



RESEARCH ARTICLE

TRADITIONAL MEDICINE AND COMPLEMENTARY ALTERNATIVE MEDICINE

*¹Chandrasekar, R., ¹Sivagami, B. and ²Habibur Rahman, S. M.

¹Department of Pharmacognosy, MNR College of Pharmacy, Fasalwadi, Sangareddy, Hyderabad, Telangana, India

²Department of Pharmaceutical Analysis, MNR College of pharmacy, Fasalwadi, Sangareddy, Hyderabad, Telangana, India

³Department of Pharmaceutics, PSG College of Pharmacy, Peelamedu, Coimbatore, Tamilnadu, India

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ABSTRACT

The use of traditional medicine (TM) complementary and alternative medicine (CAM) has increased significantly over the past few years. In this context, it is necessary to develop information to meet the needs of consumers. Inequities in availability, accessibility and affordability of health care have increased, between as well as within populations the world over. In the recent past there has been a growing interest in Traditional medicine/Complementary and Alternative Medicine (TCAM) and their relevance to public health both in developed and developing countries. Diversity, flexibility, easy accessibility, broad continuing acceptance in developing countries and increasing popularity in developed countries, relative low cost, low levels of technological input, relative low side effects and growing economic importance are some of the positive features of traditional medicine (WHO 2002). According to WHO some of the major policy challenges include safety, efficacy, quality and rational use of traditional medicine. As a continuing effort, the current paper will give an overview on herbal medicines, which are the most influential traditional medicine systems to improve public health problems.

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INTRODUCTION

The World Health Organization (WHO) defines traditional medicine as "health practices, approaches, knowledge, and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singular or in combination, to treat, diagnose and prevent illnesses or maintain well-being"¹ Using the WHO terminology, in countries where the dominant health care system is based on allopathic medicine or where TM has not been incorporated into the national health care system, TM is often termed 'complementary', 'alternative' or 'non-conventional' medicine. For example, Traditional Chinese Medicine and acupuncture would be termed "Traditional Medicine" when used in China, but 'Complementary and Alternative Medicine' when used in Europe, North America or South Africa. Some of the best-known TM systems include

traditional Indian (Ayurveda) medicine, traditional Chinese medicine (TCM), and traditional Arabic (Unani) medicine. To promote the safety, efficacy and quality of TM/CAM by expanding the knowledge base of these remedies and by providing guidance on regulatory and quality assurance standards. To increase the availability and affordability of TM/CAM where appropriate focusing on poorer populations. The strategy aims to assist countries to:

Develop national policies on the evaluation and regulation of TM/CAM practices. To this end several useful documents on the legal status of TM/CAM around the world have been published;^{2,3}

Create a strong evidence base on the safety, efficacy and quality of 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; and

Document traditional medicines and remedies

*Corresponding author: Chandrasekar, R.,

Department of Pharmacognosy, MNR College of Pharmacy, Fasalwadi, Sangareddy, Hyderabad, Telangana, India.

Today estimate that about 80% of people in developing countries still relays on traditional medicine based largely on species of plants and animals for their primary health care. Herbal medicines are currently in demand and their popularity is increasing day by day. The use of herbal medicine is becoming popular due to toxicity and side effects of allopathic medicines. India has one of the richest plant traditions in the world. About 500 plants with medicinal use are mentioned in ancient literature and around 800 plants have been used in indigenous system of medicine. India's share in the export of herbals is USD 63 billion which is just 0.2% of the global herbal market. Use of herbal medicines in developed countries has expanded sharply in the latter half of the twentieth century. Monographs on selected herbs are available from a number of sources, including the European Scientific Cooperative on Phytotherapy (ESCOP, 1999), German Commission E (Blumenthal *et al.*, 1998) and the World Health Organization (WHO, 1999).

