chem.* 2003; 51:2144–55. [PubMed] [Google Scholar]
- [31] Pramanik A, Islam SS. Chemical investigation of aqueous extract of the mature and premature

- flowers of *Moringa oleifera* (Sajina) and structural studies of a polysaccharide isolated from its premature flowers. *Indian J Chem.* 1998;37B:676–82. [Google Scholar]
- [32] Faizi S, Siddiqui BS, Saleem R, Aftab K, Shaheen F, Gilani AH. Hypotensive constituents from the pods of *Moringa oleifera*. *Planta Med.* 1998; 64:225–8. [PubMed] [Google Scholar]
- [33] Nagar PK, Iyer RI, Sircar PK. Cytokinins in developing fruits of *Moringa pterigosperma* Gaertn. *Physiol Plant.* 1982; 55:45–50. [Google Scholar]
- [34] Guevara AP, Vargas C, Sakurai H, Fujiwara Y, Hashimoto K, Maoka T, et al. An antitumor promoter from *Moringa oleifera* Lam. *Mutat Res.* 1999; 440:181–8. [PubMed] [Google Scholar]
- [35] Bhattacharya A, Agrawal D, Sahu PK, Kumar S, Mishra SS, Patnaik S. Analgesic effect of ethanolic leaf extract of *Moringa oleifera* on albino mice. *Indian J Pain.* 2014; 28:89–94. [Google Scholar]
- [36] Kumbhare M, Sivakumar T. Anti-inflammatory and analgesic activity of stem bark of *Moringa oleifera*. *Pharmacol Online.* 2011; 3:641–50. [Google Scholar]
- [37] Nitin GS, Bonde CG, Patil VV, Narkhede SB, Patil AP, Kakade RT. Analgesic activity of seeds of *Moringa oleifera* Lam. *Int J Green Pharm.* 2008;2:108–10. [Google Scholar]
- [38] Manaheji H, Jafari S, Jalal Z, Shamsali R, Reza T. Analgesic effects of methanolic extracts of the leaf or root of *Moringa oleifera* on complete Freund's adjuvant-induced arthritis in rats. *J Chin Integ Med.* 2011; 9:217–22. [PubMed] [Google Scholar]
- [39] Kanchan PU, Vinod DR, Vijay BM. Antimigraine activity study of *Moringa oleifera* leaf juice. *Int J Green Pharm.* 2012; 6:204–7. [Google Scholar]
- [40] Jurairat K, Jintanaporn W, Supaporn M, Wipawee T, Cholathip T, Panakaporn W, et al. *Moringa oleifera* leaves extract attenuates neuropathic pain induced by chronic constriction injury. *Am J Appl Sci.* 2012; 9:1182–7. [Google Scholar]
- [41] Gurvinder PS, Rakesh G, Sudeep B, Sandeep KS. Anti-inflammatory evaluation of leaf extract of *Moringa oleifera*. *J Pharmaceut Sci Innovation.* 2012; 1:22–4. [Google Scholar]
- [42] Sharma R, Vaghela JS. Anti-inflammatory activity of *Moringa oleifera* leaf and pod extracts against carrageenan induced paw edema in albino mice. *Pharmacol Online.* 2011; 1:140–4. [Google Scholar]
- [43] Ezeamuzie IC, Ambakederemo AW, Shode FO, Ekwebelem SC. Anti-inflammatory effects of *Moringa oleifera* root extract. *Int J Pharmacogn.* 1996; 34:207–12. [Google Scholar]
- [44] McKnight M, Allen J, Waterman JD, Hurley S, Idassi J, Minor RC. *Moringa* tea blocks acute lung inflammation induced by swine confinement dust through a mechanism involving TNF- $\alpha$  expression, c-Jun N-terminal kinase activation and neutrophil regulation. *Am J Immunol.* 2014; 10:73–87. [Google Scholar]
- [45] Bhattacharya A, Behera R, Agrawal D, Sahu PK, Kumar S, Mishra SS. Antipyretic effect of ethanolic extract of *Moringa oleifera* leaves on albino rats. *Tanta Med J.* 2014; 42:74–8. [Google Scholar]
