Review Article

Symposium of Herbs and their Therapeutic Implementations Present in Kadhaayu: A Novel Kadhaayu by Renatus

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ABSTRACT

India the country itself is rich in indigenous ingredients allowing treatments of several ailments. The system of usage of herbal materials has been implemented In India from times undocumented. Amla, Green tea, Turmeric, black pepper, Ginger, Shankhpushpi, Coriander, Clove, Ashwagandha, Cinnamon, Enchinacia, Liquorice, Nutmeg, Mulethi, Tulsi, Adulsa, Asafoetida were all brought together for the preparation of Kadhaayu by Renatus. In the under-mentioned review, all these plants and herbs were explored in different research works where they have shown therapeutic properties, very strong applications these herbs were assessed against Inflammation. However, this review focuses on therapeutic importance of herbs and mentions their role in diabetes, glycemia, cancer, oxidation by reactive species, role in hepato-protections etc. This review exclaims that home remedies has although been in our minds from long but it's not necessary that each and every entity of it is useful for us. To be precise one should rely on scientist prepared market formulation in which each and every content specificity against ailments has been confirmed and well researched.

Keywords: Renatus Kadhaayu, Medicinal herbs, Anti inflammation, Therapeutics.

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INTRODUCTION

Herbal drugs referred as plants materials or herbalism, involves the use of whole plants or parts of plants, to treat injuries or illnesses. Herbal drugs are use of therapeutic herbs to prevent and treat diseases and ailments or to support health and healing. These are drugs or preparations made from a plant or plants and used for any of such purposes. Herbal drugs are the oldest form of health care known to mankind [1]. There are many herbal products offered that assert to treat the symptoms of a broad range of problems, from depression to cold and flu. World Health Organization (WHO) has distinct herbal drugs as complete, labeled medicinal products that have vigorous ingredients, aerial or secretive parts of the plant or other plant material or combinations. World Health Organization has set precise guidelines for the evaluation of the safety, efficacy, and quality of herbal medicines. WHO estimates that 80% of the world populations currently use herbal drugs for major healthcare. Exceptionally, in some countries herbal drugs may also enclose by tradition, natural organic or inorganic active constituents which are not of plant source. Herbal drug is a chief constituent in traditional medicine and a common constituent in ayurvedic, homeopathic, naturopathic and other medicine systems [2]. Herbs are usually considered as safe since they belong to natural sources. The use of herbal drugs due to toxicity and side effects of allopathic medicines, has led to rapid increase in the number of herbal drug manufacturers. For the past few decades, herbal drugs have been more and more consumed by the people with no prescription.

The most common reasons for using traditional medicine are that it is more affordable, more closely corresponds to the patient's ideology, allays concerns about the adverse effects of chemical (synthetic) medicines, satisfies a desire for more personalized health care, and allows greater public access to health information [3]. The major use of herbal medicines is for health promotion and therapy for chronic, as opposed to life-threatening, conditions. However, usage of traditional remedies increases when conventional medicine is ineffective in the treatment of disease, such as in advanced cancer and in the face of new infectious diseases. Furthermore, traditional medicines are widely perceived as natural and safe, that is, not toxic. This is not necessarily true, especially when herbs are taken with prescription drugs, over-the-counter medications, or other herbs, as is very common.

Herbs and plants can be processed and can be taken in different ways and forms, and they include the whole herb, teas, syrup, essential oils, ointments, salves, rubs, capsules, and tablets that contain a ground or powdered form of a raw herb or its dried extract. Plants and herbs extract vary in the solvent used for extraction, temperature, and extraction time, and include alcoholic

extracts (tinctures), vinegars (acetic acid extracts), hot water extract (tisanes), long-term boiled extract, usually roots or bark (decoctions), and cold infusion of plants (macerates). There is no standardization, and components of an herbal extract or a product are likely to vary significantly between batches and producers. Under-mentioned are some of the important herbs which were utilized in the process of preparation of novel drug Kadhaayu.

AMLA

One of the key ingredient implicated in Renatus Kadhaayu is *Emblica officinalis.* Also known as *Phyllanthus emblica* Linn. (syn. *Emblica officinalis* Gaertn), family *Euphorbiaceae,* commonly known as Indian gooseberry, is a common household remedy that finds use in the Indian indigenous system of medicine against several ailments. The fruit has been reported to possess expectorant, purgative, spasmolytic, hypoglycemic 1-2, hepatoprotective 3-4, and hypolipidemic activity [5]. The emblica fruit is reported to have antioxidant, antihyperlipidemic, and antidiabetic properties [6].

Antioxidant activity

The *P. emblica* fruit possesses strong antioxidant properties due to the presence of high amounts of low and medium molecular weight hydrolysable tannins (gallo-ellagi) (65%-70%). *Emblica nin* A and *Emblica nin* B have a very strong antioxidant action. These two new tannins have been found to preserve erythrocytes against oxidative stress induced by asbestos, a generator of the Superoxide radical. Tannins prevent the polymerization of vincyclic monomers (MMA) into polymers (PMMA) due to the presence of a hydroxyl radical [7]. In addition, the extract elevates rat frontal cortical and striatal concentrations of SOD, CAT, and GPx and reduces LPO in these brain areas [8].

Antidiabetic activity

Many recent studies reported in the literature have sshown that amla can effectively reduce the glucose level in blood by inhibiting gluconeogenesis and glycogenolysis. Oral administration of an aqueous *P. Emblica* fruit extract (200 mg/kg b.w) at 0, 1, 2, or 4 h intervals to diabetic rats significantly reduced the blood glucose level [9]. Moreover Sabu et al. 10 observed that the hypoglycemic effect of ethanolic extracts (100 mg/kg b.w) of amla fruits in diabetic rats significantly reduced the blood sugar level within 4 h.