Currently, about 45,000 species are found in the Indian subcontinent: 3,500 species of plants are of medicinal value; 500 medicinal plant species are used by the contemporary Ayurvedic industry; 80% of the medicinal plant species are procured from wild areas; and 10% of medicinal plants involved in active trade are obtained from cultivation in farms [4]. The western Himalayan region provides about 80% of herbal drugs in Ayurveda, 46% of Unani, and 33% of allopathic systems [5]; 50% of drugs recorded in the British Pharmacopoeia are related to medicinal plants growing in this region [6]. In India, approximately 25,000 plant-based formulations are used in traditional and folk medicines [7]. The number of plant species used in various IM is as follows: Ayurveda, 2,000; Siddha, 1,300; Unani 1,000; homeopathy, 800; Tibetan, 500; modern, 200, and folk, 4,500 [8]. More than 7,500 plant species are currently used in IM, including tonics, antimalarials, antipyretics, aphrodisiacs, expectorants, hepatoprotectants, antirheumatics, and diuretics [9, 10], as well as for the therapy of certain central nervous system disorders [11, 12]. There are 45,000 plant species in India, 15000-20000 plants have medicinal value in India, only 7000-7500 species are used, 700 species in Ayurvedic medicine, 600 species in Siddha medicine, 700 species in Unani medicine, and 30 species in Modern medicine. In Indian Herbal Medicines, Indian pharmacopoeia (2010 version) listed about 88 IMs/products, Formulae up to 25,000, Registered formulae around 3,000 Registered single herb up to 1,000 species Ayurvedic medicine about 2,000 species, Siddha medicine around 1,300 species, Unani medicine about 1,000 species, Homeopathic medicine around 800 species, Folk medicine 4,500 species, Tibetan medicine 500 species and Modern medicine 200 species. Usage of TCAM in developed & developing countries is represented in Fig 2. Total global herbal market in billion dollars is shown in Fig 3. The trends in the global nutrition products, is represented in Fig 4. Fig 5. Represents the global nutrition products, including herbal and botanical products.

The WHO monographs, for example, describe the herb itself by a number of criteria (including synonyms and vernacular names) and the herb part commonly used, its geographical distribution, tests used to identify and characterize the herb

(including macroscopic and microscopic examination and purity testing), the active principles (when known), dosage forms and dosing, medicinal uses, pharmacology, contra-indications and adverse reactions.

Allium cepa

The hypoglycaemic effects of *Allium Cepa* have been demonstrated in vivo. A chloroform, ethanol, petroleum ether (0.25g/kg) or water extract (0.5ml), suppressed alloxan, glucose and epinephrine-induced hyperglycaemia in rabbits and mice [14-20]. Both ethanol and methanol extracts of *Allium cepa* demonstrated diuretic activity in dogs and rats after intragastric administration [21]. Antihyperlipidaemic and anticholesterolaemic activities of the drug were observed after oral administration of minced bulbs, an aqueous extract, the essential oil or the fixed oil to rabbits or rats [22-25]. The antiallergic and anti-inflammatory constituents of onion are the flavonoids (quercetin and kaempferol) [26] the flavonoids act as anti-inflammatory agents because they inhibit the action of protein kinase, phospholipase A₂, cyclooxygenase and lipoxygenase [27] as well as the release of inflammation from leucocytes [28].

Allium sativum

Allium sativum has antibacterial and antifungal, fresh garlic. Garlic juice, aged garlic extracts, or the volatile oil all lowered cholesterol and plasma lipids, lipid metabolism, and atherogenesis both in vitro and in vivo. [29, 30], [31-33]. Antihypercholesterolaemic and antihyperlipidaemic effects were observed in various animal models after oral or intragastric administration of garlic bulbs, water, ethanol, petroleum ether or methanol extracts the essential oil, garlic extracts and the fixed oil. [34, 33] oral administration of allicin to rats during a 2-month period lowered serum and liver levels of total lipids, phospholipids, triglycerides and total cholesterol. [35] The antihypertensive activity of garlic has been demonstrated in vivo. Oral administration of garlic bulbs or alcohol or water extracts of the drug, lowered blood pressure in dogs, guinea pigs, rabbits and rats. [36-38]. Hypoglycaemic effects of *allium sativum* have been demonstrated in vivo. Oral administration of an aqueous, ethanol, petroleum ether, or chloroform extract, or the essential oil of garlic, lowered blood glucose levels in rabbits and rats. [39-43].