- [46] Kumar S. Medicinal importance of *Moringa oleifera*: drumstick plant. *Indian J Sci Res.* 2017; 16:129–32. [Google Scholar]
- [47] Ranira G, Rimi H, Kaushik R, Debajani G. Effect of *Moringa oleifera* in experimental model of Alzheimer's disease: role of antioxidants. *Ann Neurosci.* 2005; 12:33–6. [Google Scholar]
- [48] Ganguly R, Guha D. Alteration of brain monoamines and EEG wave pattern in rat model of Alzheimer's disease and protection by *Moringa oleifera*. *Indian J Med Res.* 2008; 128:744–51. [PubMed] [Google Scholar]
- [49] Akram M, Nawaz A. Effects of medicinal plants on Alzheimer's disease and memory deficits. *Neural Regen Res.* 2017; 12:660–70. [PMC free article] [PubMed] [Google Scholar]
- [50] Fathima SN, Vasudevamurthy S, Rajkumar N. A review on phytoextracts with antiepileptic property. *J Pharm Sci Res.* 2015; 7:994–1003. [Google Scholar]
- [51] Bhattacharya A, Santra S, Mahapatra S, Sahu PK, Agrawal D, Kumar S. Study of anxiolytic effect of ethanolic extract of drumstick tree leaves on albino mice in a basic neuropharmacology

- laboratory of a postgraduate teaching institute. *J Health Res Rev.* 2016; 3:41–7. [Google Scholar]
- [52] Purwal L, Shrivastava V, Jain UK. Anti-tumour activity of crude extracts of leaves of *Moringa oleifera* (Moringaceae) *Indian Drugs.* 2010; 47:31–4. [Google Scholar]
- [53] Jung IL, Lee JH, Kang SC. A potential oral anticancer drug candidate, *Moringa oleifera* leaf extract, induces the apoptosis of human hepatocellular carcinoma cells. *Oncol Lett.* 2015; 10:1597–604. [PMC free article] [PubMed] [Google Scholar]
- [54] Tiloke C, Phulukdaree A, Chuturgoon AA. The antiproliferative effect of *Moringa oleifera* crude aqueous leaf extract on cancerous human alveolar epithelial cells. *BMC Complement Altern Med.* 2013; 13:226. [PMC free article] [PubMed] [Google Scholar]
- [55] Al-Asmari AK, Albalawi SM, Athar MT, Khan AQ, Al-Shahrani H, Islam M. *Moringa oleifera* as an anti-cancer agent against breast and colorectal cancer cell lines. *PLoS One.* 2015;10: e0135814. [PMC free article] [PubMed] [Google Scholar]
- [56] Tragulpakseerojn J, Yamaguchi N, Pamonsinlapatham P, Wetwitayaklung P, Yoneyama T, Ishikawa N, et al. Anti-proliferative effect of *Moringa oleifera* Lam (Moringaceae) leaf extract on human colon cancer HCT116 cell line. *Tropi J Pharm Res.* 2017; 16:371–8. [Google Scholar]
- [57] Del Mar Zayas-Viera M, Vivas-Mejia PE, Reyes J. Anticancer effect of *Moringa oleifera* leaf extract in human cancer cell lines. *J Health Disparities Res Prac.* 2016; 9:102. [Google Scholar]
- [58] Purwal L, Pathak AK, Jain UK. *In vivo* anticancer activity of the leaves and fruits of *Moringa oleifera* on mouse melanoma. *Pharmacol Online.* 2010; 1:655–65. [Google Scholar]
- [59] Charoensin S. Antioxidant and anticancer activities of *Moringa oleifera* leaves. *J Med Plants Res.* 2014; 8:318–25. [Google Scholar]