Anti-cancer activity

Nandi et al. [11] reported that an aqueous extract of *Emblica officinalis* (EO) fruit protected mice against the chromosomedamaging effects of the well known carcinogen 3,4-benzo(a)pyrene. Another study showed *P .emblica* to significantly reduce induced solid tumors in a manner suggesting an interaction with cell-cycle regulation [12]. The anti-tumor effect of a *P. emblica* aqueous fruit extract was demonstrated in tumor-bearing mice, resulting in a 35% increase in life span [13]. The chemo-preventive effects of emblica against DMBA induced gcnotoxicity in Swiss albino mice is very well documented[14].

Anti-hypcrlipidemic activity

Dietary administration of juice extract *of emblica* for 60 days caused a significant reduction in serum cholesterol and LDL levels in rabbits as reported by Ghayus and Gilani [14]. Antony et a!., [15] reported hypolipidemic action of dried extract of amla in rabbit. Flavonoids from *Emblica officinalis* and *Mangifera indica* effectively reduce lipid levels in serum and tissues of rats induced hyperlipidaemia. Hepatic HMG CoA reductase activity was significantly inhibited in rats fed *Emblica officinalis* flavonoids [16].

Hepatoprotcctive activity

An extract *of P. emblica* (PE) and quercetin (a flavonoid isolated from emblica) for hepatoprotective action was assessed against paracetamol induced liver damage in albino rats a mice [17]. Sarwat, Sultana et al., [18] carried out a study on hepatoprotective activity in rats and reported that pretreatment of emblica shows a reduction in glutathione (GSH) and glutathione-S-transferase (GST), Alkaline

phosphatase activity in thioacetamide induced liver damage in animal models. The present report showed the hepatoprotective property of a 50% hydroalcoholic extract of the fruit of EO against (anti-TB) drugs induced hepatic injury. The biochemical manifestations of hepatotoxicity induced by rifampicin (RIF), Isoniazid (RIF), and Pyrazinamide (PZA), either given alone or in combination were evaluated [19].

GREEN TEA

Today, tea is the most regularly consumed beverage in worldwide. There are mainly four types of tea derived from the leaves of Camellia sinensis plant with different processing methods such as green, white, oolong and black tea. Green tea has attracted the interest of consumers due to its health benefits against a variety of disorders, ranging from weight loss to cancer. Several reports showed that these non-nutrient bioactive compounds have antioxidant, anticancer, antiobesity and other pharmacological and biological functions, thus making them an excellent source for nutraceutical applications. The health- benefits of green tea are mainly due to their polyphenol content; around 60–80% of polyphenols are flavan-3-ols, commonly known as catechins. Catechins are the major components of tea; which constitute about 30% of the dry weight of green tea, and 9% of black tea [20].

Antioxidant effect

Nowadays, green tea is one of the most commonly used nutraceuticals due to its antioxidant property. EGCG is considered as one of the most active compound and well known for its strong antioxidant properties,

suggesting that the presence of O-trihydroxyl group and 3-gallate esters plays an important role in antioxidant activity, radical scavenging effect and preventing oxidative destruction of many biological compounds 21. Consumption of green tea in average limit (1–6 cups / day) enhanced the plasma and blood antioxidant potential, hence leads to a reduced oxidative damage in macromolecules such as DNA and lipids [22].

Anti-carcinogenic property

Currently, cancer is a major source of morbidity and mortality worldwide. Many researchers studied the effect of green tea on cancer therapy . Mainly EGCG has been extensively used in cancer research. There are several anticarcinogenic mechanisms was attributed to EGCG that may include inhibition of angiogenesis, DNA hypermethylation, NF-kB, telomerase activity, proliferation and metastasis of tumor cells; initiation of tumor suppressor genes and promotion of tumor cell apoptosis [23] .

Anti-inflammatory effect

Inflammation is a body response to foreign substances in the human body, leading to damage in the cell tissues. The defense mechanism of anti-inflammatory effect after consumption of green tea catechins showed improvement of production of IL-10 (anti-inflammatory cytokine), increase of IL-6 secretion and mediated signaling pathway [24]; reduced production of destructive matrix enzymes such as metalloproteinases via TNF- α induced phosphorylation of MAPKs (mitogen-activated protein kinases) and decreased expression of the CCR_2 (chemokine receptor) and reduced levels of the proinflammatory cytokines IL-1 and TNF. EGCG is best known for its higher antioxidant activity and also has capacity to decrease the rheumatoid arthritis, inflammation response in the body. EGCG showed strong inhibition of IL-1β inducible nitric oxide synthase (NOS), cyclooxygenase (COX-2) expression and activity in cartilage cell cultures. The over expression of NOS 2[4-26] and COX-2 are mediated by NF-kB, which can also modulate in the presence of EGCG [25,26,27].

Antimicrobial property

Green tea catechins affect the growth of a large number of microorganisms, which include Gram-positive and Gram-negative aerobic bacteria, anaerobic bacteria, viruses and fungi. The antimicrobial mechanisms of green tea catechins are mainly due to the destruction of the bacterial cell membrane, prevention of bacterial fatty acid synthesis and other enzymes such as protein tyrosine kinase, cysteine proteinases, DNA gyrase, ATP synthase and inhibition of efflux pump activity 280. The antifungal activity of EGCG was also reported against pathogenic yeasts, such as Candida albicans. However, the mechanism of action was unclear [29].

Anti-obesity property

Obesity is characterized as excessive accumulation of fat in the body that may have significant negative impact on overall health and may lead to the development of certain diseases, such as diabetes and arteriosclerosis. EGCG plays an important role, which directly interferes with the lipid digestion by inhibiting the enzyme known as phospholipase A_2 and thereby prevents the lipid / cholesterol emulsion interfere in the gut [30]. The EGCG is capable of elevating the lipid metabolism, leading to excess burning of calories and ensuing fat loss. It can also interfere with the digestion of starch by inhibiting -amylase. In addition, EGCG ingestion is very useful during a weight loss program because it is strongly related with improvement of circulation, activity of free radical scavenging, and enhancement of mood [31].

