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Importance of Indian Medicinal Plants

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Abstract: - Without medicinal herbs, our healthcare system would be lacking. Several communities developed medical knowledge systems before modern medicine, referred to as "traditional medicine," "indigenous medicine," etc. Throughout the history of human civilization, medicinal plants have been vital. Nearly all societies and civilizations have traditionally relied heavily on medicinal plants as a source of medicine. The traditional medicine community views medicinal plants as a rich supply of materials for making numerous modern medications. Medicinal plants have been used for centuries to treat illnesses, preserve food, add flavor, and stop disease outbreaks. Many plants are also said to have numerous other uses, including anti-oxidant, anti-inflammatory, anti-insecticidal, anti-parasitic, antibacterial, and anti-hemolytic qualities. Tribal people use these plants extensively all over the world. This review article discusses the traditional therapeutic uses of 21 species of plants from various families.

Keywords: Traditional medicine, Anti-parasitic, Health disorders, Folk medicine, Herbs.

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1- Introduction:

Natural or produced from natural materials are several significant medications. Natural goods or their derivatives comprise 48.6% of all cancer medications recorded from the 1940s to the present, and more than one-third (39.1%) of all FDA-approved medications come from natural sources. Natural ingredients are valuable sources when searching for new drugs. Natural products are important in the search for new drugs, as evidenced by the existence of approximately 200,000 natural metabolites with various bioactive qualities 1. Plant products have medicinal potential that dates back more than 5,000 years, as evidenced by their use in Indian, Egyptian, Chinese, Greek, and Roman civilizations for disease treatment and body system revitalization 2. All classes of people in India employ a vast range of medicinal plants, both as processed pharmaceutical industry products and as traditional medicines in various indigenous medical systems like Siddha, Ayurveda, and Unani 3. Herbal remedies like ashwagandha and brahmi aid in improving immunity, raising energy levels, improving nutrition, and repairing body cells 4. Aromatic and medicinal plants can contribute significantly to improving rural residents' subsistence livelihoods, particularly for women, in an environmentally sustainable way that preserves the biodiversity of these natural resources 5. Currently, up to 80% of people worldwide receive primary healthcare from traditional medicine, according to the World Health Organisation (WHO). Some chemical active compounds that have specific physiological effects on humans are responsible for the therapeutic value of plants 6. According to Nerindran *et al*. (2016) 7, plants are considered a rich source of bioactive compounds and could provide an alternate supply of insecticides. High-profile pharmacological properties include anti-oxidative, anti-allergic, hypoglycemic, and anti-carcinogenic properties found in secondary metabolites, also known as phytochemicals, derived from plants. Free radicals, unstable chemicals, can harm cells, however, these secondary metabolites shield the cells from their effects 8. The idea of preserving food with naturally occurring antibacterial substances, particularly those derived from plants is gaining popularity. According to Chavan *et al*. (2016) 9, looking for plants with therapeutic benefits is necessary. Plants have evolved a sophisticated defence mechanism that consists of a wide variety of compounds. It has long been known that antimicrobial compounds in plant tissues play a significant role in the products these plants naturally produce. In addition, these compounds can work as fungicidal and bactericidal agents that are active against the pathogens that cause human diseases, or as botanical pesticides 10. Researchers never stop looking for new and more effective medication sources as the demand for pharmaceuticals develops

due to both our expanding population and the growing number of different diseases. Medicinal plants are among the top priorities in the hunt for natural goods for the pharmaceutical sector.

2- Distribution of Medicinal Plants:

Of the 17,000 species of higher plants found in India, 7500 are recognized to have therapeutic applications 11. There are an estimated maximum of 1717 species of medicinal plants in the 1800–1600 m elevation range. At the regional level, Uttaranchal 12(Kala, 2004) has yielded the greatest number of documented species of medicinal plants, followed by Sikkim and North Bengal 13. According to the distribution analysis, medicinal plants are found in various habitats and landscape features. The tropical forests of the Himalayas, the Aravalis, the Vindhyas, the Eastern and Western Ghats, and the Chota Nagpur plateau are home to almost 70% of India's medicinal plant species. Within the Himalayas, the Kashmir Himalayan region is tucked away in the Northwestern folds of the Himalayas, which have been recently identified as a global biodiversity hotspot 14.