- [60] Luqman S, Suchita S, Ritesh K, Anil KM, Debabrata C. Experimental assessment of *Moringa oleifera* leaf and fruit for its antistress, antioxidant, and scavenging potential using *in vivo* and *in vitro*. *Evid Based Complement Alternat Med* 2012. 2012:1–17. [PMC free article] [PubMed] [Google Scholar]
- [61] Sreelatha S, Padma PR. Antioxidant activity and total phenolic content of *Moringa oleifera* leaves in two stages of maturity. *Plant Foods Hum Nutr.* 2009; 64:303–11. [PubMed] [Google Scholar]
- [62] Kumar V, Pandey N, Mohan N, Singh RP. Antibacterial and antioxidant activity of different extract of *Moringa oleifera* leaves—an *in vitro* study. *Int J Pharm Sci Rev Res.* 2012; 12:89–94. [Google Scholar]
- [63] Singh BN, Singh BR, Singh RL, Prakash D, Dhakarey R, Upadhyay G, et al. Oxidative DNA damage protective activity, antioxidant and anti-quorum sensing potentials of *Moringa oleifera*. *Food Chem Toxicol.* 2009; 47:1109–16. [PubMed] [Google Scholar]
- [64] Satish A, Reddy PV, Sairam S, Ahmed F, Urooj A. Antioxidative effect and DNA protecting property of *Moringa oleifera* root extracts. *J. Herbs Spices Med Plants.* 2014; 20:209–20. [Google Scholar]
- [65]. Wangcharoen W, Gomolmanee S. Antioxidant capacity and total phenolic content of *Moringa oleifera* grown in Chiang Mai, Thailand. *Thai J Agric Sci.* 2011; 44:118–24. [Google Scholar]
- [66] Sinha M, Das DK, Bhattacharjee S, Majumdar S, Dey S. Leaf extract of *Moringa oleifera* prevents ionizing radiation-induced oxidative stress in mice. *J Med Food.* 2011; 14:1167–72. [PubMed] [Google Scholar]
- [67] Paliwal R, Sharma V, Pracheta SS. Elucidation of free radical scavenging and antioxidant activity of aqueous and hydro-ethanolic extracts of *Moringa oleifera* pods. *Res J Pharm Technol.* 2011; 4:566–71. [Google Scholar]
- [68] He TB, Huang YP, Huang Y, Wang XJ, Hu JM, Sheng J. Structural elucidation and antioxidant activity of an arabinogalactan from the leaves of *Moringa oleifera*. *Int J Biol Macromol.* 2018; 112:126–33. [PubMed] [Google Scholar]
- [69] Aa AB, Om J, Ts E, Ga A. Preliminary phytochemical screening, antioxidant and antihyperglycaemic activity of *Moringa oleifera* leaf extracts. *Pak J Pharm Sci.* 2017; 30:2217–22. [PubMed] [Google Scholar]
- [70] Stavros L, John T. Extraction and identification of natural antioxidants from the seeds of



- the *Moringa oleifera* tree variety of Malawi. *J Am Oil Chem Soc.* 2002; 79:677–83. [Google Scholar]
- [71] Cajuday LA, Pocsidio GL. Effects of *Moringa oleifera* Lam. (Moringaceae) on the reproduction of male mice (*Mus musculus*) *J Med Plants Res.* 2010;4:1115–21. [Google Scholar]
- [72] Nayak G, Honguntikar SD, Kalthur SG, D'Souza AS, Mutalik S, Setty MM, et al. Ethanolic extract of *Moringa oleifera* Lam. leaves protect the pre-pubertal spermatogonial cells from cyclophosphamide-induced damage. *J Ethnopharmacol.* 2016; 182:101–9. [PubMed] [Google Scholar]
- [73] Nath D, Sethi N, Singh RK, Jain AK. Commonly used Indian abortifacient plants with special reference to their teratologic effects in rats. *J Ethnopharmacol.* 1992; 36:147–54. [PubMed] [Google Scholar]
