REVIEW OF LITERATURE

Natural products including plants, minerals and animals have been the basis of treatment of human diseases. History of medicine practically dates back to existence of human civilization. Fossil records date back the use of plants, at least, to the middle Paleolithic age some 60,000 years ago.\(^\text{87}\)

The basis of development of modern medicine is rooted in traditional medicine and therapies. The Greek physician Galen (AD 129-200) devised a pharmacopoeia describing the appearance, properties and use of many plants of his time.\(^\text{88}\) Natural products chemistry actually began with the work of Seturner, who first isolated morphine from opium in 1805. This, in turn, was obtained from opium poppy (\textit{Papaver somniferum} L.) by process that have been used for over 5000 years.\(^\text{89}\)

In last few decades, the importance and popularity of traditional medicine was realized by some of the international authorities and agencies, including WHO.

Role of WHO in promotion of Traditional Medicine:

The WHO has been promoting T M as a source of less expensive, comprehensive medical care, especially in developing countries. A group of WHO experts met in Congo Brazzaville in 1976. This group sought to define traditional African medicine as ‘the sum total of practices, measures, ingredients and procedures of all kinds whether material or not, which from time immemorial has enabled the African to guard against diseases, to alleviate his /her suffering and cure him/herself.\(^\text{90}\)
Later on, in 1978, a declaration on traditional medicine for health care was made by WHO in the International conference held at Alma Ata, U.S.S.R.\textsuperscript{91} In this historic International conference on primary health care at Alma Ata, the World Health Assembly recommended that government give high priority to the incorporation of the TMPs into the health care team and proven traditional remedies into the national drug policies and regulations.\textsuperscript{91}

Further, in 1991, the guidelines for the assessment of herbal medicine were developed by WHO.\textsuperscript{92} The 6\textsuperscript{th} International Conference of Drug Regulatory Authorities held at Ottawa in the same year ratified the same.

The salient features of WHO guidelines are: \textsuperscript{78}

1. **Quality assessment:** Crude plant materials or extract plant preparation and finished product.

2. **Stability:** Shelf life.

3. **Safety assessment:** Documentation of safety based on experience and toxicological studies.

4. **Assessment of efficacy:** Documented evidence of traditional use and activity determination (animals and human).

The research on TM is being promoted and conducted all over the world, especially in developing countries like China, India and other Asian and African countries. Literature review is the essential part of the research activity. To aid the research in ethnomedicine, Dr. Fransworth, University of Illinois has computerized information on biological activities of 1000s of plants and other natural products, including over 3000 plant species used to regulate human fertility.\textsuperscript{93}
At the University of Illinois, ‘NAPRALERT (National Products Alert)’ database was established. This is a computerized database derived primarily from scientific information gathered from the world literature on the chemistry, pharmacology, and ethnopharmacology of natural plant products. It includes ethnomedicinal uses of about 9200 of 33,000 species of monocotyledons, dicotyledons, gymnosperms, lichens, pteridophytes and biophytes.\textsuperscript{94} it can provide both a general profile on a designated plant and a profile on the biological effects of a chemical constituent thereof. A valuable feature of the NAPRALERT database is its ability to generate information on plants from a given geographical area.

The growing herbal market and its great commercial benefit might pose a threat to biodiversity through the overharvesting of the raw material for herbal medicines and other natural health care products. These practices, if not controlled, may lead to extinction of the endangered species and the destruction of the natural habitats and resources. Hence it is essential to promote the activities to preserve them and also cultivation of the medicinal plants. Costa Rica had set aside 25\% of its land to preserve the forests, in part to provide plants and other materials for possible pharmaceutical and agricultural applications.\textsuperscript{94}

WHO hosted interregional workshop to address methodologies for the selection and use of TM in national Primary Health Care (PHC) programs. WHO, The International Union for the Conservation of Nature and Natural Resources, and the World Wide Fund for Nature developed guidelines for conservation of medicinal plants.\textsuperscript{94}

In 2002, WHO launched its first ever comprehensive traditional medicine strategy.\textsuperscript{78}
The strategy is designed to assist countries to:

- Develop national policies on the evaluation and regulation of TM/CAM practices;
- Create a stronger evidence base on the safety, efficacy and quality of the TM/CAM products and practices;
- Ensure availability and affordability of TM/CAM including essential herbal medicines;
- Promote therapeutically sound use of TM/CAM by providers and consumers;
- Document traditional medicines and remedies.