Antidiabetic property

Epidemiologica studies showed that EGCG has a great effect on glucose tolerance and insulin sensitivity. It is associated with the prevention and inhibition of diabetes mellitus through a several effects, such as inhibition of insulin resistance, improvement of insulin secretion, regulation of glucose uptake, increases the glucose tolerance and its role in oxidative stress and inflammation [32].

TURMERIC, OR *CURCUMA LONGA*

Turmeric has piqued the interest of the medical and scientific communities, as well as the culinary community. Turmeric (*Curcuma longa*) is a ginger-related perennial herbaceous rhizomatous plan, [34]. However, turmeric is a spice popular in the Middle East and Asia for flavoring food and as a component of traditional medicines due to its health benefits. It has been discovered in nutraceuticals, beverages, and processed foods in recent years. Curcumin's antioxidant properties, as well as its anti-inflammatory properties, make it an effective chemosensitizer and chemotherapeutic agent for the treatment and management of colon cancer and other diseases [35].

Anti-cancer agent

Oncologists are studying curcumin's anti-cancer properties alone or in combination with standard chemotherapeutics [36]. Oncology researchers have been examining curcumin's anti-cancer properties for some time now, and they have seen significant improvements in cases of gastrointestinal, breast, and lung cancer [37, 38]. Curcumin also inhibits carcinogenesis by altering tumor development and angiogenesis in in vitro and in vivo trials [39].

Anti-inflammatory

Curcumin, as a potential anti-inflammatory agent, has also been shown to reduce inflammation through a variety of other mechanisms that are beyond the scope of this review. Furthermore, it has been shown to inhibit pro-inflammatory cytokine release at the same level as

dexamethasone (an FDA-approved drug for the treatment of sepsis) while having fewer side effects, whereas dexamethasone has been linked to adverse effects such as hypertension in the elderly and stunted growth in children when used for longer periods of time [40] Nanocurmin has thus emerged as a viable drug for the treatment of inflammatory disease due to its ability to regulate inflammatory pathways.

Anti-Diabetic- It is well known that T2DM represents a condition where body is not able to properly respond to insulin produced. This condition is highly related with inflammatory cytokines production and oxidative stress; so, due to anti-inflammatory and antioxidative action of curcumin, it might be an effective therapeutic agent. The option of using curcumin in the treatment of this condition was firstly investigated by Srinivasan [41], who found that 5 g of turmeric powder was able to decrease blood sugar in one patient diagnosed with T2DM. In another study, curcuminoids supplementation significantly decreased fasting blood glucose (FBG), hemoglobin A1c test (HbA1c) and insulin resistance index (HOMA-IR), total serum free fatty acids (FFAs) and TG, while increased lipoprotein lipase (LPL) activity in T2DM patients [42].

BLACK PEPPER (*Piper nigrum*)

Black pepper (*Piper nigrum* L.) holds a prominent position and is acknowledged as "King of Spices" 41. It has manifold functional uses in the traditional food formulations, kitchens, perfumery, traditional medicine, and even in beauty care [42]; [43.] Black pepper's pungency and flavor is due to presence of alkaloid piperine, volatile oil, and oleoresins [44]. In Indian folklore medicine, it is mainly used as an immune enhancer [45] and to treat against diarrhea, asthma, chronic indigestion, gastric ailments, colic, insomnia, and epilepsy [46].

Antioxidant activity

Some scientists observed high antioxidant activities of black pepper essential oil and oleoresins as compared to synthetic antioxidants [47]. Likewise, Su et al. indicated that black pepper is a potential dietary source of natural antioxidants [48]. Therefore, presence of these functional ingredients in black pepper makes it a strong candidate to ameliorate oxidative stress [49]. Gulc¸in attributed these actions to its strong hydrogen-donating ability, metal chelating, and effectiveness to scavenge free radicals [50]. Additionally, synergistic effects of piperine with some other antioxidants like curcumin also assign valuable position to black pepper in disease prevention strategies related to ROS and allied species [51].

Anti-inflammatory Potential

Mujumdar indicated that piperine mitigate the acute inflammatory process, through stimulating the pituitary adrenal axis [52]. Later, Bang strengthened the anti-inflammatory activities of piperine (20 and 100 mg/kg/day) through some *in vitro* trials [53]. They postulated that inhibition of interlukon, matrix metalloproteinase, prostaglandin E2, and activator protein 1 are possible routes for their said properties. Recently, Sabina reported that piperine (50/100 ug/ml) suppressed the level of *β*-glucuronidase and lactate dehydrogenase in dose-dependent manner [54]. Piperine along with some other components can inhibit

the expression of enzymes like 5-lipoxygenase and COX-1 that are responsible for leukotriene and prostaglandin biosynthesis. These effects collectively are valuable to prevent degenerative disorders like rheumatoid arthritis too [55].

GINGER

Ginger (*Zingiber officinale* Roscoe, Zingiberaceae) is one of the most commonly consumed dietary condiments in the world [55]. The oleoresin (i.e., oily resin) from the rhizomes (i.e., roots) of ginger contains many bioactive components, such as 6-gingerol (1-4′-hydroxy-3′- methoxyphenyl-5-hydroxy-3-decanone, which is the primary pungent ingredient that is believed to exert a variety of remarkable pharmacological and physiological activities. Ginger's current name comes from the Middle English *gingivere*, but this spice dates back over 3000 years to the Sanskrit word *srngaveram*, meaning "horn root," based on its appearance. In Greek, it was calledn *ziggiberis*, and in Latin, *zinziberi*. Interestingly, ginger does not grow in the wild and its actual origins are uncertain. Indians and Chinese are believed to have produced ginger as a tonic root for over 5000 years to treat many ailments, and this plant is now cultivated throughout the humid tropics, with India being the largest producer. Ginger was used as a flavoring agent long before history was formally recorded.