- [74] Leone A, Spada A, Battezzati A, Schiraldi A, Aristil J, Bertoli S. Cultivation, genetic, ethnopharmacology, phytochemistry and pharmacology of *Moringa oleifera* leaves: an overview. *Int J Mol Sci.* 2015; 16:12791–835. [PMC free article] [PubMed] [Google Scholar]
- [75] Patel RK, Patel MM, Kanzariya NR, Vaghela KR, Patel RK, Patel NJ. *In vitro* hepatoprotective activity of *Moringa oleifera* Lam. leaves on isolated rat hepatocytes. *Int J Pharm Sci.* 2010; 2:457–63. [Google Scholar]
- [76] Nanjappaiah HM, Shivakumar H. Prophylactic and curative effects of *Moringa oleifera* Lam. pods in CCl<sub>4</sub> damaged rat liver. *Indian J Nat Prod Resour.* 2012; 3:541–6. [Google Scholar]
- [77] Hamza AA. Ameliorative effects of *Moringa oleifera* Lam. seed extract on liver fibrosis in rats. *Food Chem Toxicol.* 2010; 48:345–55. [PubMed] [Google Scholar]
- [78]. Fakurazi S, Hairuszah I, Nanthini U. *Moringa oleifera* Lam. prevents acetaminophen induced liver injury through restoration of glutathione level. *Food Chem Toxicol.* 2008; 46:2611–5. [PubMed] [Google Scholar]
- [79] Das N, Kunal S, Santinath G, Bernard F, Sanjit D. *Moringa oleifera* Lam. ethanolic leaf extract prevents early liver injury and restores antioxidant status in mice fed with high-fat diet. *Indian J Exp Biol.* 2012; 40:404–12. [PubMed] [Google Scholar]
- [80] Pari L, Kumar NA. Hepatoprotective activity of *Moringa oleifera* on antitubercular drug-induced liver damage in rats. *J Med Food.* 2002; 5:171–7. [PubMed] [Google Scholar]
- [81] Omodanisi EI, Aboua YG, Chegou NN, Oguntibeju OO. Hepatoprotective, antihyperlipidemic, and anti-inflammatory activity of *Moringa oleifera* in diabetic-induced damage in male Wistar rats. *Pharmacognosy Res.* 2017; 9:182–7. [PMC free article] [PubMed] [Google Scholar]
- [82] Eldaim MA, Elrasoul SA, Elaziz SA. An aqueous extract from *Moringa oleifera* leaves ameliorates hepatotoxicity in alloxan-induced diabetic rats. *Biochem Cell Biol.* 2017; 95:524–30. [PubMed] [Google Scholar]
- [83] Adeyemi OS, Aroge CS, Akanji MA. *Moringa oleifera*-based diet protects against nickel-induced hepatotoxicity in rats. *J Biomed Res.* 2017; 31:350. [PMC free article] [PubMed] [Google Scholar]
- [84] Gilani AH, Janbaz KH, Shah BH. Quercetin exhibits hepatoprotective activity in rats. *Biochem Soc Trans.* 1997;25: S619. [PubMed] [Google Scholar]
- [85] Ruckmani K, Kavimani S, Anandan R, Jaykar B. Effect of *Moringa oleifera* Lam. on paracetamol induced hepatotoxicity. *Indian J Pharm Sci.* 1998; 60:33–5. [Google Scholar]
- [86] Devaraj VC, Asad M, Prasad S. Effect of leaves and fruits of *Moringa oleifera* on gastric and duodenal ulcers. *Pharm Biol.* 2007; 45:332–8. [Google Scholar]
- [87] Debnath S, Guha D. Role of *Moringa oleifera* on enterochromaffin cell count and serotonin content of experimental ulcer model. *Indian J Exp Biol.* 2007; 45:726–31. [PubMed] [Google Scholar]
- [88] Ndong M, Uehara M, Katsumata S, Sato S, Suzuki K. Preventive effects of *Moringa oleifera* (Lam.) on hyperlipidemia and hepatocyte ultrastructural changes in iron deficient rats. *Biosci Biotechnol Biochem.* 2007; 71:1826–33. [PubMed] [Google Scholar]
