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Moringa Oleifera: A Review Article on Pharmacognostic, Phytochemical, Pharmacological Value and It's Application In Various Disease and Disorder.

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ABSTRACT:
Moringa oleifera Lam belongs to the family Moringaceae. It is regarded as a feeding herb and is widely grown in India. These plants have important therapeutic properties in all parts. For nutritional and medicinal purposes, moringa offers a unique and abundant blend of antioxidants, vitamins, amino acids, anti-inflammatory, anti-aging, and diuretic qualities. It is believed that between 35,000 and 70,000 species of the total flora have been utilized medicinally. According to India's traditional ayurveda, moringa plant sources can cure 300 conditions. The current review aims to provide comprehensive data from reliable resources about the biological activities, pharmacognostic, traditional uses, therapeutic characteristics of various diseases, phytochemical substances,and pharmacological activities of the medicinal plant. Several cultures throughout the world have used moringa in traditional remedies for generations. It is used to treat a wide range of conditions including anxiety, cholera, cough, diarrhea, conjunctivitis, skin infections, chest congestion,blackheads. It is employed as a possible antibacterial, anticancer, and anti-diabetic drug.

KEYWORDS: Drum stick, miracle tree, antidiabetic, nutritional use, cardiovascular health.

I. INTRODUCTION

According to India's traditional ayurvedic tradition, moringa trees cure 300 medical condition s.The medicines used in Ayurveda have unique diagnostic and treatment concepts and are mostly based on natural and herbal element formulations. Since the earliest days of life, plants have been essential to humans worldwide, regardless of time or place. The plant with the highest known nutritional content is Moringa oleifera. For many years, this modest herb has been gaining progress in developing nations, and since the 1970s, substantial nutritive studies have been carried out. [1]

Since the beginning of time, herbal medicines have have been extensively used in the prevention and treatment of a wide range of human illnesses.

They are an invaluable and priceless gift fr om nature. [4] The use of herbs, commonly referred to as phytotherapy or medicinal plants, along with moringa, is a gift from the environment to humanity. The tree is in full leaf at the end of the dry season, when other sources of nutrition are usually sparse, making it an exceptionally promising source of food for those living in the tropics. Differentiating between various applications of plants for both dietary and medicinal purposes can be extremely challenging in many tropical countries since these uses are strongly rooted in the customs and social structure of a society. [1] One of the oldest medical traditions used in Sri Lanka and India is Ayurveda, which dates back to 6000 B.C. [4] Over 70% of humanity benefits from the use of this non-allopathic medical method. [2] For health and recovery, moringa offers a unique nutritious blend of minerals, amino acids, antioxidant substances, anti-aging, and anti-inflammatory qualities. [1] Other names for the species Moringa oleifera include drumstick tree and horseradish tree. The drumstick plant, Moringa oleifera Lam, is a well-known and reasonably priced supplier of phytochemicals. Useful varieties of Moringa. Roots, bark, flowers,seeds,leaves, and immature pods contain a variety of important phytoconstituents, including tannins, reducing sugars, terpenoids, steroidal aglycones, alkaloid compounds, and other components of plants. The leaves of plants include essential amino acids that

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the body needs to build robust and nutritious bodies. Because of their excellent nutritional content and capacity to purify water, Moringa oleifera leaves were used for thousands of years in ancient medical treatments, especially in the ayurvedic system, to cure and prevent many ailments. Plant leaves have a complex nutritional profile that includes vitamins, minerals, and vital amino acids, but they are small and challenging to collect. The majority of people in the nations of the southeast Asian area mostly rely on the effectiveness of herbal treatments. [12]

Fig.1 Moringaoleifera

The World Health Organization has been promoting moringa as a substitute for importing food products in the fight against malnutrition since 1998. Moringa oleifira statistically offers greater amounts of nutrients per gram of plant tissue than many other plant types in relation to human micronutrient and macronutrient demands. [1] Moreover, in contrast to aluminum sulfate, a coagulating chemical frequently utilized in water purification plants,seeds exhibit more persistent activity across a variety of pH values. The potential for M. oleifera to treat aquaculture waste water has also been evaluated. The results of this procedure show the simultaneous removal of suspended particles, bacteria, and water turbidity, indicating that it is suitable to swap out the typical coagulating agents entirely or in part, resulting in benefits to the environment, economic benefits, and health. Drawing from the above, this review collects data on M. oleifera (Lam.) with a focus on its chemical composition, nutritional value, pharmacological and antibacterial characteristics, uses in water effluent treatment, and ecological and social implications. [5] One of the most popular uses of the plant in the West is the filtering of contaminants and purification of water for drinking through the consumption of powdered moringa seeds. Nevertheless, the seeds may also be eaten in curry dishes, cooked, crushed, steeped for tea, or eaten raw. In many of the worldwide known "growing" nations, where malnutrition is a major problem, this tree has recently been touted as an excellent locally accessible source of digestible protein, carotenoids ,vitamin C, calcium, and iron. [6] Moringa has been used in traditional medicine passed down for centuries in many cultures around the world for skin infections, semen deficiency, tuberculosis, intestinal worms, lactation, diabetes,anemia, pregnancy, eye and ear infections, blood impurities, diarrhea, conjunctivitis,asthma, sore throat, catarrh, and chest congestion. [7]

