Chapter 1

Literature review on Medicinal plants.
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1.1. Introduction:

1.1.1. Medicinal Plants:

Long before the development of modern medicines, India in ancient times was entirely dependent on herbal medicines for health care. Many scripts carry elaborate prescriptions of herbal medicines for treating very complicated diseases. India was the leader in health care through Ayurveda. Apart from such systematic therapies, specific herbal therapies developed by individuals were used for treating the sick and these secret therapies were passed on from the older generation to the younger generation, without disclosing them to the outsiders.

Even today, herbal medicines play a significant role in India. A similar practice was also prevalent in China and many other countries in Asia and Africa. With the advancement of science, allopathic medicine gained prominence over herbal medicines. With larger commercial interest, the western countries promoted modern medicine, inspite of its high cost and side effects. However, realizing the drawbacks of allopathic medicine, the world is turning back to herbal medicines. Presently, about 80% of the world population is still dependent on medicinal plants for health care and 20% of the drugs in pharmaceutical firms are of plant origin, either extracted from the plants or synthetic derivatives of these plant species. In India, for over 500 million people, traditional herbal medicines are only alternatives source, due to easy accessibility and lower price. This sector also provides employment to over one million traditional healers and vaidyas in country. Generally, the villages acquire basic knowledge about use of various herbs from their elders and collect them fresh from their gardens or nearby forests, whenever they need them. However, with deforestation and commercialization of agriculture, many medicinal herbs are not easily available. Most Ayurvedic medicines produced by the pharmaceutical firms are used as backup remedies, tonics or to counteract the side effects of allopathic medicines, resulting in loss of faith in the system. Presently a large number of firms are involved in bulk production of herbal medicines in India. As most of these firms do not have their own source of raw materials required for processing, they are dependent on the natural forests (1).
The common belief based on tradition, that medicinal plants being "natural" or near to nature are always safe, is not held to be true lately. With advancement of technology, the scientists are able to detect minute amounts of carcinogenic and toxic chemicals in these herbs and recognize or evaluate potentially hazardous effects of some of the herbs used in traditional medicines since centuries. Though medicinal plants have been used since antiquity for the prevention and treatment of various ailments. Lately there has been great resurgence in the use of herbal remedies especially during the last decade and half.

1.2. Factors promoting use of herbal medicines:

Amongst several factors contributing towards the potential use of herbal drugs, holistic approach to the health problems, safety, lack of adverse reactions and side effects have been mostly found to particularly influence the use of such medicines in the developed countries whereas, their accessibility, affordability, historical and cultural background besides the above factors promote their use in the developing countries.

1.2.1. Role of Physicians and Pharmacists:

Physicians generally do not ask the patients about having used herbal preparations while taking their history. But because of the biological potency, side effects and adverse reactions of many herbal preparations and their increasing popularity and availability. It is necessary that patients should be asked specifically about their use, especially when presenting with unusual symptoms or signs while prescribing any allopathic medicine. Apart from the role physicians have to play in safe guarding the public health pharmacist’s interventions in the appropriate use of herbal medicines are necessary to make the overall health delivery system safe and effective (2).

1.2.2. Cultivation of medicinal plants:

Most of medicinal plants, even today are collected from wild. The continued commercial exploitation of these plants has resulted in receding the population of many species in their natural habitat. Vacuum is likely to occur in the supply of raw plant materials that are used extensively by the pharmaceutical industry as well as the traditional practitioners. Consequently, cultivation of these plants is urgently needed to ensure their availability to the industry as well as to people associated with traditional system of medicine. If timely steps are not taken for their conservation, cultivation and mass propagation, they may be lost from the natural vegetation.
forever. In *situ* conservation of these resources alone cannot meet the ever increasing demand of pharmaceutical industry. It is necessary to initiate systematic cultivation of medicinal plants in order to conserve biodiversity and protect endangered species. In the pharmaceutical industry, where the active medicinal principle cannot be synthesized economically, the product must be obtained from the cultivation of plants. Systematic conservation and large scale cultivation of the concerned medicinal plants are thus of great importance.