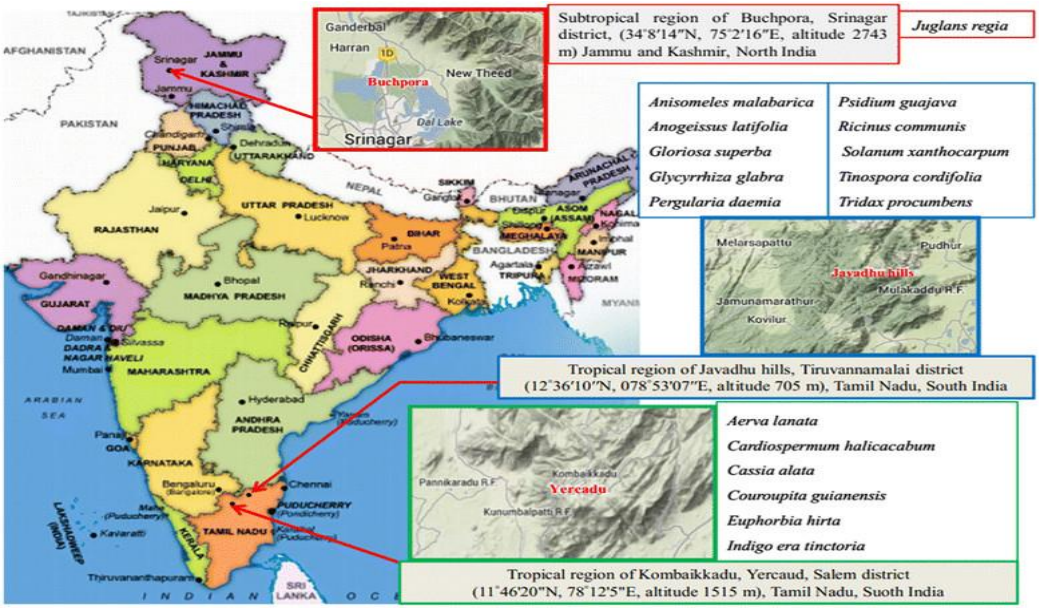

Fig 1: Sites of collection of medicinal plants from North Indian and South Indian Eastern Ghats.

3- Therapeutic potential of Phytochemicals:

The majority of people on the planet, approximately 80%, are dependent on traditional herbal medicines and ethnobotanical remedies. Examples of these include analgesics like morphine and codeine, antineoplastics like camptothecin and taxol, antidiabetic medicines like quinidine, cardiac depressants like quinidine, antigout medicines like colchicines, antidiabetic medicines like allicin, and medications for brain functions like nicotine and caffeine. 15. According to Viswanathan and Basavaraju (2010) 16, the quantity and quality of an active component typically a secondary metabolite variate depending on the region of plant growth. There are two categories of plant metabolites: main and secondary. Primary metabolites, which are important in growth and development, are similar in every living cell and include amino acids, proteins, sugar, nucleic acids, and polysaccharides. Secondary metabolites do not contribute to growth; instead, they are produced by the fundamental metabolic pathways. Secondary metabolites are commonly employed in traditional medicine since they have been demonstrated to have a variety of biological effects 17. Terpenoids, alkaloids, and phenolics are the three categories of plant metabolites. According to 18 Mazid *et al*. (2011) and 19 Ahmed *et al*. (2017), phenolics make up approximately 8000 compounds, whereas terpenoids constitute the biggest class of plant metabolites, with over 40,000 compounds. Gallic acid, also known as simple phenolics, is highly recognized for its astringent qualities and its antimicrobial, antifungal, antiviral, anticancer, anti-inflammatory, anti-anaphylactic, antimutagenic, choleretic, and bronchodilatory effects 20. According to Ahmed *et al*. (2017) 21, the flavonoid molecule coumarin derivatives show good antifungal activity. The rubefacient, circulatory stimulant, and analgesic properties of Capsicum spp. are attributed to its simple phenol, or capsaicinoids 22. According to Kumar and Tewari (2018)23, about 40% of medications are either entirely or partially derived from plants. *Catharanthus roseus* is the source of the anticancer drugs vinblastine and vincristine, whereas Taxus baccata yields paclitaxel. Taxol, which is extracted from *Taxus brevifolia*, is used to treat cancers of the ovary and lung. Serpentine that has been extracted from Rauwolfia serpentine roots is utilized 24 In 2016, Yuan and colleagues.

