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Review

A Compressive Review of the *Moringa Oleifera* Plant: Phytochemistry and Pharmacological Significance

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Abstract:

The pantropical plant Moringa oleifera has now established itself in Afghanistan, both East &West Africa and Florida. Apart from its remarkable nutritional value in many regions of the world, Moringa oleifera is widely recognized for the significant medical advantages it provides. Many of the traditional folklore claims regarding the medicinal uses of Moringa oleifera morphological parts for a variety of ailments, including heart problems, fevers, inflammation, digestive disorders, asthma, intestinal problems, and rheumatism, have been supported by scientific studies conducted in the last few decades. Numerous pharmacological properties, including analgesic, anti-inflammatory, diuretic, antioxidant, anti-hypertensive and anti-tumor activities, are possessed by Moringa oleifera. Moreover, Moringa oleifera has a number of phytochemicals, some of which are highly valued for their potential medical applications. It is said that every portion of Moringa oleifera has health benefits, adding to the plant's variety and usefulness as a remedy. An updated summary of the scientific literature on the Phytochemistry and pharmacological importance of Moringa oleifera will be provided in this review.

Keywords: *Phytochemical, Hypertension, Anti-diuretic, Ulcer, Pharmacological significance.*

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INTRODUCTION

The plant known as Moringa Oleifera is extensively distributed throughout several tropical and subtropical nations.The countries of India, Africa, Latin America and Caribbean, Mexico City, the Islands of Hawaii, and all over the Americas and the region of Southeast Asia are among the locations where it is cultivated economically. It is called the ben oil plant from oily substances obtained from seeds, the Moringa plant from the flavor of dishes made from crushed roots, and the drumstick plant from the shape and appearance of its premature pods of seeds [1]. Products made from a variety of plant-based substances are regarded as reasonably safe to eat since they are an origin of bioactive substances and multipurpose curative agents. A quarter of synthetic medications are made from plants used for medicinal purposes, which accounts for around 70–80% of the human population worldwide, based on research by the Food and Agricultural Organization of the United Nations (FAO) [2]. The species of tree which is indigenous to India and several African and Asian nations can be used as a leafy vegetable. It has been demonstrated that young leaf of Moringa Oleifera are an abundant supplier of carotenoids, including lutein and β-carotene. In conventional health care, several materials are employed, including seeds, leaves, oil, sap, bark, roots, and flowers. It has been observed that the leaves of Moringa, which are rich in lipids, minerals, antioxidants, and amino acids, provide a suitable balance of nutrients [3]. Moringa contains a wide range of essential nutrients like vitamins and minerals. The

leaves provide almost the same quantity of potassium and the antioxidant vitamin C as an oranges and a fruit like banana respectively. Moreover, it contains amino acids, calcium, iron, and protein, all of which support the growth and repair of skeletal muscle in the human body. For generations, this tree's branches, petals, seed mixture, and roots have been utilized in traditional medicine. It has historically been applied as a treatment for ailments like: Type 2 diabetes, prolonged inflammation, Microbial, viral, and bacteria-related infections Pain in the joints, cardiac health Cancer [4]. Among the several applications for moringa are: alley cultivation (tree matter production), living food (leafs as well as treated seed-cake), biological gas (from leaf tissue), blue color (hardwood), fencing (living Plant), fertilizer (seed-cake), leaf nutrient (fruit juice expressed through the leaves), green waste (from greenery), gum (from tree branches), honey- and sweet cane juice-clarifier (powdered seeds), sweetness (blossoms nectar), medical treatments (a whole parts), ornamental plantings, biological pesticides (soil incorporation of leaves to prevent growing damping off), pulp (hardwood), the rope (bark), tannin for tanning hides (the bark and gum), and water treatment (crushed seeds) [5]. As an outcome, due to Moringa oleifera potential qualities, it has become widely used in several applications [6] (**Fig1**).