1.2.3. **Processing and Utilization:**

Medicinal principles are presented in different parts of the plant like root, stem, bark, heartwood, leaf, flower, fruit or plant exudates. These medicinal principles are separated by different processes; the most common is extraction. Extraction is the separation of the required constituents from plant materials using a solvent. In the case of medicinal plants, the extraction procedure falls into two categories.

a) Where it is sufficient to achieve within set limits equilibrium of concentration between drug components and the solution.

   e.g. Tinctures, decoction, teas, etc.

b) Where it is necessary to extract the drug to exhaustion, i.e. until all solvent extractable are removed by the solvent.

Both the methods are utilized depending on the requirement although in industry the latter method is mostly used. In all industrial procedures, the raw material is pre-treated with solvent outside the extractor before changing the latter. This prevents sudden bulk volume changes (which are the main cause of channeling during extraction) and facilitates the breaking the extraction, the solvent should diffuse inside the cell and the substance must be sufficiently soluble in the solvent.

The solvent should be selective for complete extraction of biological active compound. The cost and availability of the solvent are also taken into account. Alcohol, though widely used, because of its great extractive power it is often the least selective, in that it extracts all soluble constituents. Alcohol in various ratios is used to minimize selectivity. Some materials such as alkaloids being soluble in acids, their extraction are facilitated by adjusting the pH in the acidic range. A number of alkaloids can be extracted easily with hydrocarbons after they have been released from combination with organic acids by grinding with alkali. It is first ground with moist calcium oxide and extracted with chloroform. A large number of alkaloids can be
extracted directly with aqueous acids, organic or inorganic acids, and the alkalized extracts counter extracted with hydrocarbons or other polar solvents.

### 1.2.4. Formulation and industrial utilization:

Medicinal plants are used as raw materials for extraction of active constituents in pure form as precursors for synthetic vitamins or steroids, and as preparations for herbal and indigenous medicines. A large quantity of medicinal plant material is used in the preparation of herbal and medicinal teas e.g. chamomile. These herbal and food uses are of great importance, also to the exporters from the developing countries. Hundreds of medicinal plants are items of commerce, however relatively small countries are used in formulated herbal remedies.

### 1.2.5. Quality and Evaluation:

A major lacuna in Ayurveda is the lack of drug standardization, information and quality control. Most of the Ayurvedic medicines are in the form of crude extracts which are a mixture of several ingredients and the active principles when isolated individually fails to give desired activity. This implies that the activity of the extracts is the synergistic effects of its various components. In the absence of pharmacopeia data on the various plants extract, it is not possible to isolate or standardize the active contents having the desired effects. Ayurvedic pharmacopeia compiled on modern lines and updated periodically is an urgent requirement. Research on the rationale and methodology of Ayurvedic medical practice; isolation of active constituents and their development into new therapeutics standardization and validation of known herbal medicines and other related aspects are needed. These are some problems concerning the proper identity of a number of drug species. In many cases, a single plant species has several different commercial or medicinal names in the different regions. Several distinct species are often used under the same drug name. Another problem relates to adulteration in the market samples. In other words, authentication of the botanical identity and ascertaining the genuineness of drug is great concern in practical situation (3).

### 1.2.6. Conservation:

The conservation of plants can be expected to lead not only to the saving of human lives but also to substantial economic gains for people living where the plants exist and indeed, for the rest of the world. The maintenance of essential ecological processes and life-support system; the preservation of genetic diversity and
the sustainable utilization of species and ecosystem which support millions of rural communities as well as major industries. The previously medicinal gardens and were attached to faculties or schools of medicine as long ago as the sixteenth century. Few developing countries have instituted measures to protect endangered species of medicinal plants.

1.3. Traditional and alternative systems of medicines:

1.3.1. Traditional Chinese Medicine and Kampoh system:

Plant derived drug have an important place in both traditional and modern medicine, for this reason a special effort to maintain the great diversity of plant species would undoubtedly help to alleviate human suffering in the long term proven agro-industrial technologies should be applied to the cultivation and processing of medicinal plants and manufacture of herbal medicines.

The Chinese system of medicine is still prevalent. This ancient system finds its references in the Yellow Emperor’s classic of Internal Medicine. This herbal is based on the idea that all life is subject to natural laws. The hypothesis includes two quite different systems the *yin and yang* theory and the five elements (i.e. water, metal, earth, fire and wood). These two theories have been developed separately and differ in terms of diagnosis and treatment. The traditional Chinese system of medicine has spread to Japan and Korea in a form called Kampoh, called as the traditional system of Japanese style of simplicity and naturalness, still the basic ideas like *yin and yang* have a crucial role in Kampoh medicine. As compared to Kampoh, Korean system is very much similar to Chinese system and included most of the herbs in it.