4- Selective Indian Medicinal Plants:

A list of 21,000 plants that are used therapeutically worldwide has been compiled by the World Health Organisation (WHO). Two thousand five hundred species call India home, yet just 150 of them are heavily exploited in trade. India is known as the world's botanical garden since it is the greatest producer of medicinal herbs worldwide 25.

4.1- *Azadirachta indica* (Neem):

A member of the Meliaceae family is neem (Azadirachta indica). Because it is an abundant source of antioxidants, its health-promoting properties are linked to this. Worldwide, especially in the Indian Subcontinent, it has been extensively utilized in Chinese, Ayurvedic, and Unani treatments to cure and prevent

various illnesses 26. Many pharmacologically active medications are known to be sourced from natural resources, such as medicinal plants 27, 28. Nimbin, nimbidin, nimbolide, and limonoids are among the complex compounds found in Azadirachta indica. Altering different genetic pathways and other processes contributes to the management of disease. According to Govindachari *et al.* (1998) 29, quercetin and ß-sitosterol were the first polyphenolic flavonoids to be isolated from fresh neem leaves and possess antifungal and antibacterial properties. Antimicrobial, antifungal, and anti-inflammatory properties are just a few of the many biological and pharmacological actions documented. According to Singh *et al*. (2023) 26, earlier research has verified their anti-inflammatory, antiarthritic, antipyretic, hypoglycemic, anti-gastric ulcer, antifungal, antibacterial, and anticancer properties.

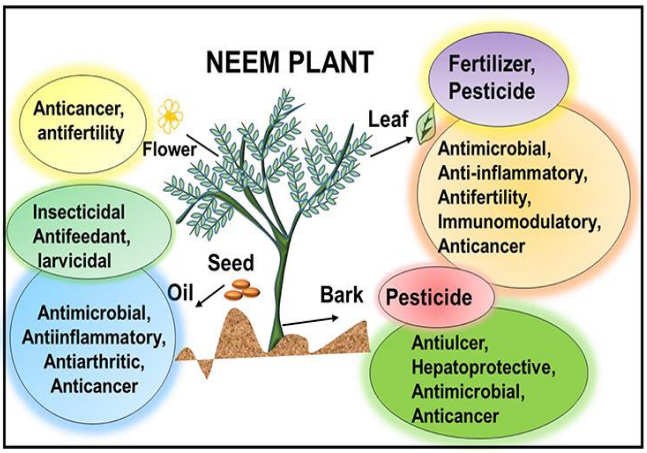

Fig 1: Benefits of Neem plants

4.2- *Withania somnifera* (Ashwagandha):