Antioxidant properties

Ginger was reported to decrease age-related oxidative stress markers [56] and was suggested to guard against ethanol-induced hepatotoxicity by suppressing oxidative consequences in rats treated with ethanol (Mallikarjuna et al. 2008). Ginger root contains a very high level (3.85 mmol/100 g) of total antioxidants, surpassed only by pomegranate and some types of berries [57]. The phorbol ester, 12-*O*-tetradecanoylphorbol-13-acetate (TPA), promotes oxidative stress by activating the nicotinamide adenine dinucleotide phosphate (NADPH) oxidase system or the xanthine oxidase system or both. Ginger was reported to suppress TPA-induced oxidative stress in human promyelocytic leukemia (HL)-60 cells and Chinese hamster ovary AS52 cells [58]. Others have shown that ginger compounds effectively inhibit superoxide production [59].

Anti-Inflammatory Effects

6-gingerol [60], a dried ginger extract, and a dried gingerol-enriched extract were each reported to exhibit analgesic and potent anti-inflammatory effects. Data suggest that ginger may exhibit anti-inflammatory effects through the modulation of calcium levels mediated through transient receptor potential vanilloid subtype 1 (TRPV1), which is a heat-and pain-sensitive receptor that can interact with 6-

gingerol [61].An earlier study showed that ginger oil (33 mg/kg), administered orally to rats for 26 days, caused a significant repression of paw and joint swelling associated with severe chronic adjuvant arthritis [62].

Antinausea Agent

Ginger root is commonly recommended for preventing seasickness [63] and is found to be superior to dimenhydrinate (Dramamine) or placebo against symptoms of motion sickness [64]. A follow-up study also indicated that 1 g of ginger might be effective in reducing the subjective severity of seasickness in naval cadets on the high seas [65]. Several double-blind, randomized, placebo-controlled clinical trials have indicated that ginger consumption is effective and safe in helping to prevent nausea and vomiting during pregnancy [64,65]. Ginger has been recommended to combat nausea associated with chemotherapy [66]. Gingerol was reported to reduce cisplatin (a platinum-based chemotherapy drug)-induced emesis in a vomiting model of mink possibly by inhibiting the central or peripheral increase of 5-hydroxytryptamine, dopamine, and substance P [67].

Anti-carcinogenic Activities

The mechanisms proposed to explain the anticancer activities of ginger and its components include antioxidant activity and the ability to induce apoptosis, decrease proliferation, cause cell-cycle arrest, and suppress activator protein 1 (AP-1) and NF-κB/COX-2 signaling pathways. Several ginger components were reported to have effective anticancer promoter activity based on their ability to inhibit TPA-induced Epstein-Barr virus early antigen (EBV-EA) in Raji cells [68]. 6-gingerol was reported to suppress the reactive oxygen species-potentiated invasive capacity of ascites hepatoma AH109A cells by reducing peroxide levels [69]. In normal RL34 rat liver epithelial cells, zerumbone was found to induce glutathione S-transferase and the nuclear localization of the transcription factor Nrf2, which binds to the antioxidant response element (ARE) of phase II enzyme genes [70].

Cardiovascular and Other Disease-Preventive Effects

Ginger has gained interest for its potential to treat various aspects of cardiovascular disease, and the in vitro and animal data supporting the anti-inflammatory, antioxidant, antiplatelet, hypotensive, and hypolipidemic effects of this condiment have been reviewed [71]. An aqueous ginger extract was reported to induce a dose-dependent decrease in arterial blood pressure in a variety of animal models [72]. At least one group found that administration or consumption of standardized ginger extract decreased aortic atherosclerotic lesion areas, plasma triglycerides and cholesterol, low-density lipoprotein (LDL)-associated lipid peroxides, and LDL aggregation in mice. In rabbits that were fed a high-cholesterol diet, administration of ginger extract resulted in a significant antihyperlipidemic effect and a lower degree of atherosclerosis compared to the group that was fed cholesterol alone [73].

SHANKHPUSHPI

Shankhpushpi is an indigenous and very significant herb that consider as a gift of nature in Ayurveda. It is a natural medicine which enhances the memory power. It rejuvenates the nervous functions. It is also a natural tonic for mental development of children. It is very bitter, pungent, alternative tonic, brightens intellect, useful in bronchitis, improve complexion, biliousness, epilepsy and teething troubles of infants etc. *Convolvulus pluricaulis* is a prostrate, spreading, perennial, wild herb commonly found on sandy or rocky ground under xerophytic conditions in northern India. The fresh plant gives pale yellow oil with a green tinge and a characteristic odour by the process of steam distillation. This plant grows on the waste land under xerophytic conditions in northern India during the month of September and October. Convolvulus is known from the margins and within the Sahara and Sind deserts, a distribution that called Saharo Sindian.

Effect on CNS

The study on phytochemical profile of a0erial parts of Convolvulus pluricaulis contained the tannins, triterpenoids, flavonoids, alkaloids, saponins glycosides and carbohydrates. Ethanol, aqueous, choloroform extracts showed the significant anxiolytic type of effect [75]. The dried powder of Shankhpushpi administered in anxiety induced animals, showed the significant anxiolytic behaviour (Yadav et al., 2020). The aqueous extraction of roots also showed the neuroprotective properties by scavenging various reactive oxygen species [76].