1.3.2. Ayurveda- Indian System of Medicine:

The term Ayurveda comes from the Sanskrit word *Au* (life) and *Veda* (knowledge). As the name implies it is not only the science of treatment of the ill but covers the whole gamut of happy human life involving the physical, metaphysical and the spiritual aspects. Ayurveda recognizes that besides a balance of body elements one has to have an enlightened state of consciousness, sense organs and mind if one has to be perfectly healthy (3). Ayurveda - Ancient Science of Life is believed to be prevalent for last 5000 years in India. It is one of the most noted systems of medicine in the world. Ayurveda is based on the hypothesis that everything in the universe is composed of five basic elements viz. space, air, energy, liquid and solid. They exist in
the human body in combined forms like vata (space and air), pitta (energy and liquid) and kapha (liquid and solid). Vata, pitta and kapha together are called Tridosha (three pillars of life). It is believed that they are in harmony with each other, but in every human being one of them is dominating which, in turn is called as the prakuti of that person. Tridosha exist in human body in seven forms called saptadhatu viz. Rasa (lymph), Rakta (blood), meda (adipose tissue), mamsa (flesh), majja (nerve tissue), shukra (reproductive tissue) and asthi (bones). These tissues are subject to wear and tear so that mala (excretory material) is formed from them. When tridosha, saptadhatu and mala are in balance with each other, it is called as healthy condition while imbalance causes a pathological condition. Authentic information on Ayurveda has been compiled by ancient Indian Medicine practitioners in forms called Samhita and other similar books. Ayurvedic pharmacy (Bhaishajya-Vigyan) proposes five basic dosage forms like swaras, kalka, kwath, hima and phant. A number of other dosage forms like churna, avaleha, ghrita, sandhana kalpa, bhasma are prepared from them. Mostly, all of them are polyherbal formulations.

1.3.3. Unani System of Medicine:

The roots of this system go deep to the times of the well-known Greek philosopher Hippocrates who is credited with it. Aristotle Golen Greek – philosopher “Father of natural history” made valuable contributions to it. This system of Greek origin was further carried to Persia (Iran), where it has been improved by Arabian physicians. This system is based on two theories viz. the Hippocratic theory of four humours and the Pythagorian theory of four proximate qualities. The four humours are blood, phlegm, yellow bile and black bile while the four qualities are the states of living human body like hot, cold, moist and dry. They are represented as earth, water, fire and air.

The Unani system of medicine aims at treating the cause of diseases and not its symptoms. For this purpose, thorough history of the patient is recorded in addition to this pulse, urine and stool examinations. The diseased condition is considered to be due to the imbalance between humours and accordingly, treatment is given. The drugs are polyherbal formulations and their collective effect is considered. Unani system of medicine is called by various names in different parts of world such as Arab medicine, Greco-Arab medicine, Loniah medicine, Islamic medicine and also oriented medicine.
1.3.4. Siddha system of Medicine:

The term ‘siddha’ means achievement and ‘siddhars’ were saintly personalities, who attained proficiency in medicine through practice of Bhakti and Yoga. According to traditional belief Lord Shiva unfolded the knowledge of medicine to his wife Parvati which was then passed to Siddhars. This is the system of pre-vedic period identified with Dravidian culture and it is largely therapeutic in nature. Like Ayurveda, this system believes the role of three humors i.e. vatta, pitta and kapha and that all objects in universe are made up of five basic elements namely, earth, water, sky, fire and air. The identification of causative factors of diseases is done through pulse reading, color of body, study of voice, urine examination, and status of digestive system and examination of tongue. The literature of Siddha system is mostly in Tamil (4). The exploitation of plants by man for the treatment of diseases has been in practice for a very long time. Herbal drugs constitute a major part in all the traditional system of medicines. A special feature of higher plants is their capacity to produce a large number of organic chemicals of high structural diversity, the so called secondary metabolites. (5).