Ashwagandha, or *Withania somnifera*, is highly valued in the Indian Ayurvedic medical system as a Rasayana (tonic). Most people refer to ashwagandha (*Withania somnifera*, fam. Solanaceae) as "Indian Ginseng" or "Indian Winter cherry." It is beneficial as a nervine tonic and used for various illnesses. Ashwagandha is the most important of all the herbs used in Ayurvedic Rasayana. Herb 30 is referred to as "Sattvic Kapha Rasayana" 30. According to Gilani *et al*. (2009) 31, ashwagandha is widely distributed throughout India, from the northern tropics to the southern regions. Ashwagandha's leaves and roots are mostly employed in medicine. In addition to having an aferine A concentration of 0.16%, they are also a good source of dietary fiber (28.8%) and minerals (10.1%)32. Ashwagandha, sometimes referred to as Indian ginseng, has several health benefits, including lowering cholesterol, treating erectile dysfunction, boosting male fertility, lowering anxiety, relieving stress, combating diabetes, preventing hair loss, treating osteoporosis and rheumatoid arthritis, treating cancer, stimulating the thyroid gland, enhancing immunity, raising blood flow, controlling seizures, promoting muscle growth, lowering ocular diseases, and having anti-tumor, anti-inflammatory, and antibacterial properties 33. Since these compositions are rich sources of *Ashwagandha*, *Ashwagandha* is composed of multiple nutrients, including glycowithanolides (antioxidants), potassium nitrate, iron, fatty acids, tannins, glucose, alkaloids, and countless other compounds 34. *W. somnifera* has long been used to treat gastrointestinal issues, dyspepsia, and diarrhoea 35. It has been observed that several phytoconstituents, including phenolic compounds, anthocyanin, ascorbic acids, and numerous other significant constituents, influence a plant's antioxidant activity 36. The therapeutic substances called secondary metabolites, present in plant leaves, stems, roots, and sap, have been beneficial to humans. Because of their wide range of therapeutic applications, secondary metabolites from plants, including saponins, alkaloids, flavonoids, glycosides, anthraquinone, steroids, and tannins, have also been employed in modern medicine 37.

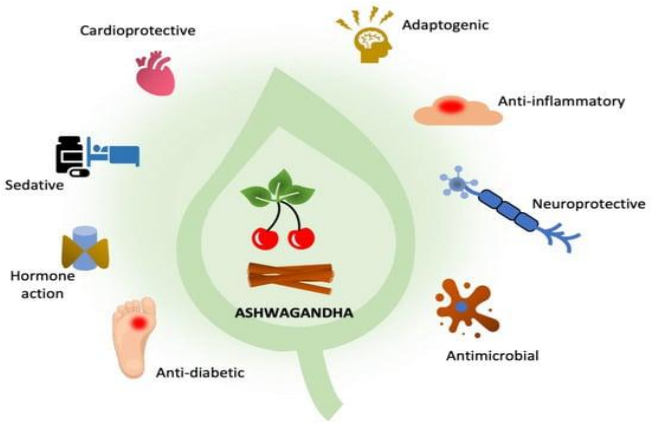

Fig 2: Health Benefits of Ashwagandha

4.3- *Cymbopogon citratus* (Lemon grass):

Lemon grass contains several bioactive compounds that have medicinal qualities. There is a lot of evidence to support its ethnopharmacological usage 38. As per the World Health Organisation, more than sixty percent of individuals in developing countries think herbal medicine substantially impacts the healthcare system. Bioactive substances abound in the leaves of *C. citrates.* According to 38 Singh *et al*. (2024), the phytochemicals extracted and identified from these leaves are mostly flavonoids, alkaloids, saponins, tannins, and phenolic compounds. This grass has a distinct lemon scent, which is a result of its high oil citral concentration. Redolent oils can be used in detergents, soaps, and other products. Both the food and fragrance sectors use it since it's a good source of citral. According to 39 Visabhav *et al*. (2013), it serves as the precursor for synthesizing ionones, which are the precursors of vitamin A. Lemon grass has medical benefits due to many bioactive chemicals. There is a lot of data to support its ethnopharmacological uses 40. As to 41 Okemy *et al*. (2015), the WHO reports that over two-thirds of the populace in developing nations views herbal medicine as a significant component of the healthcare sector. Metabolic illnesses such as obesity and diabetes mellitus are caused by medical problems such as hyperlipidaemia, hypercholesteremia, and hyperglycemia. Lemon grass is said to have hypolipidemic, hypocholesterolemic, and hypoglycemic qualities. It has been demonstrated that taking plant extracts lowers very low-density lipids and plasma cholesterol, two factors that are strongly linked to heart disease. One possible future anti-protozoan medication is lemongrass. It has been documented that *Cymbopogon* species can prevent *Aspergillus sp*. and *Penicillium citrinum* from growing and producing aflatoxin, which slows down the degeneration of melon seeds 42.