Aloe vera

Aloe vera gel preparations accelerate wound healing [44-47]. In vivo studies have demonstrated that *Aloe vera* gel promotes wound healing by directly stimulating the activity of macrophages and fibroblasts. [44]. The anti-inflammatory activity of *Aloe Vera* gel has been revealed by a number of in vitro and in vivo studies [44]. *Aloe vera* gel significantly reduced acute inflammation in rats (carrageenin-induced paw oedema), although no effect on chronic inflammation was observed. [48].

Centella asiatica

The pharmacological activity of *Centella asiatica* is due to presence of several saponin constituents, including asiaticoside, Asiatic acid and madecassic acid. [49].

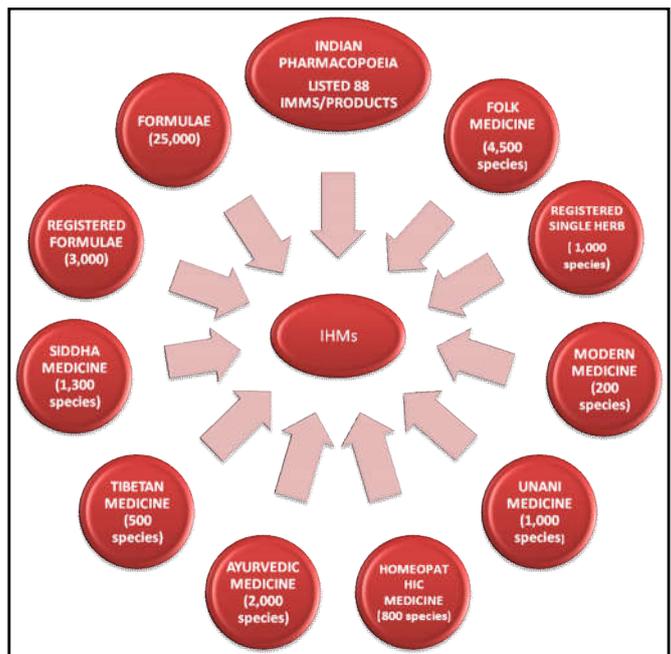


Fig. 1. Plant species in Indian herbal medicine (IHM)