Antiaddictive Effect

Shankhpushpi churan (powder) was studied on alcoholic addictive mice for its antiaddictive behaviour. It showed the effective result on Cortico-hippocampal GABA levels and reported the antiaddictive potential [77] Effect on learning and memory Study on Polyherbal Formulation, in which Convolvulus pluricaulis was content, on streptomycin induced memory impairment. The whole observation was for 14 days which result the improvement in cholinergic behaviour, reduction in oxidative stress [78]. The Convolvulus pluricaulis also known as cognitive booster, the study done on variety named Canscora decussta. The ethanolic extract of plant showed the significant result in Nerve Growth Factor, which could be the reason of boosting in cognition power [79].

Neuro-protective effect

The neuroprotective study done on aluminium induced toxicity in brain of rats, in which aqueous extract of Convolvulus pluricaulis administered for 3 months. It indicated the prevention the neurotoxicity and reduced the oxidative stress. It showed the positive effect in altered activity of proteins on various level of cholinergic synap [80]. The methanolic extract of four varieties of Shankhpushpi showed the antiamensic effect by inhibiting the 5-lipooxygenase which is responsible for the neurodegenerative disorders [81]. The aqueous extract of

plant also reported neuroprotective effect scopolamine induced stress [82].

Antigastric & Antiulcer effect

The Convolvulus pluricaulis in the form of fresh juice was given for 5 days, reported the significant result in protecting gastric mucosa by the production of mucin [83].

Hepatoprotective effect

The hepatoprotective effect of Convolvulus pluricaulis was studied on aqueous, alcoholic, chloroform extract. It is reported that serum biochemical parameters are decreased by extract treated animals [84].

Antioxidant effect

The study done on aqueous extract Convolvulus pluricaulis showed significant antioxidant effect by scavenging the free radicals of stressed induced conditions that may be due to the presence of flavonoids, alkaloids and glycosides [85]. Methanolic extract of Convolvulus pluricaulis reported the antioxidant effect by scavenging free radicals.

Anticonvulsion effect

The anticonvulsant effect of Convolvulus pluricaulis was study on strychnine induced rats. The aqueous extract of plant acted as the co therapeutic agent in reduction of seizures. Another study done on methanolic extract of Convolvulus pluricaulis showed significantly reduction in the phase of convulsions [86].

Anti-inflammatory and antipyretic effect

The ethanolic extract of Convolvulus pluricaulis showed the markable result as antipyretic and moderately anti-inflammatory effect [87].

Effect on Lipid profile

The protective role of Convolvulus pluricaulis on lipid profile was studied on high fat induced animals. The aqueous extract was given for 14 days, resulted the hypolipidemic effect of plant [31] . The study on silver nanoparticles by biosynthesis process using leaf extract of Convolvulus Pluricaulis. It was observed for their catalytic, electrocatalytic effect on different parameter scales. The result showed positive effect on electrocatalytic behavior[88].

CORIANDER

Coriander (*Coriandrum sativum L.*), a herbal plant, belonging to the family Apiceae, is valued for its culinary and medicinal uses. All parts of this herb are in use as flavoring agent and/or as traditional remedies for the treatment of different disorders in the folk medicine systems of different civilizations. Coriander is indigenous to the Mediterranean region and is widely cultivated in Russia, Central Europe, North Africa and Asia [89.90]. The fruits of coriander, also known as the seeds, are globular and aromatic with a slight bittersweet, spicy taste. Coriander seed is an integral part of curry powder and is used in minced meat dishes and stews. Young leaves of the plant are used to make sauces and chutneys. The green leaves are consumed as fresh herbs, in salads and as garnishes due to its attractive green color and aroma. Coriander oil is also used in cosmetics, body care products and perfumes. Traditionally, coriander has been used to treat gastrointestinal disorders such as anorexia, dyspepsia, flatulence, diarrhea, pain and vomiting.

Anti-microbial activity

Essential oil and aqueous extract of coriander leaves showed inhibitory activity against many bacteria and yeast species. In particular, the essential oil showed marked inhibitory effect against Gram-positive bacteria (e.g. *Staphylococcus aureus* and *Bacillus* spp) and Gram-negative (e.g. *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Klebsiella pneumonia* and *Proteus mirabilis*). The seed essential oil also showed antifungal activity against *Candida albicans*. On the other hand, the leaf essential oil was also found to inhibit a number of Candida species (C.albicans CBS 562, C. parapsilosis CBS 604, C. dubliniensis CBS 7987 and C. krusei CBS 573) at a dose in the range of 125 mg/mL–500 mg/mL. Different chemical fractions of the essential oil showed antimicrobial activity comparable to standard antibiotics with biological activity being attributed to the concentration of alcohol-soluble bioactives [91,92].

Anti-oxidant activity

In an early study, administration of coriander seeds in rats fed with a high fat diet showed decrease in peroxides levels, free FA and glutathione as well as increased activity of antioxidant enzymes 93 In another related study 94, aqueous and methanolic extracts of coriander leave and stem were assessed for their anti-oxidant activity using different assays. Both aqueous and methanolic extracts of stem and leaves showed a reducing activity with the leaf being more active in scavenging free radicals. Coriander seed oil quenched 35% and 32.4% of DPPH radicals and galvinoxyl radicals, respectively.

Anti-diabetic activity

A supplementation of 200 and 250 mg/kg of ethanolic extract of seeds caused a decrease in serum glucose concentration and increased activity of beta cells as compared to a diabetic control. Recently, Aissaoui et al. (2011) [94] validated the medicinal use of coriander seeds in management of diabetes in Morocco. The mechanism of the anti-hyperglycemic action was partly investigated by Chithra and Leelamma (1999) [95]. Pretreatment with coriander seed powder caused changes in carbohydrate metabolism; increased concentration and activity of hepatic glycogen and glycogen synthase were observed. Therefore, decreased glycogenolysis and gluconeogenesis and enhanced activities of glucose-6-phosphate dehydrogenase along with other glycolytic enzymes might all be an indication of the antihyperglycemic activity of coriander seeds.