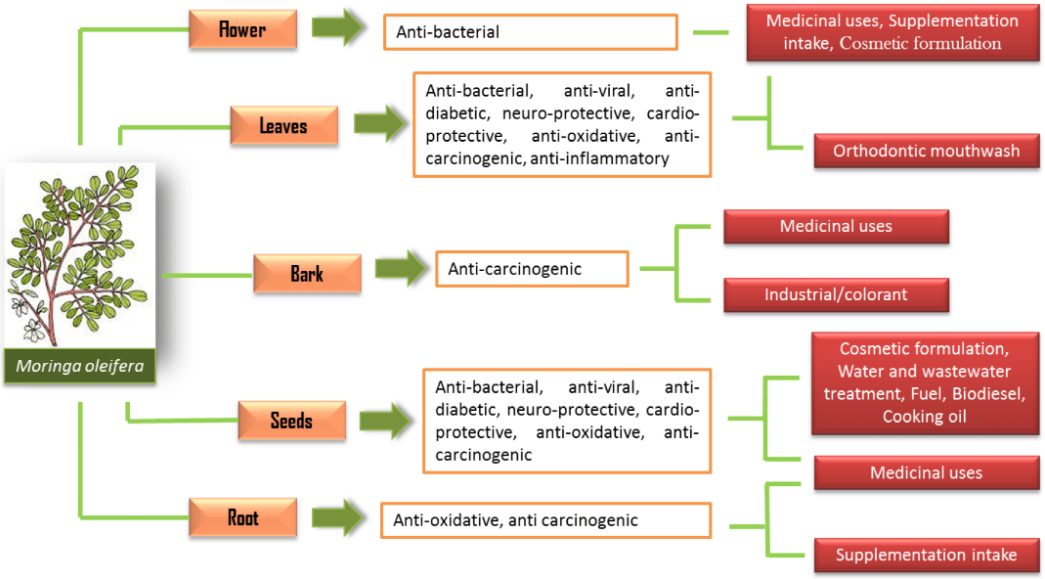

Fig.1-The use of Moringa Oleifera in various Applications

M. oleifera has gained notoriety for its applications as a fertilizer, biogas producer, and other uses [7]. It is a highly adaptive species that can reach upwards of between five and ten meters in a short amount of time it can reach 4 m in just 6 months. It lives for roughly 20 years [8]. Because of its exceptional power to produce nutritious food, that include a variety of vegetal components including leaves, pods shells, stems, blossoms, fruits, and the seeds, it is regarded as an extremely adaptable plant. These structures hold nutrition and biologically active substances. Elements having a large range of applications in food, including phenolic substances, lipids, carbs, fibers, nutrients, and vitamins. However, given the presence of harmful chemicals, it is likely not safe to consume the entire plant [9, 10].

TAXONOMIC CLASSIFICATION

Table-1: Moringa oleifera taxonomic classification [11, 12]

Kingdom	Plantae
Sub kingdom	Tracheobionta
Super Division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Capparales
Family	Moringaceae
Genus	Moringa
Species	Oleifera

BOTANICAL DESCRIPTION

Synonyms

There are many different names for the tree of Moringa oleifera around the globe. The list of synonyms is above [13].

Table-2: Synonyms of Moringa oleifera

Latin	**Moringa Oleifera**
Sanskrit	Subhanjana
Hindi	Saguna, Sainjna
Gujarati	Suragavo
Tamil	Morigkai
English	Drumstick tree, Horseradish tree, Ben tree
Munaga Malayalam	Murinna, Sigru
Punjabi	Sainjna, Soanjna
Unani	Sahajan
Ayurvedic	Akshiva
Telugu	Mulaga

DIFFERENT PART OF MORINGA

Stem:-Although the stem is inherently lengthy, it is occasionally not properly formed. The tree is between 1.8 and 3 meters tall, with a short enough flat branches [14].

Leaves: - The fluffy, 1-4cm lengthy green in color, curving leaflet found on tripinnate complexity leaves are curved.The leaves that grow on the tree sometimes lead people to believe it to be a leguminous plant.Usually, the tops of the branches are where the alternating twice or three-times pinnate leaves appear (**Fig.2**). They have a lengthy petiole containing 8–10 pairs of pinnae, each of which bears 2 sets of inverted elliptical leaves and just one, 1-2cm tall leaflet at the tip. They are 20–70 cm tall and have a grayish tint when growing [15].

Flowers: -Large, delicately scented blooms are carried on 15–25 cm long flowers. The majority of the flowers are white to cream in colors, with an overall diameter of 2.5 cm, while some variants have a hint of pink. (**Fig.2**) they blooms, which are 2.5 cm diameter and somewhat scented, are abundantly produced in auxiliary panicles that drop panicles that are 10 to 25 cm long. They have white dots at the bottom of them.

Branch: -The outer layer took on the appearance of an umbrella as the branches spread out erratically.