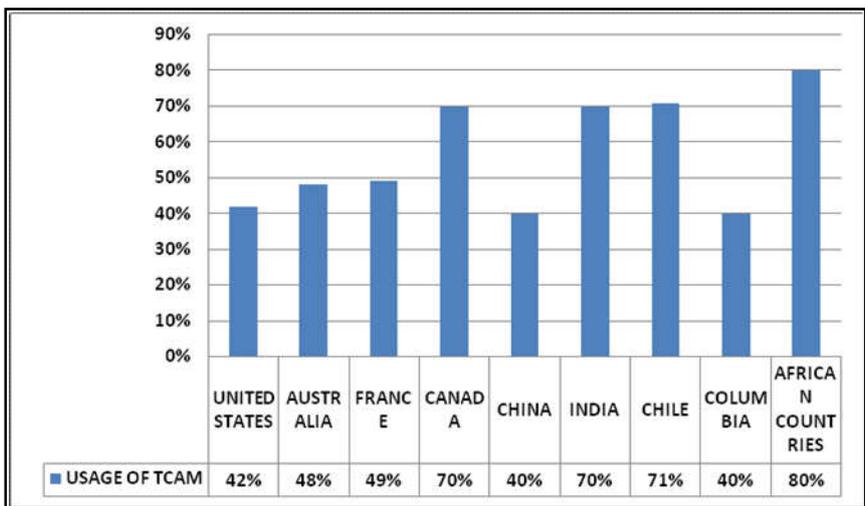


Fig. 2. Usage of TCAM in Developed & Developing Countries

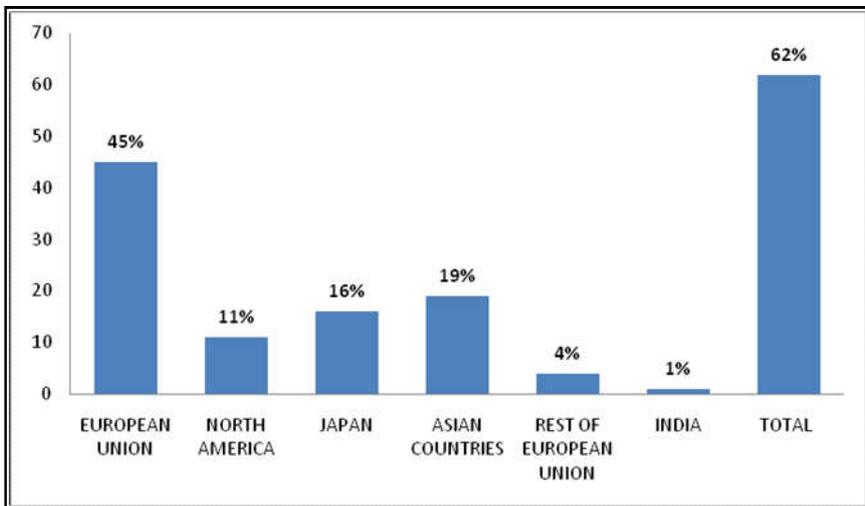


Fig. 3. Total global herbal market in billion dollars

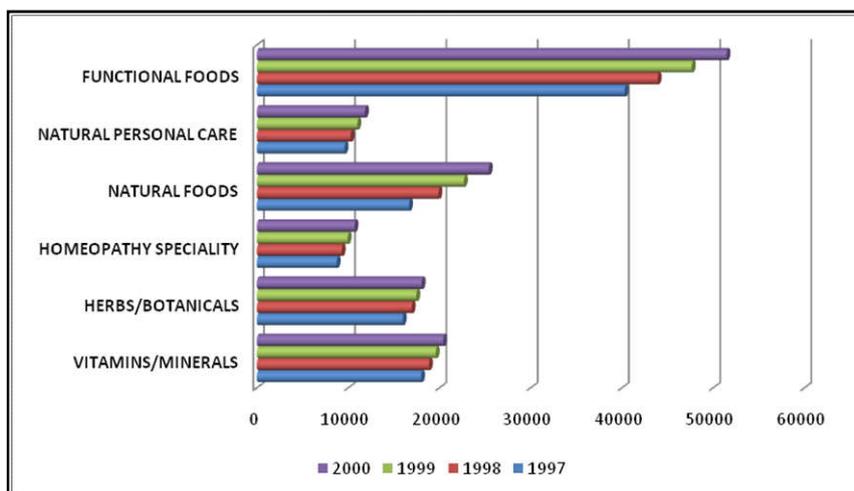


Fig. 4. Represents the trends in the global nutrition products, 1997–2000 in US \$