Anti-dyslipidemic activity

A decrease in triglyceride levels and LDL and VLDL cholesterol and increased HDL cholesterol was among reported observations. Furthermore, administration of coriander seed oil decreased the levels of TLs, total cholesterol, TAG and LDL-cholesterol in rats fed on a high cholesterol diet. Pure coriander seed oil seems to be more effective in its anti-hypercholesterolemic effect as opposed to a blend of oils containing coriander oil 96. The activity of key enzyme in cholesterol biosynthesis, HMG-CoA reductase, was also decreased, with the effect being attributed to a hepatic degradation of cholesterol with increased concentration of hepatic and fecal bile acids and neutral ST. Anti-cholesterolemic effect of coriander was further confirmed by Dhanapakiam et al. [96], who reported that supplementation with coriander caused a general decrease in cholesterol and triglyceride levels in rats.

Diuretic and anti-hypertensive activities

The extract of coriander seeds was studied for its diuretic effect in anesthetized rats, and the results showed a dose-dependent increase in urine output, excretion of electrolytes and glomerular filtration rate with a mechanism similar to that of the standard drug, furosemide. The aqueous-methanolic extract of coriander fruits was also found to exhibit diuretic effect in conscious rats. The aqueous-methanolic extract of coriander fruits was found to possess anti-hypertensive effect in anesthetized rats, along with vasodilator effect mediated through a combination of endothelial-dependent (cholinergic) and independent (Ca++ channel blockade) pathways [99].

Anti-mutagenic activity

Coriander juice was assessed for its anti-mutagenic activity by using the Ames reversion mutagenicity assay (his- to his+) with the Salmonella typhimurium strain as an indicator organism. The aqueous crude coriander juice significantly decreased mutagenicity of metabolized aromatic amines, and this effect seems to be positively correlated with chlorophyll content in the juice. There was no observed toxicity associated with coriander juice [100].

Anti-inflammatory effect

The use of coriander as anti-inflammatory agent is evident by a traditional formulation from Sri Lanka, Maharasnadhi Quather (MRQ), containing coriander seeds as one of its principal component. MRQ has been reported to have analgesic and anti-inflammatory properties both in animal models and human subjects. Administration of MRQ significantly inhibited carrageenan-induced rat paw edema. The formulation also increases pain tolerance in rats by 57% after 1 h of treatment as assessed by the hot plate test. The analgesic effect was suggested to be mediated via a supra-spiral effect. Supplementation of MRQ in patients suffering from rheumatoid arthritis for 3 months improved pain, inflammation and mobility without any adverse effects on liver functions and gastrointestinal activities [101]. A poly-herbal formulation, consisting of coriander as one of the constituents, showed inhibitory effect against inflammatory bowel disease. The activity was comparable to that of prednisolone [102].

CLOVE

Syzygium aromaticum (*S. aromaticum*) (synonym: *Eugenia cariophylata*) commonly known as clove, is a median size tree (8-12 m) from the Mirtaceae family native from the Maluku islands in east Indonesia. For centuries the trade of clove and the search of this valuable spice stimulated the economic development of this Asiatic region 103. The production of flower buds, which is the commercialized part of this tree, starts after 4 years of plantation. Flower buds are collected in the maturation phase before flowering. The collection could be done manually or chemically-mediated using a natural phytohormone which liberates ethylene in the vegetal tissue, producing precocious maturation. Clove is native of Indonesia but nowadays is cultured in several parts of the world including Brazil in the state of Bahia. This plant represents one of the richest source of phenolic compounds such as eugenol, eugenol acetate and gallic acid and possess great potential for pharmaceutical, cosmetic, food and agricultural applications.

Antioxidant activity

According to Gülçin *et al*.(2012) the antioxidant activity of clove oil compared with synthetic antioxidants measured as the scavenging of the DPPH radical decreased in the following order: clove oil>BHT>alfa-tocopherol>butylated hydroxyanisole>Trolox. Pretreatment with clove essential oil decreases the oxidative stress assessed by malondialdehyde and reduced glutathione levels in mice's brain. This study concluded that clove oil could revert memory and learning deficits caused by scopolamine in short and long term as a result of the reduction in the oxidative stress [105].

Antimicrobial activity

The antimicrobial activities of clove have been proved against several bacteria and fungal strains. Sofia *et al.* tested the antimicrobial activity of different Indian spice plants as mint, cinnamon, mustard, ginger, garlic and clove . The only sampled that showed complete bactericidal effect against all the food-borne pathogens tested *Escherichia coli* (*E. coli*), *Staphylococcus aureus* and *Bacillus cereus* was the aqueous extract of clove at 3%. At the concentration of 1% clove extract also showed good inhibitory action.

In another work published by 106, the antibacterial activity of black pepper, geranium, nutmeg, oregano, thyme and clove was tested against 25 strains of Gram positive and Gram negative bacteria. The oils with the widest spectrum of activity were thyme, oregano and clove respectively.

Antinociceptive

The employment of clove as analgesic have been reported since the 13th century, for toothache, join pain and antispasmodic, being the eugenol the main compound responsable for this activity. The mechanism evolved has been attributed to the activation of calcium and chloride channels in ganglionar cells. The voltage dependant effects of eugenol in sodium and calcium channels and in receptors expressed in the trigeminal ganglio also contributed to the analgesic effect of clove . Other results show that the analgesic effect of clove is due to the action as capsaicin agonist. The peripheral antinociceptive activity of eugenol was reported by Daniel showing significant activity at doses of 50, 75 and 100 mg/kg.[107]

Antiviral activity

The antiviral activity of eugeniin, a compound isolated from *S. aromaticum* and from *Geum japonicum*, was tested against herpes virus strains being effective at 5 µg/mL, and it was deducted that one of the major targets of eugeniin is the viral DNA synthesis by the inhibition of the viral DNA polymerase (Kurokawa *et al.,* 1998). In another study, aqueous extracts of *S. aromaticum* (L.) Merr. et Perry and other plants as *Geum japonicum* Thunb., *Rhus javanica L.*, and *Terminalia chebula Retzus* among others showed strong antiherpes simplex virus type 1 (HSV-1) activity when combined with acyclovir. This synergic activity was stronger in the brain that in the skin and it was also proved that those combinations were not toxic to mice [108].