DIFFERENT PART OF MORINGA OLEIFERA

Fruits: - Fruits, also known as pods, are the troubled shells that contain seeds. Embryos are green, with certain assortments showing slight radish coloration. Triangular, brown, and tapering at both ends with nine ribs, the pods range 35 to 130 cm in height and 12.8 cm in width. When dried, they break across into 3 halves.

Seeds: -The round, partially permeable seeds have three papery wings and a brown color (**Fig.2**). The majority of seed combinations are brown from light to dark brown; however they might also be white if some of them are not very viable. In a matter of days, feasible seeds germinate. The three white wings on the body actually beat out at a rate of 130 beats per second [16].

(A)

(B)

(C) **(D)**

Fig.- 2: A- Leaves, **B-**Flower, **C-** Fruits, and **D-**Seeds

USES OF MORINGA OLEIFERA PLANT

The tree is mostly prized for its soft, edible pods, which taste a lot like asparagus. Cooked or pickled, they are consumed as a wholesome vegetable. Consume food raw or cooked, the tender leaves are similar to the watercress and go well with the flowers [17, 18, 19]. They are abundant in mineral substances, amino acids, riboflavin, beta-carotene, thiamine, and other vitamin A and vitamin C [20, 21]. For every 100 grams of pulp, the color green pods contain between 92 and 126 milligrams of ascorbic acid and vitamin C [22]. Protein makes up about 5–10% of the immature fruits, flowers, and leaves (**Fig.3**). The young seeds may be eaten cooked or raw, and if they are fried, they taste like peanuts as well [23]. Since the root bark contains a lot of alkaloids, especially moringine, a poisonous substance related to ephedrine, it needs to be eliminated entirely [24]. Moringa seeds are employed in an established technique to filter out water pollutants [25]. As anthelmintic and ant paralytic, root are cooked with other herb and soaking in either alcohol or water to create beverages and infusion that are used as toothache cures [26, 27]. Lastly, florals are employed to make aphrodisiacs and to cure tumors, hysteria, inflammation, muscular disorders, and splenic development [28, 29].

Fig.-3 Plant of Moringa Oleifera

PHYTOCHEMISTRY

This plant kingdom is especially rich in substances that include sugars such as rhamnose as well as a rather uncommon class of substances known as glucosinolates and isothiocyanates [30, 31].

Certain elements found in Moringa plans, for instance, have been shown reported to exhibit hypotensive, chemotherapy, and antibacterial properties. These components contain 4-(4'-O-acetyl-α-L-rhamnopyranosyloxy) benzylisothiocy-anate (1), 4-(α-L-rhamnopyranosyloxy)benzyl isothiocy-anate (2), niazimicin (3), pterygospermin (4), benzyl isothiocyanate (5), and 4-(α-L rhamnopyranosyloxy) benzyl glucosinolate (6). Although these substances are comparatively exclusive to the Moringa family, it also contains a multitude of nutrients, minerals, and other phytochemicals that are well known, like the carotenoids (which include pro-vitamin A or β-carotene) [32].