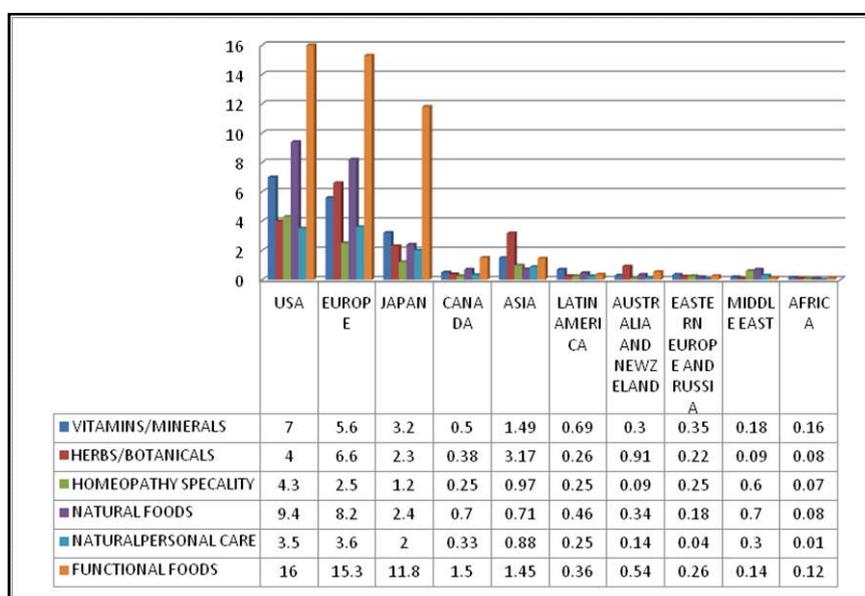


Fig. 5. Represents the global nutrition products, including herbal and botanical products in US \$

Table 1. Plants listed in WHO monographs of some selected medicinal plants

S. No.	Plant botanical name	Common name	Family name	Plant part used
1.	<i>Allium cepa</i> L.	Onion	Liliaceae	Bulbs
2.	<i>Allium sativum</i> L.	Garlic	Liliaceae	Bulbs
3.	<i>Aloe vera</i>	Aloes	Liliaceae	Leaves
4.	<i>Centella asiatica</i> (L.)	Pennywort	Apiaceae, Umbelliferae	Entire plant or dried aerial part
5.	<i>Curcuma longa</i> L.	Turmeric	Zingiberaceae	Rhizome
6.	<i>Ginkgo biloba</i> L.	Ginkgo	Ginkgoaceae	Leaf
7.	<i>Panax ginseng</i> C.A. Meyer	Ginseng	Arijaliaceae	Root
8.	<i>Glycyrrhiza glabra</i> L.	Liquorice, yasthi	Fabaceae	Roots and rhizomes
9.	<i>Plantago afra</i> L., <i>Plantago indica</i> L., <i>Plantago ovate</i> Forsk, <i>Plantago asiatica</i> L.	Psyllium, isabgol	Plantaginaceae	Seed
10.	<i>Cassia senna</i> L.	Senna	Fabaceae, Leguminosae	Leaves
11.	<i>Thymus vulgaris</i> L.	Thyme	Lamiaceae, Labiatae	Leaves
12.	<i>Zingiber officinale</i> Roscoe	Ginger	Zingiberaceae	Rhizome
13.	<i>Ephedra sinica</i> Stapf	Ephedra	<i>Ephedraceae</i>	Stem and aerial parts
14.	<i>Valeriana officinalis</i> L.	Valerian	<i>Valerianaceae</i>	Rhizomes, roots and stolons
15.	<i>Andrographis paniculata</i> (Burm.f.)	Andrographidis	<i>Acanthaceae</i>	Aerial parts
16.	<i>Angelica sinensis</i> (Oliv)	Chinese Angelica	<i>Apiaceae, Umbelliferae</i>	Roots
17.	<i>Calendula officinalis</i> L.	Chinese safflower	<i>Asteraceae, Compositae</i>	Flowers
18.	<i>Syzygium aromaticum</i> (L.)	Clove	Myrtaceae	Flower buds
19.	<i>Hypericum perforatum</i> L.	St John's Wort	<i>Clusiaceae</i>	Aerial parts
20.	<i>Ocimum sanctum</i> L.	Tulsi	<i>Lamiaceae</i>	Leaves
21.	<i>Oenothera biennis</i> L.	Evening primrose	<i>Onagraceae</i>	Seeds
22.	<i>Silybum marianum</i> (L.)	Milk thistle	<i>Asteraceae</i>	Fruits

In vitro, each of these compounds stimulated the production of human collagen I, a protein involved in wound healing [50]. Topical application of asiaticoside promoted wound healing in rats and significantly increased the tensile strength of newly formed skin. [51-54]. Extracts of *Herba Centellae* effectively treated stress induced stomach and duodenal ulcers in humans [49, 55]. Oral administration of *C. asiatica* extract to rats produced a dose dependent reduction in stress induced gastric ulceration, and the antiulcer activity was similar to famotidine [56].