The following literature evidences confirm the sequential documentation of historical use of plants in materia medica, pharmacopoeia etc. (Table No. 5.1)
Table No. 5.1: History of use of ethnobotanicals

<table>
<thead>
<tr>
<th>YEAR</th>
<th>OBSERVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 BC King Assurbanipal of Sumeria US Pharmacopoeia</td>
<td>Compilation of the first known materia medica—an ancient form of today’s United states pharmacopoeia—containing 250 herbal drugs (including garlic, still favorite of herbal doctors).</td>
</tr>
<tr>
<td>1100 BC</td>
<td>First recording of Chinese Materia Medica</td>
</tr>
<tr>
<td>1200-1000 BC to 7th century AD</td>
<td>Documentation of Indian Ayurveda system: ‘Atharva Veda’ and ‘Rig Veda’ dating back to second millennium BC. ‘Charaka Samhita’ (900 BC), Sushruta Samhita(600BC), ’Ashtanga Hridaya’ by Vagbhatta.</td>
</tr>
<tr>
<td>300 BC to 700 AD</td>
<td>Translation of Ayurvedic texts into Greek (300BC), Tibetan and Chinese (300AD), Persian and Arabic (700AD)</td>
</tr>
<tr>
<td>1st century A.D. De Materia Medica</td>
<td>Written by Dioscorides; text contains 950 curative substances, of which 600 are plant products and the rest are minerals and of animal origin.</td>
</tr>
<tr>
<td>AD 129-200 The Greek physician-Galen</td>
<td>Devised first pharmacopoeia describing the appearance, properties and use of many plants of his time.</td>
</tr>
<tr>
<td>Sertturner 1805</td>
<td>Pioneer of natural product chemistry; who first isolated morphine from opium (Papaver somniferum L.) by process that have been used for over 5000 years.</td>
</tr>
<tr>
<td>1976 WHO assembly</td>
<td>World Health Assembly drew attention to reserve constituted by those practicing TM</td>
</tr>
<tr>
<td>2002</td>
<td>WHO launched first ever comprehensive TM strategy</td>
</tr>
</tbody>
</table>
Ethnomedicine:

About 200 years ago our pharmacopoeia was dominated by herbal medicines and almost 25% of the drugs prescribed worldwide are derived from plants. Of the 252 drugs considered as basic and essential by the WHO, 11% are exclusively of plant origin and a significant number are synthetic drugs obtained from natural precursors.

Current Scenario of ethnomedicine:

Ethnomedicine has been considered as a rapidly developing discipline due to failure of synthetic molecules and cost effectiveness of herbal medicine in the process of drug development. It is estimated that, throughout globe, about 250,000 of plant species having therapeutic value exist out of which 45,000 exist in India. Only 25% of these are used and that too by traditional healers and practitioners in India. (Table No 5.2) Unfortunately, very few of these have been scientifically validated. (Table 5.3)
Table No.5.2: Current therapeutic uses of traditional plants

<table>
<thead>
<tr>
<th>PLANT SOURCES</th>
<th>COMPOUND NAME</th>
<th>THERAPEUTIC USAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Atropa belladonna</em> L. (Belladona)</td>
<td>Atropine</td>
<td>Anti-cholinergic</td>
</tr>
<tr>
<td><em>Camellia sinensis</em> (L.) Kuntze.</td>
<td>Caffeine</td>
<td>Central nervous system stimulant</td>
</tr>
<tr>
<td><em>Catharanthus roseus</em> (L.) G.Don</td>
<td>Vinblastine/Vincristine</td>
<td>Anti-cancer agent</td>
</tr>
<tr>
<td>(Madagascar periwinkle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cephaelis ipecacuanha</em> (Brot.) A. Rich. (Ipecac)</td>
<td>Emetine</td>
<td>Amoebicide, Emetic</td>
</tr>
<tr>
<td><em>Cinchona officinalis</em> L. (Yellow cinchona)</td>
<td>Quinine</td>
<td>Antimalarial, Anti-pyretic</td>
</tr>
<tr>
<td><em>Digitalis purpurea</em> L. (Common Foxglove)</td>
<td>Digoxin</td>
<td>Cardiotonic</td>
</tr>
<tr>
<td><em>Ephedra sinica</em> L. (Ma-Huang)</td>
<td>Ephedrine</td>
<td>Sumpathomimetic</td>
</tr>
<tr>
<td><em>Erythroxylum coca</em> Lam.</td>
<td>Cocaine</td>
<td>Local anaesthetic</td>
</tr>
<tr>
<td><em>Mucuna deeringiana</em> (Bort) Merr. (Velvet bean)</td>
<td>L-dopa</td>
<td>Anti-parkinsonism</td>
</tr>
<tr>
<td><em>Papaver somniferum</em> L.</td>
<td>Noscapine/codaine</td>
<td>Anti-tussive</td>
</tr>
<tr>
<td><em>Papaver somniferum</em> L. (Opium poppy)</td>
<td>Morphine</td>
<td>Analgesic, Sedative</td>
</tr>
<tr>
<td><em>Pilocarpus jaborandi</em> Holmes (Jaborandi)</td>
<td>Pilocarpine</td>
<td>Parasympathomimetic</td>
</tr>
<tr>
<td><em>Rauwolfa serpentina</em> (L.) Benth. ex Kurz.</td>
<td>Reserpine</td>
<td>Anti-hypertensive</td>
</tr>
<tr>
<td><em>Strichnos guianensis</em> L. (Pot curare)/Chromdroedereone (Tube curare)</td>
<td>Tubocurarine</td>
<td>Muscle relaxant</td>
</tr>
</tbody>
</table>