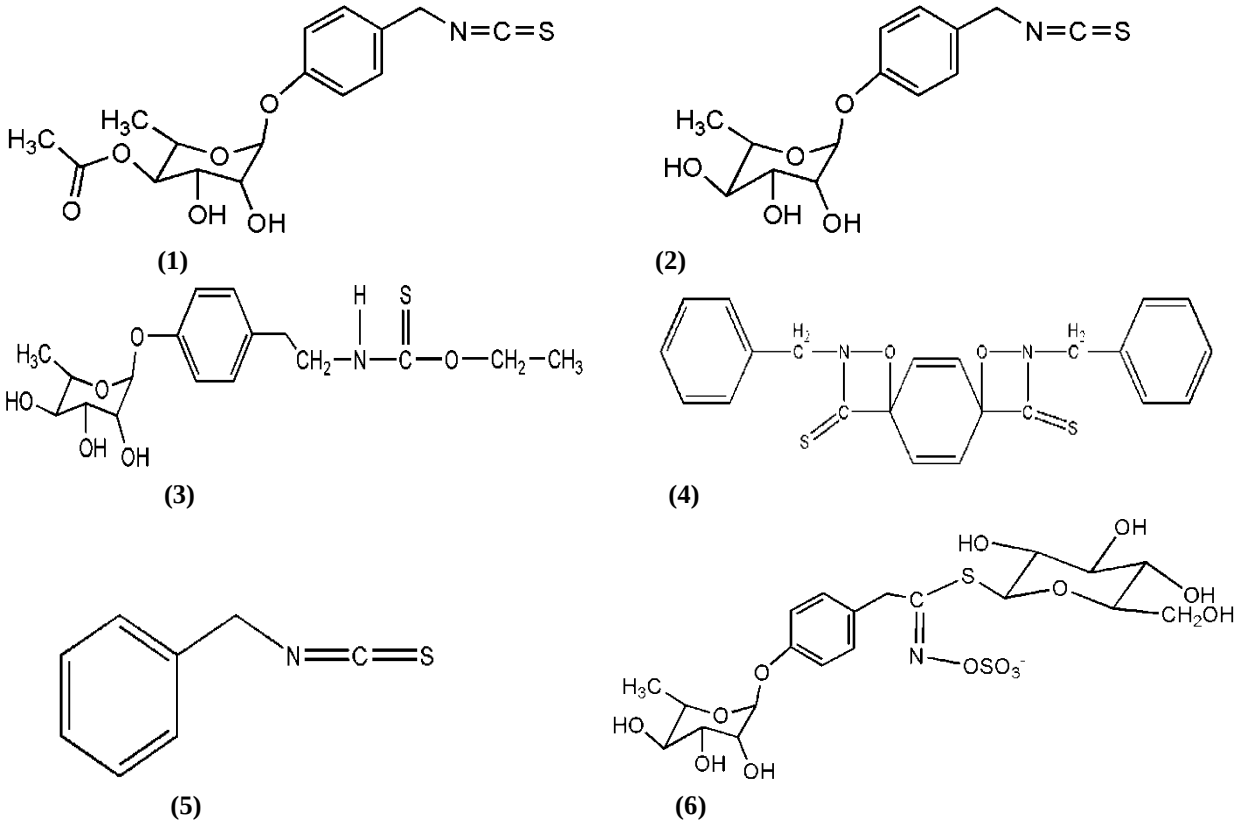

Fig.4:- Phytochemicals present in Moringa spp.: 4-(4'-O-acetyl-α-L-rhamnopyranosyloxy)benzyl isothiocy-anate **(1),** 4-(α-L-rhamnopyranosyloxy)benzyl isothiocy-anate **(2),** niazimicin **(3),** pterygospermin **(4),** benzyl isothiocyanate **(5),** and 4-(α-L rhamnopyranosyloxy) benzyl glucosinolate **(6).**

The Moringa oleifera tree plant has several phytochemical components that may be discovered throughout the plant. **Table 3:** Presents a tabular list of these elements based on existing research [33, 34, 35].

S. No.	PLANT PART	EXTRACT	PHYTO-CONSTITUENTS
1	Leaves	Both alcoholic and watery	Niazirin and Niazirinin – nitrile glycosides,4-[(4′-O-acetylalpha- L- rhamnosyloxy) benzyl isothiocyanate, Niaziminin A, and Niaziminin B, three mustard oil glycosides, niaziminin, a thiocarbamate,4-(alpha-1-rhamnopyranosyloxy)-benzylglucosinolate, quercetin-3-O-glucoside and quercetin-3-O-(6″-Malonyl-glucoside),Niazimicin.
2	Seeds	Water-based and Hydro alcoholic	Methionine, cysteine, 4-(alpha-L-rhamnopyranosyloxy) benzylglucosinolate, niazimicin, Niazirin, and moringine are among the substances.
3	Flowers	Alcoholic hydro	Proteins, D-mannose, kaemopherol, isoquercetin, kaempferitin, and vitamin C.
4	Pods	Alcoholic hydro	Isothiocyanate, nitrates thiocarbamates, methyl-p-hydroxybenzoate, the antioxidant beta-s O-(1heptenyloxy) propyl the undecanoate, and O-ethyl-4-(alpha-L-rhamnosyloxy) benzyl carbamate.
5	Roots	Alcoholic	Moringine, spirachin, 1, 3-dibenzyl urea, or 4-(alpha-L-rhamnopyranosyloxy) benzylglucosinolate, alpha-

			phellandrene, p-cymene, Deoxy-niazimicine, and moringine as well as moringinine.
6	Barks	Alcoholic	Alpha-L- rhamnopyranosyloxy-4-benzylgiucosinolate.

PHARMACOLOGICAL SIGNIFICANCE

Many different pharmacological effects are exhibited by the herb Moringa oleifera. Above is a discussion of a few of them.