Curcuma longa

The anti-inflammatory activity of *Curcuma longa* has been demonstrated in animal models, [57-59]. Intraperitoneal administration of the drug in rats effectively reduced both acute and chronic inflammation in carrageenin induced paw oedema. [60, 61]. Oral administration to rabbits of water or methanol extracts of the drug significantly decreased gastric secretion [62] and increased the mucin contents of gastric juice [63].

Ginkgo biloba

In vitro studies have demonstrated that *G. biloba* extracts free radical scavenging [64-68]. *Ginkgo biloba* extracts have been reported to reduce free radical lipid peroxidation induced by systems in rat microsomes. *Ginkgo biloba* extract protected against brain tissue hypoxic damage in vitro. The ginkgolides and bilobalide were responsible for the antihypoxic activity of the extract, [69, 70]. Cerebral insufficiency is a term to describe a collection of symptoms associated with dementia [71, 72]. *G. biloba* effectively managed symptoms of cerebral insufficiency including difficulty in concentration and memory, absent mindedness, confusion, lack of energy, tiredness, decreased physical performance, depressive mood, anxiety, dizziness, tinnitus and headache [71, 72].

Panax ginseng

A number of polypeptides and glycans isolated from ginseng, named GP and panaxans A-E, respectively, have demonstrated hypoglycaemic activity when given intraperitoneally to mice [73, 74]. Intragastric or intradermal administration of an ethanol extract of the drug to rats decreased histamine, pentagastrin, carbachol and vagal stimulation induced gastric secretion and inhibited gastric ulcer induced by stress or by pyloric ligation. [75-77]. Liver protectant activity of ginseng has been demonstrated in vitro and in vivo [78, 79].

Glycyrrhiza glabra

The antitussive and expectorant properties of the drug has also been attributed to glycyrrhizin, which accelerates tracheal mucus secretion. [80] The spasmolytic activity of *Glycyrrhizae* has been demonstrated in vivo [82, 83], and appears to be due to the flavonoids liquiritigenin and isoliquiritigenin. [84]. Glycyrrhizin reduces the toxic action of carbon tetrachloride and galactosamine induced cytotoxicity in cultured rat hepatocytes, through its antioxidant activity [81] [80]. The antiulcer activity of *Glycyrrhizae* has been demonstrated both

experimentally and clinically. Intraperitoneal, intraduodenal, or oral administration of aqueous or alcoholic extracts of *Glycyrrhizae* reduced gastric secretions in rats, and it inhibited the formation of gastric ulcers induced by pyloric ligation, aspirin, and ibuprofen. [80] [85, 86]. The anti-inflammatory and antiallergic actions of the drug have been attributed to the corticosteroid like activity of glycyrrhizin and glycyrrhetic acid. [80]

Plantago ovate

Semen plantaginis increases the volume of the faeces by absorbing water in the gastro intestinal tract, which stimulates peristalsis [87, 88]. The intraluminal pressure is decreased, colon transit is increased, and the frequency of defecation is increased. [87] [89, 90] When mixed with water, the therapeutic efficacy of the drug is due to the swelling of the mucilaginous seed coat which gives bulk and lubrication [91]. Semen plantaginis increases stool weight and water content owing to the water bound fibre residue and an increased fecal bacterial mass. The antidiarrhoeal effects of Semen plantaginis have been extensively investigated in patients with acute and chronic diarrhea. [92, 93].

Cassia senna

Effect on the motility of the large intestine resulting in an accelerated colonic transit, thereby reducing fluid absorption, and an influence on fluid and electrolyte absorption and secretion by colon increasing fluid secretion. [94, 95].