HISTORY

Moringa has a long history that begins in 150 B.C. Historical evidence indicates that the consumption of Moringa fruit, leaves contributed to the ancient cognitive ability and healthy skin kings and queens. Moringaoleifera leaf extract was supplied to Indian Marian fighters throughout the duration of the war. It was thought that the drink made from moringa would give them more energy and reduce the pain and stress that came with fighting. Alexander the Great was defeated by these valiant warriors. After discovering the substance, three young professionals started researching the dietary advantages of the Moringa tree. As their investigation progressed, scientists were astounded by the incredible nutritional value that these tiny leaves and fruits had. [7] In addition to being a common vegetable in these areas, Moringa is well recognized and used for its multiple health benefits. People have referred to it as the "tree of miracles" because of its incredible capacity to treat a variety of diseases, including some chronic diseases.Because of its many uses, a number of studies were conducted to identify bioactive components from different plant parts. Because they are low-cost, herbal medicines, sometimes referred to as phytomedicine, are still regarded as reliable and frequently used as supplements in the medical industry. [13]

SYNONYMS

Moringa oleifera in Latin ; Sanskrit – Subhanjana, Hindi: Sainjna, Saguna ;Suragavo in Gujarati, Morigkai in Tamil ; Mulaga, Munaga, and Telugu, Malayalam - Sigru, Murinna,; Sahajan in Unani, Ayurvedic: Raktaka, Akshiva, Tikshnagandhaa, Spanish: Ben, Ángela, Moringa, Portuguese: Moringueiro, ; Moringa La ken in Chinese, shevga in Marathi, English: Ben, Horseradish, and Drumstick trees. [2,14]

II. PHARMACOGNOSTIC STUDY[2,15]

MORPHOLOGICAL IDENTIFICATION

Moringa oleifera It is a tiny, rapidly growing

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evergreen or annual plant that typically grows to a height of 10 or 12 meters. It features feathery foliage of tripinnate leaves, white gray bark, and spreading, weak branches.

LEAVES

Up to 45 cm long, the bipinnate or frequently tripinnate leaves have hairy, green, and almost hair-free upper surfaces. These leaves are compound, with leaves that are 1-2 cm long, and the green, sticky twigs.

Fig.2 : Leaves of Moringa oleifera

FLOWER

The aromatic, bisexual, yellowish-white blooms are borne on hairy stalks that spread into axillary panicles that are between 10 and 25 centimeters long. The individual flowers have dimensions of roughly 0.7 to 1 cm in length and 2 cm in width. They include five unbalanced petals. The petals are yellowish-white and have thin veins. The pistil is composed of a single-celled ovary and a slender style. There are five stamens, including five short, sterile threads.

Fig.3. Flower of Moringa Tree

FRUITS

Grown mainly between March and April, fruits are trilobed capsules. They are triangular, brown, pendulous, and split into three sections length wise when dried, measuring between 30 and 120 cm long and 1.8 cm broad. Approximately 24 seeds are present in a fruit when it is developing. When a pod reaches maturity, its colour transforms from green to brown.

Fig. 4 Fruits of Moringa tree

SEEDS

The seeds are around 1 centimeter in diameter, with three papery lobes and a semi-permeable seed shell and brownish. If the kernels are not very viable, the hulls can turn white. Viable seeds will grow in two weeks, and a tree can yield between 15,000 and 25,000 seeds annually. The usual mass of a seed is 0.3 gm.

Fig.5 Seed of moringa tree

BARK

The thick, soft, warty, corky, and whitish-gray bark eventually becoming rough. A white gum that initially turns brownish black when exposed is released by wounded bark. The wood is soft and thin.

Fig.6 Bark of moringa tree

ROOTS

Seedlings grow very few lateral roots and a large, tuberous, white taproot with a characteristic pungent odour. When trees are planted from seeds, they form a dense, tuberous lateral system that spreads widely and a deep, sturdy taproot.