ANTIOXIDENTS ACTIVITY

Moringa Oleifera exhibits antioxidant qualities in both the leafy parts and an entire pod [36]. Because of the exceptionally high quantities of polyphenols, a water-based extract of both tender and fully developed leaves had a good direct scavenging action on antioxidants such as superoxide, nitric oxide (Nitric Oxide), and 2, 2-diphenyl-2-picryl hydrazyl (DPPH) and inhibited the oxidization of lipids [37]. The extract of fruit has shown beneficial effects in eradicating free radicals from the body and decreasing iron- along with FeSO4-induced microsomal destruction of lipids in a degree-dependent fashion [38].

NEUROPROTECTIVE ACTIVITY

Dementia is an incurable neurological condition that has grown more prevalent because of a growing elderly population. It is characterized by a significant loss in overall cognitive capability, including decreased memory, attention, language, and problem-solving ability [39]. The main cause of dementia is Alzheimer's disease (AD), a chronic neurological illness that is irreversible. The harm to proteins, DNA, and lipids can occur from ROS-associated oxidative stress, which can also cause cell death through mitochondrial malfunction [40, 41, 42].

ANTIPYRETIC ACTIVITY

It is possible to speculate about the antipyretic medication action of Moringa due to its biologically active ingredients' anti-inflammatory properties impact.A research was created to evaluate the antibiotics properties of MO seed extracts dissolved in ethanol, the petroleum-based liquid ether, and ethyl acetate solvents utilizing the yeast-induced hyperpyrexia occurs technique. Throughout the trial, paracetamol served as a control drug. Unsurprisingly, seeds that were extracted in methanol and ethyl acetate, respectively, had strong antipyretic effects in rats [43, 44].

ANTI-CANCER ACTIVITY

The Lam pods of the Moringa Oleifera plant is a possible chemo preventive agent. Both the frequency and complexity of tumors decreased with the dosage-dependent administration of boiling Moringa oleifera (bMO), particularly at the greatest dose (6.0%) of bMO [45].

ANTIMICROBIAL ACTIVITY

Various researches reported that the antibacterial capabilities of stem, flowers, bark, roots, and seeds varied [46]. Following the identification of many antibacterial ingredients with inhibitory effects versus a wide range of bacteria, Moringa Oleifera has been regarded as an antibiotic.

Found that the antibacterial impact of the extracted Moringa leaf was minimal, as evidenced by development areas that were inaccessible at 1.5 mm. This suggests that the microbes were less affected by the levels of Moringa leave extract that was used. Achieved a significant outcome by using the Moringa leaves and the fruit ethanol fraction and the ethyl acetate fraction of the fruit's pulp and tree bark. found that several microbial and fungi species, including a variety of Salmonella typhi, Bacillus subtilis, albicans Candida, Staphylococci aureus, and Pseudomonas aeriginosa, are inhibited in development by preparations of moringa [47].

ANALGESIC, ANTI-INFLAMMATORY ACTIVITY

It was previously suggested that Moringa reduces inflammation-related markers and is associated with analgesic as well as anti-inflammatory effects in a number of preliminary testing investigations in rodents [48]. An alcohol-based extract of the Moringa seeds and leaves provided a comparison between the analgesic properties of aspirin and indomethacin [49]. Based on these research, it can be concluded that Moringa has an analgesic impact comparable to that of common medications like aspirin and indomethacin. An edema form caused by the carrageenan shows the anti-inflammatory effects of Moringa extraction from the leaf [50]. The c-Jun N-terminal pathways and neutrophils could both contribute to the antibacterial action.

ANTIULCER ACTIVITY

In rats, the methanol-based extract of drumstick leaf prevented the development of stomach lesions brought caused by aspirin, serotonin and indomethacin [52]. At a dose of 4g/kg total body weight, the methanol-based extract of blossom buds demonstrated antiulcerogenic efficacy against stomach ulcers produced by aspirin [53].

ANTIFUNGAL AND ANTIBACTERIAL ACTIVITY

A material that kills or inhibits the growth of microorganisms, such as fungus, protozoans, and miniscule creatures, is called an antibiotic. Antimicrobial substances may be collected and function primarily against bacteria, as demonstrated by the latter. The antimicrobial properties of Moringa Oleifera root are well recognized [54]. They are regarded as prosperous sources of antibacterial agents. Pterygospermin is an efficient bactericidal and fungicide agent that is also said to be one of Moringa's benefits [55]. While the liquid extracted from the stem wood of Moringa displayed an antibacterial effect against s. aureus [56]. The resulting substance of the lower root barks of the plant showed evidence of antifungal activity [57, 58].