Data adopted from Fransworth et al. 100
### TABLE NO.: 5.3 Validated traditional plant preparations:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Plant Name</th>
<th>Therapeutic Indication</th>
<th>Reference</th>
</tr>
</thead>
</table>
| 1.      | *Ocimum sanctum* L. (Tulsi) | 1. Bronchitis, bronchial asthma, malaria, diarrhea, dysentery, arthritis, eye diseases, chronic fever  
2. Posses antioxidant, immunomodulatory, antifertility anticancer, antidiabetic, antifungal, haepatoprotective cardioprotective, analgesic, antispasmodic | Prakash P. et al 2006 102 |
*Curcuma longa* L. | Osteoarthritis                                                                        | Kulkarni et al 1991 105 |
2. External application: rheumatism, neuralgia and boils | Johri 1992; 107  
Karan 1999 108 |
**Current status of Ethnomedicine in India:**

India is one of the 12 mega biodiversity centers having 45,000 plant species. Its diversity is unmatched due to the 16 different agro-climatic zones, 10 vegetative zones, and 15 biotic provinces. The country has a rich floral diversity. TM is the synthesis of therapeutic experience of generations of physicians practicing the indigenous systems of medicine. Traditional preparation comprises medicinal plants, minerals and organic matters etc. Herbal drug constitutes only those traditional medicines that primarily use medicinal plant preparations for therapy. The ancient record demonstrates their use by Indian, Chinese, Egyptian, Greek, Roman and Syrian dates back to about 5000 years. About 500 plants with medicinal use are mentioned in ancient texts and around 800 plants have been used in indigenous systems of medicine. Indian subcontinent is a vast repository of medicinal plants that are used in traditional medical treatments which also forms a rich source of knowledge. The various indigenous systems such as Siddha, Ayurveda, Unani and Allopathy use several plant species to treat different ailments. In India around 20,000 medicinal plant species have been recorded recently, but more than 500 traditional communities use about 800 plant species for curing different diseases.

**Documentation of Ethnomedicine in India:**

Ethnomedicine is not new in India because of its rich ethnic diversity. There are over 400 different tribal and other ethnic groups in India. The tribal population constitutes about 7.5% of Indian population. There are many reports on the traditional
use of plants for different ailments by the tribal or indigenous communities of India. Apart from tribal groups, many other forest dwellers and rural population have unique knowledge of plant as a medicine.

Due to easy accessibility and affordability women are frequent user of T M for their gynaecological problems, especially infertility and menstrual problems; but unfortunately, documentation of these T M practices are not very common. Since most of the documentation in the T M is done by ethnobotanists or ethnopharmasist, the non-medical personnel, the majority of literature is on general use of T M. Although the floristic and ethnomedicinal investigation have been carried out by various workers like Majumdar, 1971; Jain, 1979; Hajra, 1981; Ambasta, 1986, the information on plants used for gynaecological disorders is meager in these publications. Very few qualified medical personnel have taken interest in ethnomedicinal research.

Various ethnobotanists have conducted research on use of medicinal plants and TM practices in different areas and different ailments. A study conducted on documentation of ethnomedical knowledge of Kunabi tribe from Karnataka state of India reported some of the medicinal plants used for treatment of gynaecological problems. *Diospyros montana* Roxb., *Hibiscus rosa sinensis* L., * Ocimum basilicum* L., *Saraca asoca* (Roxb.) Willd. *Erythrina indica* Lam., *Ixora coccinea* L. and *Ziziphus rugosa* Lam. are the commonly used plants for the treatment of female reproductive disorders. Number of studies have been conducted in last two decades in Rajasthan to explore medicinal plant resources of Sitamata wildlife sanctuary.

A study conducted to explore traditional knowledge of Sapera (snake charmer) community in Jhajjar district of Haryana, India, mentioned that *Argemone mexicana* L.,
Curculigo capitulata Gaertn. Curcuma longa L., Punica granatum L., Momordica dioica Roxb. (ex Willd.), Curcuma longa L., Tribulus terrestris L., Tylophora indica (Burm.L.) Merr. are the most commonly used plants to treat female gynaecological problems whereas Ocimum sanctum L., Pedalium murex L., Ficus benghalensis L. are mainly used in males.¹²⁵

Although these studies are not exclusively to explore uses of plants in gynaecological problems, some of the plants such as Argyreia strigosa (Roth) Roberty. Bombax ceiba L., Dioscorea bulbifera L., Dioscorea pentaphylla L. have been mentioned for the treatment of gynaecological problems and also as contraceptive agents.¹²⁶

Formulations using combination of root of Hemidesmus indicus R. Br. and bark of Machilus macrantha Nees. and another single drug formulation using leaves of Zizyphus rugosa Lamk. and tuber of Hedychium flavescens Carey ex. Roscoe Carey have been replaced in the treatment of white discharge in Uttar Kannada district of Karnataka.¹¹⁷