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Fig.7 Roots of moringa tree

DISCRIPTION

- **Name** : Moringa oleifera
- **Other Name** : Drumstick , Horse radish tree
- **Family** : Moringaceae
- **Habitat** : All Over India.
- **Part Use** : Leaves, Fruit, bark, seed and pods. [4]

DIFFERENTS SPECIES IN THE GENUS OF MORINGA FAMILY

- Moringaarborea
- Moringaborziana
- Moringadrouhadii
- Moringaborziana
- Moringahildebrandtii
- Moringaovalifolia
- Moringpterygosperma
- Moringapygmaea
- Moringaruspoliana. [16]

ECOLOGICAL RANGE[4]

Sr. no	Ecological range	
1.	Climate	25℃
2.	Soil	6.3–9 pH
3.	Growth and development	Mature and harvested in 7 month
4.	Flower and fruiting	After planting grow 4- 12 month

Table. 1. Ecological range

BIOPHYSICAL LIMIT

Altitude: 500 m
Mean annual temperature : 250 to 350C
Soil type : wide variety of soil condition. [4]

CULTIVATION

Moringa is grown throughout the Indian plains, in hot, dry areas with an average elevation of five to ten meters, and in tropical or hot climates worldwide. It is able to endure severe weather, even in severely low-nutrient soil, and is not greatly impacted by drought. With a pH of 5.0 to 9.0, it can withstand a broad range of rainfall, with full needs estimated at 250 mm and maximum at over 3000 mm.The leaves have sticky bark, and the trunk is soft and white. There are multiple tiny leaves on each tripinnately complex leaf. The tree's wings disperse seeds, and the blossoms are white. The fruit contains 10 to 15 seeds and turns brown when it reaches maturity. [17]

III. MATERIAL AND METHODS

COLLECTION

To prevent soil variations from affecting the amount of micronutrients in the leaves, leaves of Moringa oleifira were gathered simultaneously from the same tree. Classifying To create the finest quality dried powder, only young, healthy greenery was chosen to be dried. [1]

WASHING

After the leaves' stalks were cut off from the primary branches, they were thoroughly cleaned three to four times with lots of water to get rid of any remaining dirt and other particles. Moringa leaves are 20–70 cm lengthy with 8–10 pairs of pinnae that bear two leaflets that are opposite directions, elliptic or oblong, and one leaflet that is 1-2 cm long at its highest point. Before the real drying process, any extra water had been evaporated at room temperature on clean paper, which was turned often to prevent the formation of fungi. To make handling the leaves less difficult, the petioles were preserved whole. The tips of the leaves were knotted into little groups and hanged in open spaces after washing to let the excess water drain and let the leaves air dry. Only the leaves were allowed to dry after the petioles were removed. [1]

DRYING

Spread out on sheets of cotton, the air-dried leaves were stored in a chamber with good ventilation to allow for shadow drying. The air dried leaves were spread on cotton sheets and were kept in a well ventilated room for shadow drying. Dust, insects, could not enter the room. The leaves were shade dried using the natural air stream. The leaves had been air-dried until they were dry and fragile, with only 6–7% of their moisture remaining. The air dried leaves were spread on cotton sheets and were kept in a well ventilated room for shadow drying. Dust, insects, could not enter the room. The leaves were shade dried using the natural air stream. After being reduced to a

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powder in the use of a mortar and pestle, the leaves were filtered through a fine 1 mm sieve. [1]

PRESERVATION METHODS

Moringa's nutrients remain unchanged even when stored for extended periods of time. The leaves can be frozen or dried for storage. Dehydration preservation extends Moringa's shelf life while maintaining its nutritional content. An excessive amount of leaves a significant iron accumulation. Hemo chromatosis and gastrointestinal distress can be caused on by high iron. According to a study by Yang et al., leaves dehydrated in a low temperature oven preserved more nutrients than freeze-dried leaves, with the exception of vitamin C. Therefore, drying may be accomplished with low-cost home appliances such to keep the leaves' supply of nutrition constant. Therefore, it's recommended that 70g of moringa be consumed daily to help avoid nutritional loss. [3]

CHEMICAL CONSTITUENT

LEAF :. Carotene, ascorbic acid, nicotinic acid, oxidase sulfur, prolamin, and total proteins contain the following essential amino acids: arginine, histidine, lysine, tryptophan, phenylalanine, methionine, threonine, leucine, isoleucine, and valine. [4]

SEED : A recently discovered glycoside called moringine 15.4 (alpha-L rhamnoloxy) Benzyl isothiocynate is present in the seed. glycine, serine 16, arginine, and alanine. linoleic, palmitic, stearic, and acidic. Phenyl acetonitrile (4-hydroxy) with acetamide (4-hydroxy) 9-Octadecenoicacid, O-ethyl-4-(alpha-L-rhamnosyloxy), benzyl glucosinolate, veridiflorol, Roridin E, and 9-Octadecenoic acid benzyl carbamate, glycerol-1-(9-octadecanoate), beta-sitosterol, niazimicin, niazirin, and 3-O-(6'-Ooleoyl-beta-D-glucopyranosyl). [2,4]