Ashawagandha

Ashwagandha (Withania somnifera, fam. Solanaceae) is commonly known as "Indian Winter cherry" or "Indian Ginseng". Withania somnifera (Ashawagandha) is very revered herb of the Indian Ayurvedic system of medicine as a Rasayana (tonic). It is used for various kinds of disease processes and specially as a nervine tonic. It is known as "Sattvic Kapha Rasayana" Herb. Most of the Rasayana herbs are adaptogen / anti-stress agents. The biologically active chemical constituents of *Withania somnifera* (WS) include alkaloids (isopelletierine, anaferine, cuseohygrine, anahygrine, etc.), steroidal lactones (withanolides, withaferins) and saponins [109].

The root of Ashwagandha is regarded as tonic, aphrodisiac, narcotic, diuretic, anthelmintic, astringent, thermogenic and stimulant.The leaves are bitter and are recommended in fever, painful swellings. The flowers are astringent, depurative, diuretic and aphrodisiac. The seeds are anthelmintic and combined with astringent and rock salt remove white spots from the cornea.

Anti-ulcerogenic effect

Ashwagandha was found to be useful in the prevention of stress-induced ulcers of the gastrointestinal tract 110. It showed significant protection against 18 h immobilization, cold + immobilization (4h) and aspirin induced gastric ulcers and lowered the mean ulcer index in rats.

Anxiolytic effect

Ashwagandha induced a calming anxiolytic effect that was comparable to the drug Lorazepam in all three standard Anxiety tests: the elevated plus-maze, social interaction and the feeding latency in an unfamiliar environment.

Anti-tumor effect

Withania roots caused the inhibitory effect of about 49% on colony forming efficiency of CHO cells. It inhibits the cell growth and prevents the cell attachment. It induced long term growth inhibition of CHO cells which was dependent on the cell density and duration of Ashwagandha exposure 111. This knowledge in turn will assist oncologists who plan to use the Ashwagandha as 'synergizers with conventional chemotherapy or radiation therapy.

Anti-inflammatory effect

Withaferin A and 3-b-hydroxy-2,3-dihydrowithanolide F isolated from *Withania somnifera* show promising antibacterial, antitumoral, immunomodulating and anti-inflammatory properties [112].

Anti-arthritic effect

Ashwagandha (1000 mg/kg/oral) produced significant analgesic activity for a rat experiencing heat analgesia induced by hot plate method. The peak analgesic effect of Ashwagandha was recorded as 78.03 percent at 2nd hour of administration. The involvement of pain mediators; prostaglandin and 5-hydroxytryptamine in analgesic activity of Ashwagandha was studied by pretreatment with paracetamol (100 mg/kg, ip) and cyproheptadine (10 mg/kg, ip). The analgesic activity of Ashwagandha was potentiated significantly by cyproheptadine, however, paracetamol failed to exhibit any significant change in its activity, suggesting the involvement of serotonin, but not prostaglandins in the analgesic activity of Ashwagandha [113].

CINNAMON

Cinnamon is obtained from the trees belonging to genus Cinnamomum. The name cinnamon is derived from a Greek word that means sweet wood. It can be added to food in the form of whole or ground material or as extracts or oils obtained from leaves or bark of cinnamon.

The nutrient composition of cinnamon reveals a great amount of vitamins and minerals and the main bioactive compounds are polyphenols and cinnamaldehyde. The antimicrobial, antioxidant, anti-inflammatory, antitumor and other properties of spices are reported in several studies and the bioactive content of cinnamon-based products is currently attracting much interest, either by the industry and consumers [114].

Antioxidant effect

Both the extract and the essential oil of cinnamon have showed considerable antioxidant activity. The cinnamon

extracts contain a considerable amount of phenolic antioxidants and flavonoids that are the main responsible for their high antioxidant activity. Lv et al. (2012) showed correlation between TPC and the high antioxidant capacity, although other undetected components may also contribute to this activity. Durak reported that chlorogenic acid showed higher antioxidant activity than cinnamic acid, both present in cinnamon [115].

Antimicrobial effect

Cinnamaldehyde has been shown to be the best antimicrobial compound of cinnamon, exhibiting antibacterial properties against several bacteria (*Bacillus cereus*, Listeria monocytogenes, Staphylococcus aureus, Escherichia coli and *Salmonella anatum*) and strong inhibition on a wide spectrum of fungal growth. The proanthocyanidins are important bioactive non-volatile components and also contribute to antibacterial properties of cinnamon [116].

Insecticidal effect

Cinnamon EO and extract showed to be potent insecticidal. Cinnamon EO was used against the bean weevil, *Acanthoscelides obtectus* (Say), on beans. The oil was tested for insecticidal activities and showed to decrease the growth rate of *A. obtectus* in a dose-dependent manner, and similarly lost their insecticidal activity over the time (*C. osmophloeum* was evaluated as a larvicide against several mosquito species (*Aedes albopictus, Culex quinquefasciatus*, and *Armigeres subalbatus*) [117].

Anti-tumor properties (Angiogenesis inhibitor)

Cinnamon extract from dried *C. cassia* bark, revealed a suppressing tumor progression, increasing the anti-tumor activities of cells that mediate cytotoxicity and also inhibited the expression of pro-angiogenese factors that play an essential role in tumor progression and tumor survival, *in vitro* and *in vivo* tests.