- [89] Nandave M, Ojha SK, Joshi S, Kumari S, Arya DS. *Moringa oleifera* leaf extract prevents isoproterenol-induced myocardial damage in rats:

- evidence for an antioxidant, antiperoxidative, and cardioprotective intervention. *J Med Food*. 2009; 12:47–55. [PubMed] [Google Scholar]
- [90] Barbagallo I, Distefano VA, Nicolosi D, Maravigna A, Lazzarino G, Rosa MD, et al. *Moringa oleifera* Lam. improves lipid metabolism during adipogenic differentiation of human stem cells. *Eur Rev Med Pharmacol Sci*. 2016; 20:5223–32. [PubMed] [Google Scholar]
- [91] Nahar S, Faisal FM, Iqbal J, Rahman MM, Yusuf MA. Antiobesity activity of *Moringa oleifera* leaves against high fat diet-induced obesity in rats. *Int J Basic Clin Pharmacol*. 2016; 5:1263–8. [Google Scholar]
- [92] Metwally FM, Rashad MH, Ahmed HH, Mahnoud AA, Raouf ER, Abdalla AM. Molecular mechanisms of the anti-obesity potential effect of *Moringa oleifera* in the experimental model. *Asian Pac J Trop Biomed*. 2017; 7:214–21. [Google Scholar]
- [93] Anita M, Babita A. Investigation into the mechanism of action of *Moringa oleifera* for its anti-asthmatic activity. *Orient Pharm Exp Med*. 2008; 8:24–31. [Google Scholar]
- [94] Goyal BR, Goyal RK, Mehta AA. Investigation into the mechanism of anti-asthmatic action of *Moringa oleifera*. *J Diet Suppl*. 2009; 6:313–27. [PubMed] [Google Scholar]
- [95] Mahajan SG, Mehta AA. Effect of *Moringa oleifera* Lam. seed extract on ovalbumin-induced airway inflammation in guinea pigs. *Inhal Toxicol*. 2008; 20:897–909. [PubMed] [Google Scholar]
- [96] Suzana D, Suyatna FD, Azizahwati, Andrajati R, Sari SP, Mun'im A. Effect of *Moringa oleifera* leaves extract against hematology and blood biochemical value of patients with iron deficiency anaemia. *J Young Pharm*. 2017;9: s79–84. [Google Scholar]
- [97] Adegbite OA, Omolaso B, Seriki SA, Shatima C. Effects of *Moringa oleifera* leaves on hematological indices in humans. *Ann Hematol Oncol*. 2016; 3:1107. [Google Scholar]
- [98] Archibong AN, Nku CO, Ofem OE. Extract of *Moringa oleifera* attenuates hematological parameters following salt loading. *MicroMedicine*. 2017; 5:24–30. [Google Scholar]
- [99] Manohar VS, Jayasree K, Kiran K, Rupa ML, Rohit D, Chandrasekhar N. Evaluation of hypoglycaemic and antihyperglycemic effect of freshly prepared aqueous extract of *Moringa oleifera* leaves in normal and diabetic rabbits. *J Chem Pharm Res*. 2012; 4:249–53. [Google Scholar]
- [100] Yassa HD, Tohamy AF. Extract of *Moringa oleifera* leaves ameliorates streptozotocin-induced diabetes mellitus in adult rats. *Acta Histochem*. 2014; 116:844–54. [PubMed] [Google Scholar]
- [101] Sugunabai J, Jayaraj M, Karpagam T, Varalakshmi B. Antidiabetic efficiency of *Moringa oleifera* and *Solanum nigrum*. *Int J Pharm Pharm Sci*. 2014; 6:40–2. [Google Scholar]
- [102] Sai MD, Ramesh B, Sarala KD. Evaluation of antidiabetic and antihyperlipidemic potential of aqueous extract of *Moringa oleifera* in fructose fed insulin resistant and STZ induced diabetic Wistar rats: a comparative study. *Asian J Pharm Clin Res*. 2012; 5:67–72. [Google Scholar]