IV. NUTRITIONAL APPLICATION

The plant with the highest known content of nutrients is Moringa oleifera. For many years, this modest plant has been making progress in less developed countries, and since the beginning of the 1970s, substantial nutritional studies have been carried out. Moringa offers a special and plentiful combination of nutrients, amino acids, antioxidants, anti-aging, and anti-inflammatory properties for energy and recovery. Moringa contains a number of nutrients, with calcium being one of the most important for human growth and development. The WHO has supported moringa since 1998 as a substitute for imported food sources in the fight against poverty. Growth of moringa leaves grew by 43 percent. [8] When 2 kg of dry matter was added to the feed, milk output rose by 58%. Following the addition of 3 kg of dry matter per day to the diet, milk output rose by 65%. Just picture the possible outcomes if developing nations were able to increase milk output in this manner. M. oléifera leaves have a zinc concentration ranging from 25.5 to 31.03 mg per kilogram, which is the daily requirement for zinc in a healthy diet. It is quite difficult in many tropical cultures to distinguish between plants used for food and those used for therapeutic purposes. While moringa powder and leaves may have in excess of 4000 milligrams and 1000 milligrams, accordingly, eight ounces of milk can only contain 300–400 milligrams. Moringa seed powder can be used to treat anemia instead of supplementing with iron. While powdered moringa leaf has 28 mg of iron, meat only contains two milligrams. Moringa is said to have a higher iron content than spinach. Zinc must be obtained through a nutritious diet in order for sperm cells to develop properly and for DNA and RNA synthesis to occur. [3] They include vitamin C, which shields the body from a host of ailments, including influenza and a cold, and vitamin A, which acts as a barrier against vision problems, skin abnormalities, heart difficulties, diarrhea, and numerous other medical conditions. As a result, this review covers moringa's nutritional and therapeutic uses while excluding most of the plant's more well-known uses in agro forestry and water purification.There are currently many of studies on Moringa's nutritional benefits in both the scientific and general journals. For generations, humans have used moringa for both medical and nutritional purposes. In countries that are developing, moringa can be used as a substitute to imported food supplies to cure malnutrition. Three non-governmental organizations, namely Church World Service and the Educational Concerns for Hunger Organization, have marketed moringa as "organic nourishment for the tropics." It's been reported that leaves don't need to be frozen, whether they are cooked, consumed raw, or stored as a dry powder for several months. [3,6,7,8,]

V. PHYTOCHEMICAL SCREENING

WATER COAGULATING PROTEINS DERIVED FROM SEEDS OF M. OLEIFERA

The main contributors to turbidity in liquids are organic materials found in nature and

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paused, negatively charged molecules. Particles like these reject each other due to their electrically charged surface, making it challenging for them to settle and connect.. In order to neutralize the repulsion charge and "destabilize" a suspension, a substance known as a coagulant with an opposing charge is introduced to the fluid. Because of their powerful antimicrobial and flocculant qualities, proteins isolated from M. oleifera seeds have drawn the most attention among all these Organic coagulants are used for removing impurities from water. Known by its general name, The charged protein of the Moringa oleifera plant (MOCP, frequently referred to as Flo), this cationic protein aggressively inhibits the growth of bacteria cells and absorb atoms that are negatively charged in a mixture. The most common coagulants utilized in the treatment of turbid and waste water are, synthetic polymers, aluminum. The high expense, health risks, and environmental effects of synthetic coagulants have led to a renewed concern with organic coagulants. Potential natural coagulants include the seeds of M. oleifera, Vignaunguiculata, and, more recently, an endosperm of Cocosnucifera. [9] have a lot in common with the MOCP amino acid sequence, according to analysis. The elevated levels of positively charged amino acids glutamine, and proline are the causes of the cationic character of cMoL. At 7.0 pH, the predicted secondary structure of cMoL is composed of 46% ahelix, tertiary structure classs. [9]

THE PROCESS BY WHICH WATER COAGULATES AND FLOCCULATES

It's possible that these two mechanisms are operating simultaneously. According to research, MOCP's coagulation efficacy is on par with that of a synthetic cationic polymer, 554K. The structure of the bridge building concept detailed the flocculent action of a high molecules cationic polymer like 544 K. Electrostatic forces cause ionized macro molecules, or cationic polymers, to attach to the membranes of negatively charged particles, or defects, causing the particles to dissolve. MOCP has been suggested by multiple water coagulation mechanisms. As a result, portions of particle surfaces that are negatively and positively charged develop. Particle collisions lead to the production of floes and the inter-particle saturation. The coagulation efficiency has improved in studies involving liquid coagulation molecules that were separated in a sodium chloride solution from Moringa seeds. [9] The two that are most accepted as the main coagulation mechanisms are both the absorption and bridges of unstable molecules and the absorption and charge stabilization. Adsorption, which is represented by both the Freundich and Langmuir models, is one potential method of taking off the toughness in hard water Mono sodium chloride. By generating net-like structures and then using the sweep coagulation mechanism to remove turbidity, MO-NaCl helps to remove hardness from tough harsh, and synthetically hard water. Then, agglomeration of particles results from part neutralization of the surface charge and a decline in resistance by electrostatics. attach to certain regions negatively charged particle surfaces. In accordance with the Freund-lich adsorption model, absorption and harge neutralization are suggested as the mechanisms by which MO-NaCl removes turbidity from soft water. Recently, it has been discovered that a A magnetically coagulant made from M. oleifera extracts of seeds could be helpful for enhancing the qualities of water., such as transparency, turbidity, and substances that absorb UV light at wavelengths of 254 nm. [9]