CONCLUSION

The primary aim of this work was to investigate and elucidate the pharmacological & medicinal properties of Moringa oleifera. Preclinical research has demonstrated, this plant exhibits a range of effects, including analgesic, anti-inflammatory, antipyretic, antioxidant, anticancer, hepatoprotective, gastro protective, cardiovascular, anti-obesity, anti-ulcer, antiepileptic, antidiuretics, anti-allergic, and anthelmintic, wound healing, antimicrobial, immunomodulatory, and antidiarrheal properties. The phytoconstituents found in its root, stem, bark, leaf, flower, pod, and seeds may be responsible for these actions. Moringa oleifera has enormous worth and ought to be utilized to advance public health. It might serve as the foundation for medication supplements. It could also be taken into consideration as an alternate therapy for the treatment of certain illnesses.

Credit author statement:

Shourya Pratap: conception, Writing- Reviewing and Editing, Data curation.

Shourya Pratap: Original draft preparation, Supervision.

REFERENCES

1. Razis, A. F. A., & Ibrahim, M. U. (2024). Health benefits of Moringa Oleifera. *Asian Pacific Journal of Cancer Prevention*, *15*(20), 8571-8576.
2. Pan, S.-Y., Zhou, S.-F., Gao, S.-H., et al. (2013). New perspectives on how to discover drugs from herbal medicines: CAM's outstanding contribution to modern therapeutics. Evidence-Based Complementary and Alternative Medicine, 2013, Article 627375. https://doi.org/10.1155/2013/627375
3. Moyo, B., & Masika, P. J. (2011). Nutritional characterization of Moringa leaves. African Journal of Biotechnology, 10 (60), 12925-12933.
4. Mallenakuppe, R., Homabalegowda, H., Gouri, M. D., Basavaraju, P. S., &Chandrashekharaiah, U. B. (2019). History, taxonomy and propagation of Moringa oleifera - A review. International Journal of Life Sciences, 5, 2322-2327. https://doi.org/10.21276/SSR-IIJLS.2019.5.3.7
5. Azlan, U. K., & Mediani, A. (2022). A comprehensive review with updated future perspective on the ethnomedicinal and pharmacological aspect of Moringa oleifera. MDPI, 27 (18), 5765.
6. Pareek, A., Pant, M., Gupta, M. M., Kashania, P., Ratan, Y., Jain, V., Pareek, A., & Chuturgoon, A. A. (2023). Moringa oleifera: An updated comprehensive review of its pharmacological activities, ethnomedicinal, phytopharmaceutical formulation, clinical, phytochemical, and toxicological aspects. International Journal of Molecular Sciences, 24 (3), 2098. https://doi.org/10.3390/ijms24032098
7. García, M. G. (2016). Moringa oleifera: Árbol multiusos de interésforestal para el sur de la PenínsulaIbérica. Departamento de Ingeniería y Gestión Forestal y Ambiental, Universidad Politécnica de Madrid, Madrid, Spain, 1-12.
8. Martínez, L., & Bastida, N. G. (2019). Green alternatives to synthetic antioxidants, antimicrobials, nitrates, and nitrites in clean label Spanish Chorizo. Antioxidants, 8 (6), 184.
9. Milla, P. G., & Penalver, R. (2019). Health benefits of uses and applications of Moringa Oleifera in bakery products. Plant, 10 (1), 1-10.
10. Koul, B., & Neikuzo Chase, N. (2015). Moringa Oleifera Lam.: Panacea to several maladies. Journal of Chemical and Pharmaceutical Research, 7 (6), 687-707.