- [103] Khan W, Parveen R, Chester K, Parveen S, Ahmad S. Hypoglycemic potential of aqueous extract of *Moringa oleifera* leaf and *in vivo* GC-MS metabolomics. *Front Pharmacol*. 2017; 8:577. [PMC free article] [PubMed] [Google Scholar]
- [104] Jangir RN, Jain GC. Antidiabetic and antioxidant potential of hydroalcoholic extract of *Moringa oleifera* leaves in streptozotocin-induced diabetic rats. *Eur J Pharm Sci*. 2016; 3:438–50. [Google Scholar]
- [105] Odedele LO, Ajao FO, Yusuf J, Adu FD. Effect of aqueous *Moringa* seed extract on oxidative stress in alloxan-induced gestational diabetic rats. *Med Res Arch*. 2017; 5:1–14. [Google Scholar]
- [106] Karadi RV, Palkar MB, Gaviraj EN, Gadge NB, Mannur VS, Alagawadi KR. Antiuro lithiatic property of *Moringa oleifera* root bark. *Pharm Biol*. 2008; 46:861–5. [Google Scholar]
- [107] Paikra BK, Dhongade HKJ, Gidwani B. Phytochemistry and pharmacology of *Moringa oleifera* Lam. *J Pharmacopuncture*. 2017; 20:194–200. [PMC free article] [PubMed] [Google Scholar]

- [108] Caceres A, Saravia A, Rizzo S, Zabala L, Leon ED, Nave F. Pharmacologic properties of *Moringa oleifera* 1: preliminary screening for antimicrobial activity. *J Ethnopharmacol.* 1992; 36:233–7. [PubMed] [Google Scholar]
- [109] Mahajan SG, Mehta AA. Inhibitory action of ethanolic extract of seeds of *Moringa oleifera* Lam. on systemic and local anaphylaxis. *J Immunotoxicol.* 2007; 4:287–94. [PubMed] [Google Scholar]
- [110] Hagiwara A, Hidaka M, Takeda S, Yoshida H, Kai H, Sugita C, et al. Anti-allergic action of aqueous extract of *Moringa oleifera* Lam. leaves in mice. *Eur J Med Plants.* 2016; 16:1–10. [Google Scholar]
- [111] Rastogi T, Bhutda V, Moon K, Aswar PB, Khadabadi SS. Comparative study on the anthelmintic activity of *Moringa oleifera* and *Vitex negundo*. *Asian J Res Chem.* 2009; 2:181–2. [Google Scholar]
- [112] Cabardo DE, Jr, Portugaliza HP. Anthelmintic activity of *Moringa oleifera* seed aqueous and ethanolic extracts against *Haemonchus contortus* eggs and third stage larvae. *Int J Vet Sci Med.* 2017; 5:30–4. [PMC free article] [PubMed] [Google Scholar]
- [113] Rathi B, Patil PA, Baheti AM. Evaluation of aqueous extract of pulp and seeds of *Moringa oleifera* for wound healing in albino rats. *J Nat Remedies.* 2004; 4:145–9. [Google Scholar]
- [114] Rathi BS, Bodhankar SL, Baheti AM. Evaluation of aqueous leaves extract of *Moringa oleifera* Linn. for wound healing in albino rats. *Indian J Exp Biol.* 2006; 44:898–901. [PubMed] [Google Scholar]
- [115] Momoh MA, Salome CA, Onyishi IV. Natural healing compound for the treatment of excision and incision wound in rat's model. *Int J Pharm Sci Rev Res.* 2013; 22:1–5. [Google Scholar]
- [116] Lambole V, Kumar U. Effect of *Moringa oleifera* Lam. on normal and dexamethasone suppressed wound healing. *Asian Pac J Trop Biomed.* 2012;2: S219–23. [Google Scholar]