PHYTOCHEMICAL ANALYSIS OF MORINGA OLEIFERA

HISTOLOGICAL EXAMINATION

Sliced fresh flowers from both plants were treated with 10%, 20%, 30%, 40%, and 50% alcohol for two minutes each. Next, two drops of saffranine were added, and the mixture was left for five minutes. Finally, 60%, 70%, and 80% alcohol was applied, and two drops of malachite green were included, and the process was repeated for five minutes each. Pour one drop of oil over the slide after treating it with 90% and 100% alcohol, then use a microscope to examine the sections. [10]

POWER MICROSCOPY

Chloral hydrate was added to powder samples after a modest amount of samples were taken. After letting it stand for roughly three minutes, it was examined under a microscope. After that, it was mounted in 50% glycerin and examined under a microscope. To identify the starch grains in the powder, a dilute iodine (N/50) solution was also used for staining. Using a mortar and pestle, dried flowers from JS and MO were crushed. Trituration agitation were used to aid in the crushing process. H2SO4 solution was applied to the powder in order to identify the crystals of calcium oxalate. [10]

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PRELIMINARY PHYTOCHEMICAL ANALYSIS

According to protocol, qualitative tests were performed on the combined species' liquid and ethyl acetate extracts to identify different phytochemical contents.Using standard methods, a phytochemical screening of alkaloids, terpenes, steroids, flavanoids, carbs, saponins, and tannins was carried out. [10]

THIN LAYER CHROMATOGRAPHY

The two plant extracts the aqueous and the ethyl acetate were subjected to TLC monitoring through reconstitution with 5 milliliters of solvent, respectively. Each extract (15µl) was put on TLC plates (20 × 20 cm silica gel after the volume was reduced to 1 ml. The solvent systems that were used to develop the plates were butanol:ethanol: water (50:45:5acetone: butanol (70:20:10), acetic acid:chloroform (90:10), acetone:chloroform: water (80:15:5), hexane: chloroform (80:20), butanol:acetic acid: water (40:55:5), ethyl acetate:methanol: water (10:65:35),. Following development, every TLC plate was dried, examined under a UV lamp (254 and 366 nm), labelled. [11]

VI. BIOLOGICAL ACTIVITIES

CHARACTERISTICS OF ANTHELMINTHS:

An assessment of the findings showed that M. oleifera's ethanolic leaf extract was the most effective at inhibiting the embryonation of eggs, with a substantial difference, at at 3.75 and 5 mg per milliliter, 60.3 percent and 92.8 percent, respectively. As a result, a smallest LC50 measurement of 0.985 mg per milliliter was achieved. The effectiveness of Moringa oleifera's infusing and mashed water-based extract as well as its ethanolic extract was evaluated in vitro against fresh eggs, developed eggs, and human contortus L1 and L2 larvae in the present investigation by Tayo et al. (2014). With an IC50 value of less than two mg/ml and an LC50 value of more than 3.5 mg/ml, eggs responded to infused water-based extract more readily than larvae did. When compared to Vitex negundo, the ethanol extract from Moringa oleifera leaves exhibited more anthelminthic take act over Pherritima posthuma, the India earthworm. In veterinary medicine, moringa oleifera leaves may be used to treat avian coccidiosis. Additionally, at 5 mg/ml, this extract prevented 99% of H. contortus eggs from hatching, with an LC50 value of 1.7 mg/ml. In terms of larval activity, the ethanolic extract exhibited the highest potency, inducing 98.8% and 100%. An effective macerated aqueous extract was demonstrated. [8]

IMMUNE-MODULATING AND ANTI-INFLAMMATORY QUALITIES

Coppin et al. (2013) discovered that following LPS therapies, moringa oleifera leaves' capacity to prevent macrophage cells from producing nitric oxide (NO) was shown. following a number of in vitro and in vivo experiments using animal models. Among these, flavonoids with anti-inflammatory properties like quercetin could prevent NF-kB activation and the NF-kB-dependent downstream processes that followed. The most effective antibacterial, and anti-oxydant properties were found in flavonoid like quercetin and kaempferol, other phytochemicals. Numerous in vitro and in vivo investigations have recommended this plant for the treatment of inflammation, hyperglycemia, and hyperlipidemia. [8]