A study conducted in Bidar district of same state has mentioned many of the plants used for common gynaecological problems, for example use of Abrus precatorius L., Argemone maxicana L., Caesalpinia bonducella (L.) Flem., Catharanthus roseus (L.) G. Don., Lawsonia innermis L.¹²⁹ Fresh rizome of Circuma longa L., tuber of Hedychium flavescens Carey ex. Roscoe and white flowers of HRS are reported to be used in the treatment of urinary tract infection.¹²⁷
Research Approach to herbal products:

Since pluralistic healthcare system is used in India, there is an unfettered choice for the quest for new clinical efficacy of traditionally used medicinal plants.\textsuperscript{128} For this purpose approach with reverse pharmacology will be of much help. A new concept of ‘observational therapeutics’ which is antecedent of path of reverse pharmacology, has emerged. This approach of reverse pharmacology and also the golden triangular research for correlating the three fields by R&D network viz. modern medicine, Indian system of medicine, and life &pharmaceutical sciences has been followed in recent years for drug discovery.\textsuperscript{129} This approach will help the in newer drug development from medicinal plants.

Literature on Indian medicinal plants: \textsuperscript{130}

There is vast literature in Ayurveda on medicinal plants in Sanskrit, Hindi and regional languages. However translating the technical Sanskrit and Indian word into English may cause errors. In India, record of utility of natural and plant products to cure ailments appeared in ‘Rigveda’ dating back 4500-1600BC., wherein 67 plants species were mentioned. Later on these plant species were equated botanically. The ‘Yajurveda’ includes 81 prescriptions for curing several diseases, of which 100 Sanskrit names of herbs were identified botanically. ‘Athervaveda’ mentions number of therapeutic recipes, time, method of treatment and also the knowledge on trade of herbs. About 290 herbs mentioned in this were identified botanically on later date.\textsuperscript{131}

**Institutions/ Centres Working on Indian Medicinal plants:**

A large number of academic, industrial and government institutions are conducting research on the medicinal plants. Table No. 5.4 provides list of some of eminent institutions which are active in research on medicinal plants and in Ayurveda.
Table No. 5.4 Herbal Research institute/centres in India:

<table>
<thead>
<tr>
<th>Name</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCRAS (Central Council for Research in Ayurveda and Siddha)</td>
<td>New Delhi</td>
</tr>
<tr>
<td>NBRI (National Botanical Research Institute) (CSIR)</td>
<td>Lucknow</td>
</tr>
<tr>
<td>Gujarat Ayurveda University</td>
<td>Jamnagar</td>
</tr>
<tr>
<td>Bhavan’s SPARC</td>
<td>Mumbai</td>
</tr>
<tr>
<td>National Institute of Ayurveda</td>
<td>Jaipur</td>
</tr>
<tr>
<td>Arya Vaidya Shala</td>
<td>Kottakal</td>
</tr>
<tr>
<td>Interdisciplinary School of Health Sciences</td>
<td>Pune</td>
</tr>
<tr>
<td>Banaras Hindu University</td>
<td>Varanasi</td>
</tr>
<tr>
<td>CIMAP (Central Institute for Medicinal and Aromatic Plants)</td>
<td>Lucknow</td>
</tr>
<tr>
<td>ICMR (Indian Council for Medical Research)</td>
<td>New Delhi</td>
</tr>
<tr>
<td>National Medicinal Plants Board</td>
<td>New Delhi</td>
</tr>
<tr>
<td>Indian Drug Manufacturers Association</td>
<td>Mumbai</td>
</tr>
<tr>
<td>Regional Medical Research Centre (ICMR)</td>
<td>Belgaum</td>
</tr>
<tr>
<td>NISCOM (National Institute of Science Communication)</td>
<td>New Delhi</td>
</tr>
<tr>
<td>IHMMR (Indian Institute of History of Medicine and Medical Research)</td>
<td>New Delhi</td>
</tr>
<tr>
<td>CDRI (Central Drug Research Institute) (CSIR)</td>
<td>Lucknow</td>
</tr>
<tr>
<td>TBGRI (Tropical Botanical Garden &amp; Research Institute)</td>
<td>Thiruvantpuram</td>
</tr>
<tr>
<td>Podar Hospital and Research Centre</td>
<td>Mumbai</td>
</tr>
<tr>
<td>FRHLT (Foundation for Revitalisation of Local Health Traditions)</td>
<td>Bangalore</td>
</tr>
<tr>
<td>IASTAM (International Association for the Study of Traditional Asian Medicine)</td>
<td>Mumbai</td>
</tr>
</tbody>
</table>

**Indian Medicinal plants as a Source of Antioxidants and Radical Scavengers:**

A review of literature shows that there are over 40 Indian medicinal plants showing antioxidant abilities at various levels of protection. Some of them are *Allium cepa* L., *Allium sativum* L., *Aloe vera* (L.) Burm.f, *Asparagus racemosus* Willd., *Butea monosperma* (Lamk.) Taub. *Commiphora mukul*, *Curcuma longa*, *Emblica officinalis*,...
Hemidesmus indicus, Ocimum sanctum L., Terminalia arjuna (Roxb.) Wt. & Arn.,
Tinospora cordifolia (Willd) Miers, Withania somnifera Dun. and Zingiber officinalis
Rosc.\textsuperscript{135} There are also a number of ayurvedic formulations containing ingredients from
medicinal plants that show antioxidant activities.