Thymus vulgaris

The spasmolytic and antitussive activity of thyme has been most often attributed to the phenolic constituents thymol and carvacrol, which make up the large percentage of volatile oil [96-99]. In vitro studies have shown that both thyme essential oil and thymol have antifungal activity against a number of fungi. [100-103]. Both the essential oil and thymol had antibacterial activity against a number of bacterial species. [104, 105].

Zingiber officinale

Intraduodenal administration of an acetone extract of ginger root to rats increased bile secretion for 3 hours after dosing, while the aqueous extract was not active. [106]. The antiemetic action of the peripherally acting agent copper sulfate was inhibited in dogs given an intragastric dose of ginger extract, but emesis in pigeons treated with centrally acting emetics such as apomorphine and digitalis could not be inhibited by ginger extract. [107]. One of the mechanisms of inflammation is increased oxygenation of arachidonic acid, which is metabolized by cyclooxygenase and lipoxygenase, leading to prostaglandin and leukotriene two potent mediators of inflammation [108].

Ephedra sinica

Ephedrine like epinephrine relaxes bronchial muscles and is a potent bronchodilator owing to its activation of the β -adrenoreceptors in the lungs [109, 110].

Valeriana officinalis

In vivo studies suggest that the sedative properties of the drug may be due to high concentrations of glutamine in the extracts. [111]. The spasmolytic activity of the valepotriates is principally due to valtrate or dihydrovaltrate [112].

Andrographis paniculata

Aqueous extracts of the leaves inhibited HIV-1 infection and replication in the lymphoid cell line. Intragastric administration of an ethanol extract of the aerial parts to rats decreased yeast induced pyrexia. [113]. Herba *Andrographidis* has antidiarrhoeal activity in situ [114, 115]. An ethanol chloroform or butanol extract of aerial parts inhibited the *E. coli* enterotoxin-induced secretory response which causes a diarrhoeal syndrome in rabbit and guinea pig ileal loop assay. [116, 117]. A 50% ethanol extract of the aerial parts inhibited the growth of *Plasmodium berghei* both in vitro and in mice after intragastric administration [118]. The aerial parts and their constituents andrographolides have anti hepatotoxic activity in vitro and in vivo. [119-120].

Angelica sinensis

Aqueous extracts of *Angelica sinensis* stimulated smooth muscle contractions of the bladder, intestine and uterus when administered intravenously to dogs. [121, 122]. Intraperitoneal administration of a decoction of the roots ameliorated galactosamine induced hepatotoxicity in rats. [123] In animal models, both aqueous and ethanol extracts of the roots had an effect on arrhythmias induced by epinephrine, barium chloride and digitalis [124, 125]. In vitro and in vivo studies have shown that extract of the roots inhibit platelet aggregation and have antithrombotic activity. [126].

Calendula officinalis

The essential oil of the flowers inhibited the growth in vitro of *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Candida albicans*. [127]. A tincture of the flowers suppressed the replication of herpes simplex, influenza A2 and influenza APR-8 viruses in vitro. [128]. The triterpene fraction of an extract of the flowers had a marked anti-inflammatory activity in mice against ear edema. [129]. External application of a hydroalcoholic extract accelerated the rate of concentration and epithelialization of excision wounds in rats [130].

Syzygium aromaticum

Ethanol 95% or aqueous extract of *Caryophylli* inhibited the growth in vitro of *Staphylococcus aureus* [131]. The juice of the flower bud inhibited the growth in vitro of *Mycobacterium tuberculosis*. [132]. An aqueous extract of the flower buds had antiviral activity against HSV-1 in vitro and in mice [117]. Topical application of a methanol extract of the flower buds suppressed ear oedema in mice. [133]. A petroleum ether or ethylene chloride extract of the flower buds exhibited strong antioxidant activity in vitro. [134, 135].