HYPOLIPIDEMIC PROPERTIES

Chumark et al. (2008) investigated the Efficacy of leaves from Moringa oleifera on hypolipidemia in fed rats a diet high in cholesterol (5%) over a duration of 12 weeks. He concurrently administered extract from Moringa oleifera leaves (0.1 g/kg BW/day) to a group of people. When compared to rabbits fed a high-cholesterol diet alone, the treatment group of Moringa oleifera leaves showed a considerable reduction in triglycerides, total cholesterol, HDL, and LDL at the conclusion of the experiment 75.4%, 44.2%, 52%, and 42.7%, respectively. Several bioactive compounds, including phenolic flavonoids, have significant impacts on lipid control and may be involved in these effects .The extract from the leaves of Moringa oleifera shows up to contain phenolic compounds that bind bile acids by creating insoluble complexes, which delays the absorption of cholesterol and inhibits pancreatic cholesterol esterase activity, resulting in decreased plasma cholesterol levels. When compared to rabbits fed a high-cholesterol diet alone, the treatment group of Moringa oleifera leaves showed a considerable reduction in triglycerides, total cholesterol, HDL, and LDL at the conclusion of the experiment 75.4%, 44.2%, 52%, and 42.7%, respectively.He reports an 86.52% decrease in the development of internal carotid atherosclerotic plaque as a result. [8]

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HEPATO AND KIDNEY PROTECTIVE PROPERTIES

Oyagbemi et al.(2013) observed an increase in serum levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatinine, blood urea nitrogenase (BUN), and alkaline phosphatise (ALP) after mice were given a leaf extract from Moringa oleifera. Histopathological analyses of these animals did not find any histological abnormalities in the central vein or sinusoids. A similar outcome was achieved by Adeyemi and Elebiyo. Das et al. found decreased liver damage and decreased levels of ALT, AST, and ALP in rats.This result raises the possibility that the leaves can help prevent nonalcoholic fatty liver disease (NAFLD). After providing the Moringa oleifera leaf extract to the animals, the researchers saw a decrease in the levels of serum ALT, AST, ALP, BUN, and creatinine. A similar outcome was achieved by Adeyemi and Elebiyo. Das et al. found decreased liver damage and decreased levels of ALT, AST, and ALP in rats.This result raises the possibility that the leaves can help prevent nonalcoholic fatty liver disease (NAFLD).Histological analyses supported these results, showing that treating rats with Moringa oleifera leaves improved the drug-induced liver and kidney damage. [8]

HYPOGLYCEMIC PROPERTIES

Evidence said that Moringa oleifera's hypoglycemic action, which significantly lowers blood sugar levels, has been confirmed. The methanol extract from its fruit dried powder has generated N-benzyl carbamates, and a benzyl, all of which have been demonstrated to dramatically increase the release of insulin from mouse pancreatic beta cells. They additionally possess inhibitory impacts on the peroxidation of lipids and the cycloxygenase activity. The hypoglycemic and anti-hyperglycemic effects of Moringa oleifera leaves may be attributed to their terpenoids. The methanol extract from its fruit dried powder has generated N-benzyl carbamates, and a benzyl, all of which have been demonstrated to dramatically increase the release of insulin from mouse pancreatic beta cells. [8]

VII. PHARMACOLOGICAL APPLICATION

ANTI-DIABETIC APPLICATION

A study on rats showed that M. oleifera aqueous extracts can treat insulin-resistant Type 2 diabetes as well as Type 1 diabetes produced by streptozotocin. In an additional study, the scientists noticed a decrease in fasting blood glucose when they provided moringa seed powder to the STZ-induced diabetic rats. It has been shown that moringa can treat Type 1 and Type 2 diabetes. A person with diabetes classified as type 1 has a shortage in the insulin hormone. which is necessary to keep blood glucose levels within the appropriate range. Insulin resistance is connected to diabetes type 2. Another possible cause of type 2 diabetes is dysfunct beta cells, which are unable to detect glucose levels and as a result decrease insulin signaling, raising blood glucose levels. [9] Antioxidant enzyme levels in the serum also rose in the rats given 500 milligrams of powdered moringa seed per kg of body mass. Due to their poor antioxidant content, beta cells undergo apoptosis as a result. [3] Seven human studies yielded remarkable results one showed that In an individual with good health, M. oleifera substantially boosts the body's production of insulin; five more investigations found a substantial drop in blood glucose levels in humans; a sixth study found a decline in postprandial blood sugar; and a seventh study discovered that Moringa also lowers the amount of hemoglobin A1C in a blood glucose test. [9]

ANTICANCER

WHO states that cancer is the second very common cause of death worldwide in 2018 and is expected to account for 9.6 million fatalitiesCancer is responsible for about 1 in 6 deaths worldwide. Treatments for cancer include radiation, chemotherapy, and surgery are costly and come with side effects. At specified concentrations, M. oleifera is a natural, dependable, and safe anti-cancer agent. Leaf extracts, both soluble and solvent-based, have been demonstrated to be potent anticancer agents. [3] Usually utilized as an anticancer agent, the ROS induction is the target of a study that demonstrated that extracts from moringa leaves can also combat ROS. The anticancer properties of M. oleifera leaves have been reported by research. Recent research of the leaf extracts of M. oleifera and Indigofera arrecta has confirmed their complementary effects and ability to inhibit the growth of cancer cells. [18] Dichloromethane and methanolic M. oleifera extracts from leaves show in vitro anticancer efficaciousness against people hepatocellular carcinoma, colorectal adenocarcinoma, and breast adenocarcinoma, with no detrimental effects on people fibroblasts. [5]When M. oleifera leaf extract