Fig 3: Structure of Lemongrass

4.4- *Zingiber officinale* (Ginger):

For a long time, people have used ginger (*Zingiber officinale Roscoe*), a member of the Zingiber genus and family of plants, as a spice and herbal remedy. Emesis, headaches, colds, and nausea are among the main ailments that ginger root attenuates and treats. Ginger has been shown to contain a variety of bioactive substances, including phenolic and terpene 43. Antimicrobial resistance has made the spread of infectious diseases caused by bacteria, fungi, and viruses a serious public health concern. Effective natural antibacterial agents against a wide range of pathogenic microorganisms have been discovered in several plants and spices. Ginger has reportedly demonstrated antiviral, antifungal, and antibacterial properties in recent years 44. Because they cannot withstand extremely low temperatures, ginger is best grown in tropical and subtropical areas. The recommended harvesting period for ginger depends on its intended use: it should be harvested 4-5 months after plantation if it is to be used as a vegetable or to make pickles, candies, beverages, and bleached and dehydrated ginger; it should be harvested 8–10 months after planting if it is to be used for dried ginger and to make functional products like oleoresin and ginger oil 45. A ginger plant typically reaches a height of two feet, and its yellow blossoms have a strong scent. The subterranean stem, or rhizome, of ginger, is said to have a potent, spicy flavour that can be utilized in cooking and medicine 45. Since the ginger plant belongs to the same family as cardamom (Elettaria cardamomum) and turmeric (Curcuma longa), these other medicinal plants are closely related to each other (Zingiberaceae). 60–70% of ginger is made up of carbs, 9–12% of water, 9% of proteins, 3-6% of lipids, 8% of ash, 3-8% of crude fiber, and 2-3% of essential oil. In addition to these macronutrients, minerals like calcium, magnesium, phosphorus, salt, potassium, and other bioactive substances are also present in ginger 46.

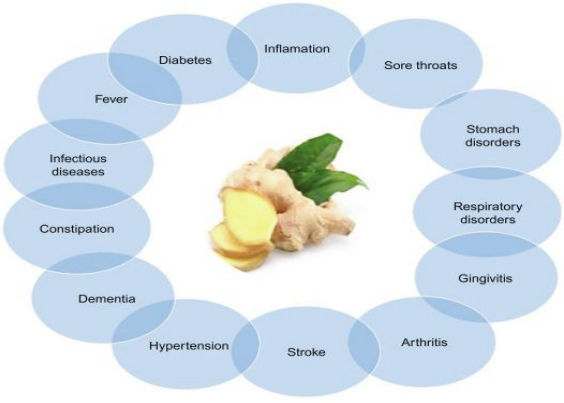

Fig 4: Benefits of Ginger

4.5- *Syzygium cumini* (Jamun):

According to 47 Singh *et al*. (2024), *Syzygium cumini*, sometimes referred to as jamun regionally in Asia, is a fruit-bearing plant that is a member of the Myrtaceae family. *S. cumini* has long been utilized as an herbal remedy. Many plant parts, including the fruit, bark, leaves, and seeds, have been used to treat various illnesses. Oral administration of *S. cumini* fruit juice has been utilized to address dysentery, diabetes, and stomach issues 48. According to 49 Sharma *et al*. (2001), *S. cumini* seeds have been used topically to heal sores and ulcers, and they have also been taken orally to cure dysentery. The seeds have been ground up and mixed with sugar. In the past, the juice of *S. cumini* leaves, combined with the juice of mango leaves and myrobalan fruit and given with honey and goat milk, was also used to treat dysentery. On the other hand, the bark decoction of *S. cumini* combined with water has been used to treat diabetes, induce drowsiness, increase appetite, and relieve headaches when taken orally 48. Rich in anthocyanins, including delphinidin-3-gentiobioside, malvidin-3-laminaribioside, petunidin-3gentiobioside 50, cyanidin diglycoside, petunidin, and malvidin 51, the fruits are also high in glucose, fructose, citric acid, mallic acid, and gallic acid.