Use and Potential of Selected medicinal plants:

Since ancient times a number of medicinal plants have been used globally but
their other potentials which may be useful in providing new leads and drug
development (other than for what purposes they are presently used) is not fully
explored. Reverse pharmacology on some of the medicinal plants may lead to novel
targets. Example of this is Forskolin which has served as a very important tool in
molecular pharmacology and endocrinology. Various Institutions are conducting
research in this field. (Table no. 4.5)
### Table No.5.5: Use and potential of selected Indian plants

<table>
<thead>
<tr>
<th>Plant name</th>
<th>Common Ayurvedic usage</th>
<th>Therapeutic potential</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Adhatoda vasica</em> Nees.</td>
<td>Antitussive</td>
<td>Antituberculosis, Haemostatic</td>
</tr>
<tr>
<td><em>Aloe vera</em> (L.) Burm. f</td>
<td>Skin diseases, Burns</td>
<td>Antidiabetic</td>
</tr>
<tr>
<td><em>Boswellia serrata</em> Roxb. ex Colebr.</td>
<td>Anti inflammatory, Anti spasmodic</td>
<td>Immunomodulator</td>
</tr>
<tr>
<td><em>Centella asiatica</em> (L.) Urb.</td>
<td>Memory-enhancer, Skin diseases</td>
<td>Antiaging</td>
</tr>
<tr>
<td><em>Curcuma longa</em> L.</td>
<td>Anti-diabetic, Anti pruritic, Wound healing</td>
<td>Cancer Prevention</td>
</tr>
<tr>
<td><em>Leptadenia reticulata</em> (Retz.) Wt. &amp; Arn.</td>
<td>Galactogogue</td>
<td>Anticonjunctivitis</td>
</tr>
<tr>
<td><em>Mucuna pruriens</em> (L.) DC.</td>
<td>Aphrodisiac</td>
<td>Antiparkinsonism</td>
</tr>
<tr>
<td><em>Ocimum sanctum</em> L.</td>
<td>In treatment of cold (antiviral or antimicrobial)</td>
<td>Anticancer</td>
</tr>
<tr>
<td><em>Picrorrhiza kurroa</em></td>
<td>In the treatment of jaundice</td>
<td>Lipid-lowering</td>
</tr>
<tr>
<td><em>Piper longum</em> L.</td>
<td>Anti -asthamatic</td>
<td>Antimalarial</td>
</tr>
<tr>
<td><em>Pterocarpus marsupium</em> Roxb.</td>
<td>Anti-diabetic</td>
<td>Antiinflammatory</td>
</tr>
<tr>
<td><em>Terminalia chebula</em> Retz.</td>
<td>Mild laxative</td>
<td>Medhya</td>
</tr>
<tr>
<td><em>Tribulus terrestris</em> L.</td>
<td>Litholytic</td>
<td>In treatment of hypertrophied prostate</td>
</tr>
<tr>
<td><em>Trigonella foenum-graecum</em> L.</td>
<td>Lipid lowering, Galactogogue</td>
<td>Antidiabetic</td>
</tr>
</tbody>
</table>
Market potential of phytomedicine

In India the sale of total herbal products is estimated at $1 billion and the export of herbal crude extract is about $80 million, of which 50% is contributed by Ayurvedic classical preparations. Plant derived drugs are important in Germany and Russia. Herbal drugs are imported by several countries for their usage of traditional medicinal preparation from various parts of the country. Some of the important Indian medicinal plants are exported to various countries.

Use of medicinal plants in gynaecological disorders:

White discharge:

*Hemidesmus indicus* R. Br. The root of the plant and bark of the ‘Gulumavu’ (*Machilus macrantha* Nees) crushed and given with milk have been reported to be effective for weakness and for white discharge per vagina.\(^{117}\)

Dysmenorrhea: Herbal Therapies:

In a study wherein essence of Fennel fruit (2% concentration 25 drops q.i.d. orally) was compared with mefenamic acid. The efficacy of both drugs were found to be similar 16.5% cases withdrew from study due to fennel’s odor.\(^ {136}\)

In another study, standardized extract of *Psidium guajava* L. was used for the treatment of dysmenorrhea in two different doses of 3mg/day and 6mg/day. These two groups were compared with Ibuprofen, another standard NSAID. There results of the study suggested that dose of 6mg/day is as effective as Ibuprofen.\(^ {47}\)
Menorrhagia:

In another clinical trial, 50 patients who had dysfunctional uterine bleeding were treated with 2 capsules herbal formulation (having good haemostatic property) twice daily for 4 months. The study concluded that herbal formulation was highly effective in the treatment of DUB as reflected by statistically significant improvement in all symptoms of DUB. The duration of flow decreased from 6.34 ± 1.86 to 4.06 ± 1.00 days and use of sanitary napkins from 8.08 ± 3.28 to 4.64 ± 1.46. At the end of treatment 88% of patients had normal menstruation. Adverse effects reported were minimal indicating the excellent safety profile.137

The interviews of TMPs conducted during initial phase of the present study it was observed that HRS is used very frequently for treating problems related to reproductive health.