1.4. Plants as source of drugs:

In many areas especially in tropics, an abundance of medicinal plants offer people access to safe and effective products for uses in the prevention and treatment of illness through self-medication. Such plants are also useful in modern medicine:

- They are used as sources of direct therapeutic agents.
- They serve as raw materials for the manufacture of more complex semi-synthetic compound.
- The chemical structures derived from plant substances can be used as models for new synthetic products.
- Plants can be used as taxonomic markers in the search for new compound.

1.5. Plants as dental drug:

About 10 different oral /dental condition with plants are common in the traditional health practice namely; toothache/decay, gingivitis, ulcerative gingivitis, angular stomatitis, mouth ulcer, swollen tonsil, oral thrush, tonsillitis and black tongue. Teeth are cleaned in the morning by chewing the roots or thin stem of certain plants until they acquire brush like ends. The fibrous end is used to brush and clean the teeth thoroughly every morning. Many plants drugs even in the crude form are well known in the international markets today (6). Medical components from plants
play an important role in conventional as well as western medicine. Plant derived medicines have been a part of the evolution of human healthcare for thousands of years. Plant based medicines were commonly used in India and China. At same time, indigenous people of rest of the planet were also utilizing plants for curing diseases. Today 88% of the global population turns to plant derived medicines as their first line of defense for maintaining health and combating diseases. (7).

1.6. Common features for herbal medicines:

- Herbal medicines are different from clinically defined medicines in their character as well as in their medicinal value.
- They are based mostly on herbal products.
- Usually, they are multi-drug formulations including animal and mineral products as essential components or additives.
- In herbal therapy, data on pre-clinical investigations are often incomplete although in majority of cases the therapeutic experiences have been accumulated over centuries.
- Some of them follow practices based on, for example, mistaken beliefs, faulty experimentation, or inaccurate information that can be dangerous.
- They mostly include empirically defined doses and course of medication.
- The identity of plant species used is often controversial.
- Safety measures are poorly adopted, in most cases.
- Additives are frequently used; many of them also have therapeutic actions.
1.7. Salient features of selected plants:

Four medicinal plants viz., *Enicostemma littorale*, *Achyranthes aspera*, *Abutilon indicum* and *Tridax procumbens* were selected for evaluation of some activity

1.7.1. Morphology of Selected Medicinal Plants:

1.7.1.1. *Enicostemma littorale* Blume: (Family: Gentianaceae).

**Habitat:**
Throughout the India, from Punjab and Gangetic plain to Kanyakumari up to 500 m.

**Common Names:**

**English:** Indian Gentian.

**Ayurvedic:** Nagjivaa, Maamajjaka, Naahi, Tikshnapatra.

**Unani:** Naai, Naahi.

**Siddha/Tamil:** Vellargu.

**Folk:** Chhotaa chirayataa (8-9).

**Uses:**

Bitter tonic, carminative, blood purifier, anti-rheumatic, anti-inflammatory, anti-psychotic, anthelmintic, cardiostimulant.

**Whole plant:** Antimalarial, antipyretic and as a laxative. This herb is also known for its anti-inflammatory and anticancer property.

**Leaves:** Show hypolipidaemic effect (10).

**Root:** Showed antimalarial activity both in vitro and in vivo.

**Chemical constituents:**

i) **Major:**
Glycosides- swertiamarin

ii) **Minor:**
It contains phenols, tannins, flavonoids, glycosides, anthroquinones, sterols and gentianine.
1.7.1.2. Achyranthes aspera Linn: (Family: Amaranthaceae)

**Habitat:**
Throughout the tropical and subtropical regions, up to an altitude of 2,100 m in the southern Andaman Islands.

**Common Names:**
- **English:** Prickly chaff flower.
- **Ayurvedic:** Apaamaarga, Chirchitaa, Shikhari, Shaikharika, Adahshalya, Mayura, Mayuraka, Kharamanjari, Kharapushpaa, pratyakpushpaa, Aaghaat, Vashira, Kanihi.
- **Unani:** Chirchitaa.
- **Unani-Siddha/Tamil:** Naayuruvi.
- **Folk:** Chirchitta, chichitaa, Latjeeraa, Agethi, Zinzudo

**Uses:**
Astringent, pectoral (ashes of the plant used in asthma and cough), diuretic, hepatoprotective, emmenagogue. Benzene extract of the plant exhibited abortifacient activity.