Fig 5: *Syzygium cumini* (Jamun)

4.6- Aloe vera:

Aloe vera is a member of the Liliaceae family of medicinal plants that are widely utilized in food goods, cosmetics, and medications 52. *Aloe vera* has many therapeutic properties, including antibacterial, antioxidant, antiviral, antiallergic, UV protection, cicatrizing, anti-inflammatory, and antiviral qualities. This is because of its composition, which consists primarily of water (>98%) in the mucilaginous gel and less than 2% of minerals, vitamins, enzymes, and polysaccharides (such as hemicellulose, cellulose, mannose derivatives, pectin, glucomannan, and acemannan). 53,54,55,56,57. Vitamins A, C, and F are present in the complex plant known as aloe vera. Enzymes such as acid phosphatase, alkaline phosphatase, amylase, lactic dehydrogenase, and lipase; vitamins B (thiamine), niacin, vitamin B2 (riboflavin), choline, and folic acid; and traces of vitamin B12. These enzymes, lipase, and amylase, are biochemical catalysts that facilitate oral digestion by hydrolyzing carbohydrates and lipids 58. There are seventy-five components in all: vitamins, minerals, carbohydrates, enzymes, phenolic compounds, anthraquinones, lignin, saponins, sterols, amino acids, and salicylic acid 59,60. According to Yamaguchi *et al*., 1993(61), the aloe plant contains the following

elements: manganese, copper, zinc, chromium, iron, sodium, potassium, calcium, magnesium, and manganese. Aloe vera has a lot of potential in the food and beverage sector. According to Gauge (1996), Klein *et al*. (1998), Franz *et al*. (2005) 62,63, 64, and others, it has been utilized as a resource for functional foods. These include yogurt and tea. Plant-based nutritional supplements are commonly utilised to promote health and avoid illness, as is well documented. Aloe vera seems to be touted as a secure, organic, and sustainable substitute for traditional artificial preservatives because it doesn't seem to alter the flavour or appearance of food 65.

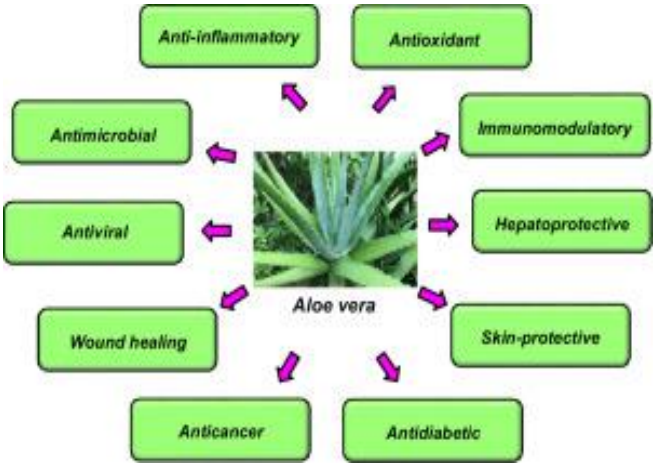

Fig 6: Health benefits of Aloe vera

4.7- *Ocimum sanctum* (Tulsi):

India has long used the Tulsi plant (Ocimum sanctum) to make traditional remedies since it is one of the most prized and multifaceted medicinal herbs. Known for its numerous therapeutic benefits, Tulsi has been dubbed the "Queen of Herbs" and the "Mother of Medicine of Nature" 66(Anbarasu *et al*., 2007). For the treatment of primary health-related disorders, almost 85% of the world's population either completely or partially depends on herbal remedies. Herbal medications are the main treatments, according to the conventional medical system. Tulsi has been utilized in medicine for thousands of years, and it greatly promotes and preserves human health 67. The entire Tulsi plant, utilized in medications, has been shown to have numerous therapeutic benefits as well as beneficial phytochemicals that function as antibacterial agents against harmful bacteria. In the Charaka Samhita, Charaka refers to it. Ayurvedic treatments for common colds, headaches, stomach issues, inflammation, heart illness, poisonings of many kinds, and malaria use Tulsi extracts 68. The medical community faces a pressing need to find new antibiotics since microbiological diseases are becoming increasingly resistant to the ones that are currently on the market. Nonetheless, it has been demonstrated that conventional plants are superior providers of cutting-edge antibacterial medications. The greatest sources of natural medicines are found in the majority of Indian flora 69. In India, Tulsi has been the cornerstone of the Ayurvedic holistic medical system. Many plant parts have been used widely for thousands of years to treat a variety of systemic ailments, including malaria, bronchitis, upper respiratory infections, and skin diseases. certain researchers have examined the ability of Tulsi oil and extracts to inhibit the growth of certain bacterial and fungal diseases 70.