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(200–1000 μg/ml) is added to cells subjected to excessive oxidative stress and normal cells, the amount of lipid peroxidation products is reduced after 24 hours.Isolated related bioactive chemicals with an inhibitory effect on the tumor promoter include isothiocyanate and thiocarbamate. Remarkably, M. oleifera aqueous leaf extract was shown in another investigation to decrease presence of pancreatic cancer cells, tumor growth, and metastatic activity. [18]

ANTIMICROBIAL APPLICATION

The antibacterial properties of M. oleifera extracts is also attributed to tannins and gallic acid, which inhibit Vibrio, as well as saponins, tannins, isothiocyanates, phenolic compounds, such as alkaloids and flavonoids, which have an inhibiting impact. [5] Using a disk diffusion technique, the seeds, leaves, bark, and of Moringa oleifera demonstrated in vitro antimicrobial properties against a number of bacteria, including Streptococcus faecalis, Bacillus subtilis, Bakillus aureus, Staphylococcus epidermidis, Shigella shinga, aeruginosa, E. coli, and Aspergillus niger. [2] Additionally, it was observed that Moringa oleifera had antifungal action against Trichophyton rubrum and T. mentagraphytes, Fusarium solani, and Rhizopus solani using both dilution in broth and agar plate techniques. This essential oil's antifungal properties have been linked to polyphenols, hydrocarbons, phytol, thymol, hexacosane, pentacosane, and heptacosane. [5]

ANTI-INFLAMMATORY APPLICATION

The ethyl acetate extract from Moringa oleifera leaves was found to decrease the production of cytokines (TNF-α, IL-6, and IL-8) by human macrophages when exposed to both LPS and cigarette smoke extract. The anti-inflammatory mechanism may be aided by the many bioactive compounds present in the leaves of Moringa oleifera. [8] In a carrageenin-induced model of paw edema, methanolic extracts bark, leaves, and flowers, aqueous extracts of the roots, and ethanolic extracts of the seeds of Moringaoleifera have all demonstrated anti-inflammatory effect. Because 1,3-dibenzyl urea, aurantiamide acetate. Using carrageenan-induced in-vitro anti-inflammatory in nature M. oleifera leaf infusions made with steaming water. Stalks, flowers, roots, and seeds were tested pharmacologically. which were isolated from roots, demonstrated this anti-inflammatory action, they were identified as the cause of Moringa oléifera roots' anti-inflammatory properties. [2] The anti-inflammatory appplication of ethanolic seed extracts, methanolic extract of flowers and leaves, and aqueous and methanolic extract of M. oleifera bark and root were demonstrated. [18]

CARDIOVASCULAR ACTIVITY

The leaves of Moringa oleifera have an ethanolic extract that has hypotensive or hypertension properties. The chemical components of M. oleifera leaves extract that were shown to contribute to the anti-adipogenic actions were derivatives of iso-quercetin. Since obesity has been linked to the onset of heart issues, the study proposed that M. oleifera therapy prevented obesity by promoting death in matured adipocytes. It was discovered that the promising hypotensive action of thiocarbamate and isothiocyanate glycosides. The liquid extract of Lam's Moringa oleifera hypolipidaemic, anti-atherosclerotic, and antioxidant qualities in vitro and in vivo. [2] During the late phases of ischemic stroke, the administration of Moringa extract of seeds also improved animal survival, corrected spatial cognitive decline, and stimulated cholinergic neurogenesis, and neuroplasticity. Moreover, a dose of It was shown that 500 milligrams per kilogram of body weight was beneficial for both the treatment and prevention of acute stroke caused by ischemic stroke. [18]

ANTIHYPERTENSIVE AGENT

Rats' blood pressure was significantly reduced by isolated substances from M. oleifera leaf, niazinin A, niazimicin A+B, and niazinin B. These effects may have been caused by a calcium antagonist effect. [18] Studies were conducted on the activity-directed separation of M. oleifera pods in extracts made from ethanol, and the results revealed the easily absorbed components that cause the hypotensive effect. An investigation was conducted to look into the substances that provide M. oleifera its antihypertensive properties. The compounds that were successfully identified included thiocarbamate and isothiocyanate glycosides, which were found in this is the acetate phase of M. oleifera bean ethanol extract. [19]

ANTIOXIDANT ACTIVITY

The Moringa oleifera leaf extract, whether aqueous, methanolic (70%), or ethanolic (80%), has potent antioxidant and radical scavenging properties. According to Bajpai et al., the presence of kaemferol in Moringa oléifera leaves is