**Seed**- emetic; used for biliousness.

**Flowers**- The flowers ground and mixed with sugar, are given for menorrhagia.

**Root**- Astringent, haemostatic.

Along with other therapeutic applications. The Ayurvedic pharmacopoeia of India indicates the use of whole plant in lipid disorders and obesity, the root for its blood purifying property.

The plant juice and ash are used for treating bleeding piles. An alkaline powder of the plant is used in preparing kshaarasutra of Ayurvedic medicine, which is recommended for treating fistula-in-ano.
Chemical constituents:

i) Major:
Potash, saponins and oleanolic acid and its ester.

ii) Minor:
Ecdysterone and oleanolic acid.

1.7.1.3. *Abutilon indicum* Linn: (Family: Malvaceae (11-12)).

**Habitat:**
Throughout the hotter parts of India found as a weed in the sub-Himalaya, tract and other hills up to 1, 2000 m.

**Common Names:**

**English:** Country Mallow, flowering Maples, Chinese Bell-flowers

**Ayurvedic:** Atibalaa, Kankatikaa, Rishyaprottaa.

**Unani:** Kanghi, Musht-ul-Ghauli, Darkht-e-Shaan.

**Folk:** Kanghi, Kakahi, Kakahiya, Dabali

**Uses:**

**Dried, whole plant**- febrifuge, anthelmintic, demulcent, diuretic, anti-inflammatory (In urinary and uterine discharges, piles, lumbago).

**Juice of the plant**- Emollient.

**Seed**- Demulcent (used in cough, chronic cystitis), laxative.

**Leaves**- Cooked and eaten for bleeding piles.

**Flowers**- Anti-inflammatory, Bark-astringent, diuretic.

**Root**- Nervine tonic, given in paralysis; also prescribed in strangury.

Along with other therapeutic applications, the Ayurvedic pharmacopoeia of India indicates the use of the root in gout, polyuria and haemorrhagic diseases.

**Chemical constituents:**

i) Major:
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Alkaloids, leucoanthocyanins, flavonoids, sterols, triterpenoids, saponins and cardiac glycosides

ii) Minor:

Mucilage, tannins, asparagines.

1.7.1.4. Tridax procumbens Linn: (Family: Asteraceae; Compositae ((13-16)

Habitat: Waste places, road sides and hedges throughout India.

Common Names:

English: Mexican Daisy.
Ayurvedic: Jayanti.
Siddha/Tamil- vettukkaaya-thalai
Folk: Akala kohadi (Bihar).

Uses:

Whole plant: An aqueous extract of the plant produced reflex tachycardia and showed a transient hypertensive effect on normal blood pressure of dogs; it had also showed a marked depressant action on the respiration. Alcoholic extract of the whole plant (excluding roots) at a dose of 300 mg showed good anti-secretary, antidiarrhoeal activity against E. coli enterotoxin induced secretory response in rabbit and guinea pig ileal loop models.

Leaves: Styptic, antidiarrhoeal, antidysenteric. Also used for bronchial catarrh.
The leaf juice exhibits antiseptic, insecticidal and parasiticide properties. It is used to check hemorrhage from wounds, cuts and bruises, also for restoring hair growth.

Chemical constituents:

i) Major:

Alkaloids, phenolics, saponins and tannins

ii) Minor:
Fumaric acid, n-alkenes, saturated and unsaturated fatty acids along with dotria contanol.

1.8. Safe and Efficacious Herbal Drugs:

The overall goal in drug development is quality, safety and efficacy. All measures in drug development are directed to this goal. The requirements of health authorities on quality, safety and efficacy are standardized on a high level based on the development procedure for the herbal as well as synthetic drugs. Health authorities are reluctant to accept traditional drug preparations from other cultural areas without well-documented data on quality, safety and efficacy. In many developing countries, appropriate utilization of local resources to cover drug needs is dependent on preliminary scientific study to determine the efficacy and safety. Despite many shortcomings, the number of users of herbal drugs is increasing in the developing as well as the industrialized world. Traditional herbal medicines, although currently serving the health care needs of majority of the world’s population, can be further increased in coverage and broadened in terms of safety and efficacy provided that some basic principles of drug preparation, evaluation and uses are brought into practice. (16-18).

1.9. References:

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