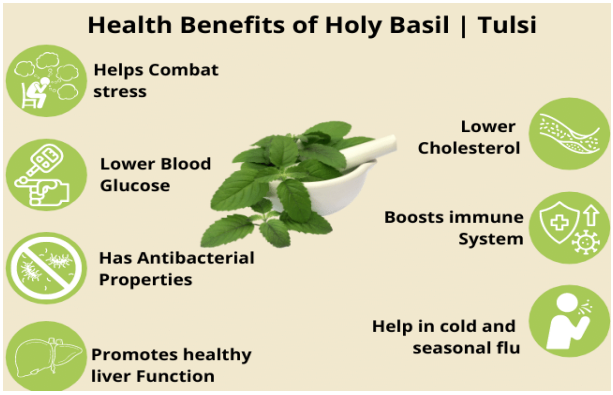

Fig 7: Health benefits of Tulsi (*Ocimum sanctum).*

4.8- *Cinnamomum zeylanicum* (Dalchini):

One of the most significant and well-liked spices in the world, cinnamon is utilized in ancient and contemporary medicine and food. Due to its scent, which may be added to a wide range of foods, fragrances, and medical items, cinnamon is mostly employed in the aroma and essence sectors 71. The two main components of cinnamon that contribute to its scent and the range of biological activities that have been linked to it are cinnamaldehyde and trans-cinnamaldehyde (Cin), which are found in the essential oil 72. In addition to its traditional uses in medicine, cinnamon has been found to have anti-inflammatory, antiemetic, nematicidal, insecticidal, larvicidal, and anticancer properties. Historically, cinnamon has also been used as toothpaste and to treat dental issues, bad breath, toothaches, and oral microflora. 73. The flavor of cinnamon makes it a desirable spice, but there may be medical benefits as well. A significant fraction of synthetic chemicals with beneficial impacts on health are secondary metabolites. Although most of them are dietetic neutral, their effects on human health are often favorable. One of the safer substances used in medicine is thought to be plant oils 74. Numerous health benefits of cinnamon have been shown, including its antioxidant content and potential impact on neurological, microbiological, and cardiovascular disorders as well as diabetes. These benefits are attributed to the bioactive components of cinnamon 75. Moreover, culinary goods might use cinnamon as a preservative. To suppress hyperpigmentation or the browning effect seen on fruits, vegetables, and mushrooms, (E)-cinnamaldehyde is used as a factor that inhibits the activation of tyrosinase. As a result, cinnamon agents have a wide range of uses, including in the food, cosmetic, and medical industries 76.

Fig 8: Benefits of Cinnamon

Conclusion:

Understanding the role that medicinal plants play in human health is crucial since research indicates that these plants may be used in the future to create novel medications to treat diseases that are only starting to surface. Due to the documented poor record keeping and the growing use of Western pharmaceuticals, the knowledge of medicinal plants, dosages, and the conditions treated may be severely undermined in the days ahead. It is important to conduct thorough research and additional scientific studies to determine the facts around ingestion, dosages, side effects, active ingredients, and contraindications while using medicinal plants as they can result in serious poisoning and negative health impacts if used improperly. There are a tonne of opportunities to investigate the properties, nutrients, and various pharmacological components of traditional plants that can be used to synthesize medication. The separation, identification, and application of active screening of natural plant materials through genuine use for healthy living should be the focus of an increasing amount of research. The moment has come to spread awareness of Ayurveda throughout the world.

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