11. Mall, E. R., & Homabalegoda, H. (2019). History, taxonomy & propagation of Moringa Oleifera. SSR Institute International Journal of Life Sciences, 5 (3), 2322-2327.
12. Mishra, G., & Singh, P. (2011). Traditional use, phytochemistry, and pharmacological properties of Moringa Oleifera plant. Der Pharmacia Lettre, 3 (2), 141-164.
13. Foidl, N., & Makkar, H. P. S. (2001). The potential use of Moringa Oleifera for agriculture and industrial uses. Mangua, Nicaragua, 1-20.
14. Chaudhary, K., & Chaurasia, S. (2017). Nutraceutical properties of Moringa Oleifera. European Journal of Pharmaceutical and Medical Research, 4 (4), 646-666.
15. Dahot, M. U. (1988). Vitamin contents of the flowers of Moringa oleifera. Pakistan Journal of Biochemistry, 21, 21-24.
16. Gupta, K., & Barat. (1989). Nutrient contents and antinutritional factors in conventional and non-conventional leafy vegetables. Food Chemistry, 31(2), 105-116.
17. Nautiyal, B. P. (1987). Moringa (Drumstick) – an ideal tree for social forestry. My forest, 23 (1), 53-58.
18. Sreeeamulu, N. (1982). Chemical composition of some leafy vegetables grown in Tanzania. Journal of Plant Foods, 4 (3), 139-141.
19. Verma, S. C. (1976). Nutritional value of Moringa. Current Science, 45 (21), 769-770.
20. Dogra, P. D. (1975). Vitamin C content in Moringa pod vegetable. Current Science, 44 (1), 31.
21. Ramachandran, C., & Peter. (1980). Drumstick (Moringa oleifera): A multipurpose Indian vegetable. Economic Botany, 34 (3), 276-283.
22. Morton, J. F. (1991). The horseradish tree, Moringa pterygosperma (Moringaceae) – a boon to arid lands? Economic Botany, 45 (3), 318-333.
23. Popoola, J. O., & Obembe. (2013). Local knowledge, use pattern, and geographical distribution of Moringa oleifera Lam. (Moringaceae) in Nigeria. Journal of Ethnopharmacology, 150, 682-691.
24. Sivasankari, B., & Anandharaj. (2014). An ethnobotanical study of indigenous knowledge on medicinal plants used by the village peoples of Thoppampatti, Dindigul district, Tamil Nadu, India. Journal of Ethnopharmacology, 153, 408-423.
25. Anwar, F., & Latif, S. (2007). Moringa oleifera: A food plant with multiple medicinal uses. Phytotherapy Research, 21 (1), 17-25.
26. Yabesh, J. E., & Prabhu. (2014). An ethnobotanical study of medicinal plants used by traditional healers in Silent Valley of Kerala, India. Journal of Ethnopharmacology, 154, 774-789.
27. Leone, A., & Spada, A. (2015). Cultivation, genetic, ethno pharmacology, phytochemistry and pharmacology of Moringa Oleifera leaves. International Journal of Molecular Sciences, 16, 12791-12835.
28. Fahey, J. W., & Zalcmann, A. T. (2001). The chemical diversity and distribution of glucosinolates and isothiocyanates among plants. Phytochemistry, 56 (1), 5-51.
29. Bennett, R. N., & Mellon, F. A. (2003). Profiling glucosinolates and phenolics in vegetative and reproductive tissues of the multi-purpose trees Moringa oleifera L. (Horseradish tree) and Moringa stenopetala L. Journal of Agricultural and Food Chemistry, 51 (12), 3546-3553.
30. Fuglie, L. J. (2001). The Miracle Tree: Moringa oleifera - Natural Nutrition for the Tropics. Church World Service, Dakar, 68.
31. Dixit, S., & Tripathi, A. (2016). Medicinal properties of Moringa Oleifera. International Journal of Engineering Research and Reviews, 3 (2), 176-185.
32. Foidl, N., & Makkar, H. P. S. (2001). The potential use of Moringa Oleifera for agriculture and industrial uses. Managua, Nicaragua: 1-20.
33. Sharma, V. R., & Paliwal, R. (2011). Phytochemical analysis & evaluation of antioxidant activities of hydroethanoic extract of Moringa Oleifera Lam. Journal of Pharmaceutical Research, 4 (2), 554-557.
34. Paikra, B. K., & Hemant Kumar. (2017). Phytochemistry and pharmacology of Moringa Oleifera Lam. Journal of Pharmacopuncture, 20, 194-200.
35. Luqman, S., & Suchita, S. (2012). Experimental assessment of Moringa Oleifera leaf & fruit for its antistress, antioxidant & scavenging potential using in vivo & in vivo assays. Evidence-Based Complementary and Alternative Medicine, 2012, 1-17.