*Hibiscus rosa sinensis* L.: Shoe flower, Japa, Japakusum, Rudrapushp

*Hibiscus rosa sinensis* is a popular herbal remedy among numerous geographically and culturally distinct populations and include flower extracts used as emmenogogues, abortifacients, contraceptives, and labour inducers.138
HRS, a native of southeastern Asia (China), is commonly found throughout tropics, usually grown as an ornamental house plant throughout the world.

**BOTANICAL DESCRIPTION:**

*Hibiscus rosa sinensis* L. is, in reality, a high polymorphic group composed of complex hybrids and their derivatives. HRS plants are among the showiest of flowering shrub, evergreen, 3-4 meters tall.

**Roots:** Roots are cylindrical, 5-15 cm in length and 2 cm in diameter, off white in colour with light brown transverse lenticels, Fracture is fibrous. Roots taste sweet and mucilaginous but afterwards taste acrid.

**Leaves:** Leaves are simple ovate or ovate-lanceolate. Leaves are entire at the base and coarsely and irregularly serrated dentate at the apex, shining green above.

**Flowers:** Flowers are pedicillate, solitary, axillary, actinomorphic, hermaphrodite, pentameric and complete. Corolla consists of 5 petals, oblanceolate, entire or dentate at apex, red in colour about 8-10 cm in diameter. Staminal tube protrudes far beyond the petals. Calyx 2-3 cm long, divided almost to the middle.

**Fruits:** Fruits (very rarely formed) are capsules about 3cm long.
Varieties: Many varieties exist differing in size and colour, in single or double forms. The important colours include red, white, yellow, light red.

APPLICATIONS:

- Herbal shampoo/ Hair oil for cosmetic
- Medicinal
- Beverages

ACTIONS AND MEDICINAL APPLICATIONS:

Roots:

- Roots are reported as demulcent, febrifuge and used for cough, fever, pruritis.
- Fresh juice of roots of white flowered HRS with milk, sugar and cumin is given in gonorrhea.
- Powdered root combined with equal quantity of powdered lotus root and the bark of *Eriodendron anfractuosum* DC. is used in menorrhagia

Leaves:

- The leaves are emollient, refrigerant, anodyne, antiscorbutic, aperient, diuretic, laxative, sedative and depeurative and useful in burning sensation, liver disorders, fatigue, gonorrhea, wound healing, abortion, expulsion of the placenta, skin diseases, constipation and pruritis.
- Staminal column is diuretic used for renal problems.
Flowers:

- Flowers are bitter, acrid, astringents, demulcent, emollient, refrigerant, constipating, hypoglycemic, aphrodisiac, emmenagogue, haemostatic, constipating, cardiotonic. They are useful for treating alopecia, menstrual disorders, haemorrhoids, epistaxis, cerebral disorders, dysentery, genitourinary problems, seminal weakness, skin diseases, diabetes, cardiac debility,

- Buds are used in the treatment of vaginal and uterine discharges.

- Leaves and flowers are good for wound healing and for promoting growth and colour of hair.

**CHEMICAL CONSTITUENTS:**

HRS flowers mainly contain anthocyanins and flavanoids. These are cyanadin-3, 5-diglucosides, cyanadin-3sophoroside-5glucoside, quercetin-3-diglucoside, 3, 7-diglucoside. Other minor constituents are cyclopeptide alkaloid, cyaniding chloride, quercetin, hentriacontane and vitamins ie. riboflavin, niacin, thiamine, ascorbic acid and also carotene.

Various extracts of HRS leaves revealed the presence of alkaloids, glycosides, reducing sugars, fatty material, resin and sterols and absence of tanins and saponins. Isolation of Taraxeryl acetate, β-sitosterol and four uncharacterized compounds which include an alkaloid and three sterols has also been reported in the leaves. The leaves of HRS were also investigated for their fatty acids, fatty alcohol and hydrocarbon content. Two cyclic acids viz. sterulic and malvalic acid have also been identified.
PHARMACOLOGICAL PROFILE: 143

Ameliorative potential: 144

When hyperproliferation and oxidative stress was induced in the mice pretreated with HRS extract there was no reduction in the level of detoxification and antioxidant enzymes.

Antifertility activity: 145-148

There was significant reduction in the weight of the ovaries, uterus and pituitary gland on continuous administration of HRS extract for 30 days in albino rats. The postcoital antifertility property of benzene hot extract of HRS flowers, leaves and stem bark was investigated. Only extract from flowers was effective in preventing pregnancy. A strong anti-implantation and uterotropic activity was observed with 400mg/kg body weight dosage.

Analgesic activity: 149

Ethanol extract of dried leaves administered orally to mice with 125mg/kg dose was effective when tested in aconitine induced writhing.

Antidiabetic activity: 150

The ethanol extract of HRS at doses of 250mg/kg and 500mg/kg significantly reduced the blood glucose levels in the treatment of both acute and subacute hyperglycemia.
Antiinflammatory activity: 149

Intraperitoneal administration of ethanol extract (70%) of dried leaves of HRS was effective against carrageenan induced Paw oedema.