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responsible for their antioxidant action. [2] Through its intracellular antioxidant and anti-inflammatory properties, an in vivo study using normal and obese C57BL/6J male mice evaluated the potential of Moringa seed extract to enhance metabolic health. [19] Research conducted on both normal and diabetic rats revealed that administering disolve M. oleifera leaf extracts led to a considerable an increase in the activity of the enzymes glutathione S-transferase, catalase, and superoxide dismutase and decrease in lipid peroxidation. Additionally, M. oléifera contains antioxidants such as ascorbic acid, phenolics, carotenoids that have been shown to prolong the duration of consuming foods that include fatty.The author noted that M. oleifera displayed somewhat higher antioxidant levels, particularly in the leaves, than other fruits like strawberries, which are well-known for their antioxidant qualities. The author reported isothiocyanates, glucosinolates, and thiocarbamates from the oleifera plant in a different study. [18] Many beneficial natural chemicals found in M. oleifera leaf, including ascorbic acid, phenolic, carotenoids have elevated the plant's status as a top antioxidant supply. [5,19]

WOUND HEALING ACTIVITY

When diabetic human dermal fibroblast cell migration and proliferation are markedly enhanced, M. oleifera leaves exhibit promising wound healing properties. After the dried pulps, seeds, and leaves of M. oleifera were extracted, a bioactive substance called hydroxyproline gradually decreased the rat deceased model's scar region shattering power. In addition, new research has shown that the extraction of leaves promotes wound healing and results in increased tissue regeneration and the ascension of the tubular epithelial protein arrangement in the injured material of animals with diabetes. [18] Furthermore, topical application of M. oleifera stem cream prevented Oxidative degradation caused by ultraviolet (UV) B was prevented in the skin of mice epidermic cells by M. oleifera stem (100–400 μg/ml). In addition, new research has shown that the extraction of leaves promotes wound healing and results in increased tissue regeneration and the rise of the tube-shaped epithelium protein arrangement in the injured material of animals with diabetes. [20]

ANTI-ASTHMATIC ACTIVITY

Methanol-based mixture The leaves of M. oleifera exhibited bronchodilator effects, including the inhibition of inflammatory mediators like histamine at doses between 250 and 500 mg per kilogram, as well as blockade of inflammatory mediators' release into local lung tissues. Higher levels of phytochemical substances have therefore motivated researchers to assess the The impact of dexamethasone, the gold grade drug, on asthma. The outcomes showed that M. oleifera leaf had a major effect on bronchospasm, mast cell degranulation anti-inflammation. [18]

MALNUTRITION

Most M. oleifera leaves are abundant in microscopic molecules that are critical to the survival of humans during hunger. It was demonstrated that the roots and plants included the magnesium, zinc, and Calcium reserve molecules. The minerals calcium (Ca), magnesium (Mg), and potassium (K) are predominant in the M. oleifera tissue. The main components that assisted in the battle against newborn malnutrition were the histidine-2 amino acids and the arginine from M. oleifera.But according to the identical research, M. oleifera leaves, which are rich in proteins and iron, should not be used as an infant's initial course of therapy if they are extremely underweight. Furthermore, M. oleifera names were included in the common galactagogue names search phrases from the previous study, and it was said that these names had galactagogue qualities. [18]

OTHER DISEASE

One can employ moringa as a strong neuroprotectant. The cause of cerebral ischemia is a blockage of blood supply to the cerebral cortex. Given that at dosages of 500 milligrams and 350 milligrams, accordingly, moringa decreased the acidity of ulcerated stomachs by 86.15% and 85.13%, it may be used as an antiulcer medication.

Oxygen species that react are the products of infarction and lipid peroxidation caused by this. Because of its antioxidants, moringa can lower reactive oxygen species, benefiting the brain in the process. Herbalists who treat AIDS patients often prescribe moringa. It is recommended that people with HIV include moringa in their diet in order to strengthen their immune systems. The majority of snacks consist of corn meal, However, a number of investigations have demonstrated that including a tiny quantity of moringa into maize meal might boost the nutrient content of the food in terms of minerals, energy. Before commercializing moringa, however, more research must be done on the plant as a fortified Indian snack. [3]

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ANALYSIS OF MORINGA OLEIFERA TOXIC EFFECTS

The research conducted by Adedapo et al. validated the findings One dose of the root peel of Moringa oleifera is comparatively non-toxic. M. oleifera root peels are comparatively safe, weighing more than 1 kg, which is the likely deadly single dose for humans, according to frequently used terminology for risks for mice and rat across the dosage comparable. [2] One investigation into the acute toxicities of several preparations of Moringa oleifera roots revealed a secure limit. The liquid extract's LD50 was 15.9 g/kg, whereas the ethanol-based extract's was 17.8 g/kg based on body weight.

DISCUSSION

In the present review we have highlighted various application of moringa oleifera in various diseases and disorder .various part of moringa oleifera like bark, stem ,leaf , seeds shows various pharmacological properties with less side effect .It also contain various minerals which are essential for regular body functions. So it can also use as dietary supplement in daily routine. In future, research on various parts of moringa oleifera will add important value in human health.

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