36. Sreelatha, S., & Padma, P. R. (2009). Antioxidant activity and total phenolic content of Moringa Oleifera leaves in two stages of maturity. Plant Foods for Human Nutrition, 64 (4), 303-311.
37. PrithivirajElomalai and Sumthy Govindarajan, "A rieview on Pharma Cological properties of Moringa Oleigofera", Natural Volaties&Essemtial Oils; 2021:8(5):340-355.
38. Prince, M., & Bryce, R. (2013). The global prevalence of dementia: A systematic review and meta-analysis. Alzheimer's & Dementia: The Journal of the Alzheimer's Association, 9, 63-75.
39. Kou, X., Li, J., & Bian, J. (2015). Ampelopsin attenuates 6-OHDA-induced neurotoxicity by regulating GSK-3β/NRF2/ARE signaling. *Journal of Functional Foods, 19, 765-774.
40. Kou, X., & Li, B. (2018). Nutraceutical or pharmacological potential of Moringa Oleifera Lam. Nutrients, 10 (1), 1-12.
41. Hukkeri, V. I., & Nagathan, C. V. (2006). Antipyretic and wound healing activity of Moringa Oleifera Lam. in rats. Indian Journal of Pharmaceutical Sciences, 68 (1), 124-126.
42. Farooq, F., & Rai, M. (2012). Medicinal properties of Moringa Oleifera: An overview of promising healer. Journal of Medicinal Plant Research, 6 (27), 4368-4374.
43. Budda, S., &Butryee. (2011). Suppressive effect of Moringa Oleifera Lam pod against mouse colon carcinogenesis induced by azoxymethane and dextran sodium sulfate. Asian Pacific Journal of Cancer Prevention, 12 (12), 3221-3228..
44. Samson, S. L. A., & Bentley, J. R. (2005). The effect of loop electrosurgical excision procedure on future pregnancy outcome. Trees for Life Journal, 1 (5), 1-15.
45. Abdulkadir, A. R., & Hasan, M. D. (2018). Antimalarial, antioxidant, and antimicrobial properties of Moringa Oleifera Lam. Australian Journal of Crop Science, 12 (06), 905-908.
46. Pappas, I. S., & Siomou, S. (2021). Moringa Oleifera leaves crude aqueous down-regulates of BRCA1, mta-1 and oncogenes c-myc and p53 in AsPC-1, MCF-7 and HTC-116 cells. Food Bioscience, 43, 101221.
47. Biswas, S., & Chowdhury. (2012). Pharmacological potentials of Moringa Oleifera Lam. International Journal of Pharmaceutical Science and Research, 3 (2), 305.
48. Bhattacharya, A., & Tiwari. (2018). A review of the phytochemical and pharmacological characteristics of Moringa Oleifera. Journal of Pharmacy & Bioallied Sciences, 10 (4), 181-191.
49. Soni, D., & Kumar, P. (2022). Neuroprotective potential of Moringa Oleifera mediated by NF-κB/Nrf2/HO-1 signaling pathway. Journal of Food Biochemistry, 01-16.
50. Kumar, N. A., & Pari, L. (2003). Antioxidant action of Moringa oleifera Lam. against antitubercular drugs induced lipid peroxidation in rats. Journal of Medicinal Food, 6 (3), 255-256.
51. Pal, S. K., Mukherjee, P. K., & Saha, B. P. (1995). Studies on the antiulcer activity of Moringa oleifera leaf extract on gastric ulcer models in rats. Phytotherapy Research, 9 (6), 463-465.
52. Rao, M. V., & Paliyath, G. (1996). Ultraviolet-B- and ozone-induced biochemical changes in antioxidant enzymes of Arabidopsis thaliana. Plant Physiology, 110, 125-136.
53. Ruckmani, K., & Kavimani, S. (1998). Effect of Moringa oleifera Lam on paracetamol-induced hepatotoxicity. Indian Journal of Pharmaceutical Sciences, 60, 33-35.
54. Bhatnagar, S. S., & Santapau, H. (1961). Biological activity of Indian medicinal plants. Part 1. Antibacterial, antitubercular and antifungal action. Indian Journal of Medical Research, 49, 799-805.
55. Mehta, K., & Balaraman, R. (2003). Effect of fruits of Moringa oleifera on the lipid profile of normal and hypercholesterolaemic rabbits. Journal of Ethnopharmacology, 86 (2-3), 191-195.
56. Swati, & Kaur, A. (2018). Moringa Oleifera - A Never Die Tree. Asian Journal of Pharmaceutical and Clinical Research, 11 (12), 57-65.

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