Antimicrobial activity & Wound healing activity: 151 A study conducted in animal (rat) model reported that ethanol extract of HRS enhances wound healing.

Chemopreventive activity: 153

In a study croton oil induced carcinogenesis in mice reduced significant number of tumours per mouse and also percentage of tumour bearing mice on pretreatment of skin with HRS extract in mice.

Hair growth potential: 153

A study concluded that petroleum ether extract of leaves and flowers has hair growth potential and it also concluded that leaf extract is more potent than flower extract.

Hypoglycemic activity: 154

Hypoglycemic activity of ethanol extract of HRS flowers was demonstrated in a streptozocin induced diabetic rats. Various studies suggest that hypoglycemic activity of HRS leaf extract is comparable to glibenclamide.
Cardioprotective effect: ¹⁵⁵

A study conducted to investigate the cardioprotective effect of HRS flowers (dried pulverized) showed that HRS flowers augmented endogenous antioxidant compounds of rat heart and also prevented the isoprotenelol induced myocardial injury.

Anticonvulsive activity: ¹⁵¹

A bioassay guided fractionation indicated that the anticonvulsant fraction lies in the acetone soluble part of ethanolic extract of HRS flowers. It was also demonstrated in a preclinical study in animal model.

Antifungal activity: ¹⁵⁶

Ethanol / water extract of dried leaves showed to be effective against rhizotonia solani. Mycelial inhibition was also observed.

Antiovulatory effect: ¹⁵⁷

The administration of benzene extract of HRS flowers in adult mice resulted into irregular oestrous cycles and also increased number of atretic follicles and absence of corpora lutea indicating the antiovulatory effect.
Antispermagenic and androgenic activity: \textsuperscript{158, 159}

On administration of benzene chloroform and alcoholic extract of the flowers of HRS, decrease in spermatogenic element of testis and epididymal sperm count was seen in adult albino mice.

Research on pharmacological activities on HRS:

A dose-dependent increase in the duration of oestrus, premature cornification of vaginal epithelium, and increase in the uterine weight observed following administration of the benzene extract to female albino mice suggests mild oestrogenic activity. \textsuperscript{157} An increase in ovarian ascorbic acid content was also an indication of depletion of pituitary LH. In contrast, another study indicated a dose-dependent suppression of an oestrone-induced gain in uterine weight in bilaterally ovariectomized immature rats thereby suggesting that both the alcoholic and benzene extract of HRS demonstrated anti-oestrogenic activity.\textsuperscript{148}

Recent a study conducted on oestrogenic activity of HRS do not support the above mentioned studies, but rather, suggests that HRS may exhibit serotonergic activity(61\% and 70\% binding to the 5HT\textsubscript{1A} and 5HT\textsubscript{5A} serotonin receptors, respectively).\textsuperscript{160}

THERAPEUTIC EVALUATION:

In Ayurveda, Crushed white flowers of HRS are reported to be used for treatment of urinary tract infection and burning sensation of stomach (gastritis).
A clinical trial conducted in small group of women in reproductive age group showed antifertility property of ethanolic extract of HRS with a dose of 750mg/day when administered from 7\textsuperscript{th} to 22\textsuperscript{nd} day of menstrual cycle for total 229 cycles (4years).

In another clinical trial wherein administration of powdered HRS flowers (6-9 gms in divided doses) in 20 patients produced significant reduction of blood pressure which was more marked in diastolic blood pressure than systolic.

In an another study Leucosol-H (a composite drug containing Santalum album L., Amaranthus polygamus sensu non L., Amaranthus spinosus L., Brberis aristata L., Hibiscus rosa sinensis L., Sida cordifolia L., Aegle marmelos (L.) Corr. and Ficus bengalensis L.) was administered in a dose of 10 ml./day in 15 women for two weeks. The study reported that 62\% cases had complete relief from the complaint of white discharge.

A clinical trial was conducted in 30 hypertensive patients having hypercholesteremia. They were treated with a Siddha drug ‘Anna Pavala Sindhooram’ containing HRS as one of the ingredients. The study indicated that the drug is effective in reducing cholesterol, phospholipids and triglycerides.

Another clinical study showed that an Ayurvedic drug, ‘Vidangadi Yoga’ (which has HRS flowers as one of the ingredients) is quite effective as antifertility agent.

\textbf{Ayurvedic Pharmacodynamics}: 
\textbf{Rasa}: Kashaya, Tikta, Madhura
\textbf{Guna}: Lakhu, Rooksha, Snigdha, Shlasna
Virya: Seeta

Vipaka: Katu, Madhura

Dosakarma: Kaphapittashamak

Plant pacifies vitiated kapha, pitta, cough, menorrhagia, dysmenorrhea, pruritus, burning sensation, fever, alopecia and dandruff.