Hypericum perforatum

Behavioural studies, performed primarily in rodents, have demonstrated the antidepressant activity of *Hyperici* by measuring the exploratory and locomotor activities of animals in an unknown environment. [136, 137]. A 95% ethanol extract or tincture of the herb inhibited barium and histamine induced smooth muscle contractions of guinea pig ileum in vitro 64, and contractions of cat and mouse intestine. [138]. A methanol extract of *Hyperici* inhibited the growth in vitro of *E. coli*, *Staphylococcus aureus*. [139] An acetone hot aqueous or ethyl acetate extract of the herb was active against influenza virus A2, herpes simplex virus 2, poliovirus II and vaccinia virus in vitro. [140,141]. External application of a 20% aqueous extract of the crude drug to the skin of guinea pigs and rabbits accelerated healing of experimentally induced wounds [142].

Ocimum sanctum

Intragastric administration of an aqueous suspension or a methanol extract of the leaves to mice showed analgesic activity in hot plate test. [143]. A 50% ethanol extract of the leaves inhibited histamine induced bronchospasms and pre-convulsive dyspnea in guinea pigs when administered by gastric leavage. [144, 145]. An ether or 95% ethanol extract of the leaves inhibited the growth in vitro of *Staphylococcus aureus* and *S. citreus* 144, 145. Intragastric administration of a hydroalcoholic extract of the leaves or the essential oil to rats and guinea pigs inhibited footpad oedema induced by histamine, serotonin and carrageenan. [146, 147]. Intragastric administration of a methanol leaf extract to rats suppressed fever induced by thypoid vaccine [148]. Administration of the dried leaves to rats similarly prevented ulcers induced by cold and acetylsalicylic acid [149]. Intragastric administration of a 50% ethanol extract of the leaves to albino rats with experimentally induced hyperglycaemia reduced blood glucose levels by 30% [150, 151].

Oenothera bennis

Administration of the fixed oil to rabbits for 6 weeks reduced total serum cholesterol and triglyceride levels, and increased high density lipoprotein levels. [152]. Rats fed a diet containing 11% fixed oil for 7 weeks showed a decrease in the spontaneous development of hypertension [153, 154]. Intragastric administration of the fixed oil to rats inhibited gastric mucosa damage resulting from ulcers by pylorus ligation, non-steroidal anti-inflammatory drugs and hypothermic restraint. [155]. Subcutaneous administration of the fixed oil to rats suppressed adjuvant arthritis when administered 1-15 days after adjuvant injection [156].

Silybum marianum

Silymarin and silybin have antioxidant activity in vitro both react with oxygen free radicals such as hydroxyl anions, phenoxy radicals and hypochlorous acid in various model systems such as human platelets, human fibroblasts, rat liver microsomes and mitochondria, and using enzymatically and non-enzymatically generated free inorganic radicals. [157]. Silymarin and silybin inhibited hepatotoxicity induced by

paracetamol, amitriptyline, carbon tetrachloride, ethanol, erythromycin estolate, galactosamine, nortryptiline and tert-butylchloride in rat hepatocytes in vitro. [158]. Silybin inhibited neutrophil mediated histamine release induced by peptide and anti-IgE from human basophil leukocytes. [159]. The anti-inflammatory activity of silybin was assessed in human polymolecular leukocytes in vitro. [159].

Conclusion

Traditional medicines are frequently used in urban settings as alternatives in daily health care and self-medication against minor and chronic ailments. Modern medicines at present are chemically synthesized and some are isolated from naturally occurring plants on the basis of their use in traditional medicine. Since there is increased utilization of herbs on the collection of raw materials and consequently requires sustainable utilization of these plants. This system has advantages over the allopathic system. However, the globalization of trade and market has brought about an integration of different kinds of herbal medicines over the world. But there exist major differences in the usage of TCAM in developed and developing countries. While safety is the prime concern in developed countries, access and cost seem to be issues in developing countries. Herbal-based traditional medicine has become popular in developed countries in recent years and its use is likely to be increased in the coming years. Their toxicity/safety must be evaluated for universal acceptance. We need improvements regarding the processing of raw material, packaging, quality control most have no research and development or quality control system. Standardisation of chemical finger printing towards quality control is another major requirement in developing countries. Moreover, traditional, alternative or complementary medicine depends on the adopted historic-cultural perspective.

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