- [117] Muhammad AA, Arulselvan P, Cheah PS, Abas F, Fakurazi S. Evaluation of wound healing properties of bioactive aqueous fraction from *Moringa oleifera* Lam. on experimentally induced diabetic animal model. *Drug Des Devel Ther.* 2016; 10:1715–30. [PMC free article] [PubMed] [Google Scholar]
- [118] Gothai S, Arulselvan P, Tan WS, Fakurazi S. Wound healing properties of ethyl acetate fraction of *Moringa oleifera* in normal human dermal fibroblasts. *J Intercult Ethnopharmacol.* 2016; 5:1–6. [PMC free article] [PubMed] [Google Scholar]
- [119] Elangovan M, Rajalakshmi A, Jayachitra A, Mathi P, Bhogireddy N. Analysis of phytochemicals, antibacterial and antioxidant activities of *Moringa oleifera* Lam. leaf extract—an *in vitro* study. *Int J Drug Dev Res.* 2014; 6:173–80. [Google Scholar]
- [120] Jha N, Mohanka R, Azad R. Antifungal investigation of the constituents of *Moringa oleifera* Lam. root bark extract. *Asian J Chem.* 2009; 21:7437–9. [Google Scholar]
- [121] Kaur A, Kaur PK, Singh S, Singh IP. Antileishmanial compounds from *Moringa oleifera* Lam. *Z Naturforsch C.* 2014; 69:110–6. [PubMed] [Google Scholar]
- [122] Dasgupta S, Gunda NSK, Mitra SK. Evaluation of antimicrobial activity of *Moringa oleifera* seed extract as a sustainable solution for portable water. *RSC Advances.* 2016; 31:25918–26. [Google Scholar]
- [123] Oluduro AO. Evaluation of antimicrobial properties and nutritional potentials of *Moringa oleifera* Lam. leaf in south-western Nigeria. *Malays J Microbiol.* 2012; 8:59–67. [Google Scholar]
- [124] Alozie YE, Sonye CU. Antimicrobial activity of *Moringa oleifera* leaf against isolates of beef offal. *Br Microbiol Res J.* 2015; 9:1–7. [Google Scholar]
- [125] Singh K, Tafida GM. Antibacterial activity of *Moringa oleifera* (Lam) leaves extracts against some selected bacteria. *Int J Pharm Pharm Sci.* 2014; 6:52–4. [Google Scholar]
- [126] Rao RR, George M, Pandalai KM. Pterygospermin; the antibacterial principle of *Moringa pterygosperma*, Gaertn. *Nature.* 1946; 158:745. [PubMed] [Google Scholar]
- [127] Fahey JW. *Moringa oleifera*: a review of the medical evidence for its nutritional, therapeutic and prophylactic properties. *Trees Life J.* 2005;1:5. [Google Scholar]

- [128] Sudha P, Asdaq SM, Dhamingi SS, Chandrakala GK. Immunomodulatory activity of methanolic leaf extract of *Moringa oleifera* in animals. *Indian J Physiol Pharmacol.* 2010; 54:133–40. [PubMed] [Google Scholar]
- [129] Lakshminarayana M, Shivkumar H, Rimaben P, Bhargava VK. Antidiarrhoeal activity of leaf extract of *Moringa oleifera* in experimentally induced diarrhoea in rats. *Int J Phytomed.* 2011; 3:68–74. [Google Scholar]
- [130] Choudhury S, Sharan L, Sinha MP. Anti-diarrhoeal potentiality of leaf extracts of *Moringa oleifera*. *Br J Appl Sci Technol.* 2013; 3:1086–96. [Google Scholar]
- [131] Raguindin PF, Dans LF, King JF. *Moringa oleifera* as a galactagogue. *Breastfeed Med.* 2014; 9:323–4. [PubMed] [Google Scholar]
- [132] Medhi HN, Khanikor LC, Lahon PM, Barua CC. Analgesic, anti-inflammatory and local anesthetic activity of *Moringa* in laboratory animals. *Int J Pharmacogn.* 1996; 34:207–12. [Google Scholar]