*Ocimum basilicum* L.\(^{163, 164}\)

[Image of Ocimum basilicum plant]

Syn.: Barbari, Sabja, Ramtulasi, kamkasturi, sweet basil
This plant occurs throughout India, Burma, Sri Lanka. It is commonly cultivated in gardens, lawns, sometimes grows in agricultural fields, waste places and on ridges.

**Botanical Description:** 118, 132, 166, 168

A small annual shrub or herb, erect, diffusely branched, glandular pubescent, upto 60-90 cm tall

Leaves: 2.5-5 cm long ovate, acute, entire, more or less toothed,

Racemes: 10-15 cm. long pedicels, 1-2 cm. long, terminal receme usually much longer than lateral ones, bracts stalked than calyx, ovate, acute. Calyx villous throughout accrescent, 5 mm. long, deflexed, two-lipped, upper lip entire and larger, lower lip unequally 4-toothed, mucronate. Corolla 8-13 mm long, white, pink or purplish, glabrous or variously pubescent. Stamens slightly exserted, upper filament toothed at the base. Nutlets about 2 mm. long, ellipsoid, black and pitted, mucilaginous when become wet.

**VARIETIES:** 166

Shveta tulasi and Krishna tulasi

**APPLICATIONS:**

2. Expectorant in bronchitis, asthma and cough.
4. Antihelmenthic
5. Insecticidal against mosquitoes.

6. Leaves used for flavouring purposes

**ACTIONS:**

The plant has a sharp, bitter hot taste. It is diaphoretic, diuretic, carminative and stimulant. It is an emmenagogue, useful in diseases of the heart and brain, chronic joint pains. Whole plant is aromatic;

Leaves and leafy tops have pungent taste and clove like odour

**Root:**

- Root is febrifuge. Dicoction of the root is given in as diaphoretic in fever, malaria.
- Roots are also used for bowel complaints in children.

**Leaves and stem:**

- The juice of leaves has diaphoretic, stimulating and expectorant properties. Hence it is used in catarrh, bronchitis.
- It is also applied externally in ringworm infestation and other skin diseases.
- Flowers have stimulant, diuretic and demulcent properties.

**Seeds:**

- Seeds are mucilaginous, demulcent, aphrodisiac and diuretic.
- They are useful in catarrh, respiratory disorders, given in infusion in gonorrhea chronic diarrhea, dysentery.
- A cold infusion is said to relieve the after pains of parturition.
- Seeds are washed, pounded and applied in the form of poultice to treat unhealthy wounds and sinuses.
Oil:

- The oil has aromatic property and is used for aromatherapy.
- It is reported to have antibacterial and insecticidal property and also reported to inhibit in vitro growth of Mycobacterium tuberculosis and Micrococcus pyogenes.

CHEMICAL CONSTITUENTS:

The leaves on steam distillation yield a bright volatile oil with a pleasant, aromatic odour characteristic of the plant. Analysis showed that the oil contains phenols (45-70%) and aldehydes (15-25%)

The seeds of plant give greenish yellow oil (17.8%) The fatty acid composition of the oil is as follows: palmitic 6.9%, stearic 2.1%, oleic 9%, linoleic 66.1% and linolenic 15.7%.

Based on chemical contents, basils can be divided into four groups: 1) French basil; *Ocimum basilicum* L., contains lower amounts of phenols 2) exotic- contains methyl chavicol (40-80%) 3) methyl cinnamate- contains methyl cinnamate - ether 90% 4) eugenol basil- contains eugenol

Basil contains large amounts of (E)-beta-caryophyllene (BCP), which might have of use in treating inflammatory bowel diseases and arthritis.

PHARMACOLOGICAL PROFILE:

Antiinflammatory activity:

Several study reported that *Ocimum basilicum* L. tincture (1:10) has anti-inflammatory action in acute inflammation induced with turpentine oil (i.m. 0.6 ml/100 g b.w.) in Wistar male rats. It also reduced nitric oxide synthesis.
Antioxidant activity:

A study reported that the crude extract and its subfractions of OB contained phenolic compound and flavonoids and a potent radical scavenging and antioxidant activity exhibited.\textsuperscript{171,172}

Antimicrobial activity:

A study reported that \textit{in vitro} antimicrobial activities of chloroform, acetone and two different concentrations of methanol extracts of OB were demonstrated against 10 bacterial stains and 4 yeasts strains by the disc diffusion method. The results indicated that the methanol extracts of OB exhibited the antimicrobial activity against tested microorganisms. While the chloroform and acetone extracts had no effect, the methanol extracts showed inhibition zones against strains of \textit{Pseudomonas aeruginosa}, \textit{Shigella sp.}, \textit{Listeria monocytogenes}, \textit{Staphylococcus aureus} and two different strains of \textit{Escherichia coli}.\textsuperscript{173,174}
Ayurvedic Pharmacodynamics:

**Rasa:** Katu, tikta

**Guna:** Laghu, Ruksha

**Virya:** Ushna

**Vipaka:** Katu

**Dosakarma:** Kaphvatshamak

**Properties and actions:**

**Karma:** Kaphagna

- Kasahara-avasahara-ksayagna
- (Khshayjivanisudana)
- Kanthyा