Cinnamon-water extract also exhibited an inhibitory effect on the growth of the cancer cells proliferation reported by [119]

Anti-inflammatory activity

The extracts of hexane and ethyl acetate from *C. osmophloeum* bark proved to be a promising anti-inflammatory *in vitro* Rao Ethanolic cinnamon extract decreases inflammatory symptoms in tests carried out in rats. The extract acted as anti-inflammatory on cells showing relevant results in inflammatory bowel disease [120].

ECHINACEA

E. purpurea is the best known of the dozen or so species of the genus Echinacea, a group of perennial prairie wildflowers native to the central grasslands of North America. Echinacea, once classified as Rudbeckia, is grouped within the Aster family (Compositae or Asteraceae) . Also known as common purple coneflower, *E. purpurea* is characterized by erect main stems up to 2 meters in height, alternate leaves on long stalks, coarse hairs, and solitary spiny, reddish-orange flowers surrounded by purplish bracts. *E. purpurea* is cultivated widely throughout the United States, Canada and Europe, especially in Germany, for its beauty as well as for its reported medicinal properties.d. In vitro, animal, and human studies have demonstrated the ability of various *E. purpurea* extracts to enhance the activities of various immune cells. Stimulation of ex vivo macrophages to engulf particles and to secrete cytokines has been reported by a number of reputable laboratories [121].

Anti-inflammatory effects

Inhibition of hyaluronidase was among the earliest pharmacological properties attributed to Echinacea. Wagner has reported lipoxygenase-inhibiting anti-inflammatory activity attributable to one of E. purpurea's isobutylamides, dodecatetraenoic acid. Reported inhibition of cyclooxygenase and 5-lipoxygenase by alkamide-rich Echinacea extracts lends mechanistic credibility to reported anti-inflammatory effects. Arachidonic acid metabolism and prostaglandin E2 production were reduced by several E. purpurea products in Rininger's laboratory [122.]

Anti-fungal effects

Other laboratories have also reported anti-Candida. For example, phagocytosis of Candida by ex vivo human macrophages and natural killer cells was reported to be enhanced following exposure to extracts of both E. purpurea and ginseng . Mouse macrophage activity against Candida has also been reported to be stimulated by E. purpurea polysaccharide exposure. Pretreatment with a polysaccharide-rich E. purpurea extact was reported to decrease the infection and death rates of immunosuppressed mice infected with Candida [123].

Anti-viral effects

Turner and colleagues have recently reported a trial testing the efficacy of Echinacea in preventing or ameliorating the effects of experimental colds induced by a cultured rhinovirus.Eilmes reported that complex hydrophilic and lipophilic extracts demonstrated more viral-infection-inhibition than did concentrated singleband fractions. Viracea®, a "blend of benzalkonium chloride and phytochemicals derived from Echinacea purpurea" was reported to have antiviral activity against herpes virus in a human cell model [124].

Pharmacology – Immunomodulating effects

Stimulation of various immune cells such as macrophages, other monocytes, and natural killer (NK) cells has been demonstrated repeatedly in vitro.One theory postulates that immunosuppression can result from exposure to allergens, illness, malnutrition, drugs, toxins or psychological or social stress. In that view, treatment with Echinacea could strengthen a weakened immune system, restoring balance and health [125].

Liquorice

Glycyrrhiza glabra L., commonly known as liquorice, licorice or cultivated liquorice, is a traditional plant, to which multiple health benefits have been attributed and its medicinal uses have been dated throughout the centuries. The tapered roots and rhizomes of the plant are widely appreciated and cultivated, since they contain most of the bioactive compounds which are responsible for its medicinal and culinary attributes as flavoring agent and spice. The roots of a plant *Glycyrrhiza glabra* Linn constitute an important drug in the ancient Unani literature, commonly known as Mulethi or Aslus Soos or liquorice. In addition, other Glycyrrhiza species such as Chinese liquorice (Glycyrrhiza uralensis Fisch), Russian liquorice (Glycyrrhiza echinata L.) and G. inflata Bat. are also widely used in traditional medicine. Among liquorice phytochemical constituents, glycyrrhizin (also known as glycyrrhizic or glycyrrhizinic acid, an oleanane-type triterpene saponin, is the major constituent. In addition, liquiritin apioside is the most abundant flavonoid compound in liquorice roots with significant antioxidant properties. Liquorice is well known for its multiple ethnopharmacological applications, including its uses as antiinflammatory, antiulcer, antibacterial, antifungal, antiviral, anti-allergic, and immunostimulant. [124].

Antioxidant properties

Vaya et al., [125] isolated seven compounds that provided anti-oxidant activity against low-dense lipoproteins (LDL) oxidation, with glabridin being the most potent antioxidant compound. , Martins et al. attributed antioxidant potential of hydromethanolic extracts of liquorice roots and rhizomes to apigenin and liquiritin derivatives, a methylated isoflavone and a chalcone, and identified in vitro lipid peroxidation inhibition as the main antioxidant effect (EC50= 0.24 and 22.74 mg mL-1 for TBARS and β-carotene bleaching inhibition assays, respectively).

Antimicrobial properties

Liquorice extracts have been described to have significant antimicrobial properties (antiseptic, antibiotic, antifungal, antibacterial, antiprotozoal and antiviral). In particular, Chakotiya et al. studied in vitro the effect of hydromethanolic extracts of liquorice stems and pure glycyrrhizic acid against membrane permeability, efflux activity, and biofilm formation of Pseudomonas aeruginosa, as well as their time-killing efficacy comparing to a standard chemotherapeutic drug, and reported significant inhibition of Pseudomonas aeruginosa growth for both the extract and the pure compound, while the pure compound was more effective in growth inhibition of bacteria than the extract in terms of time exposure (4 and 12 h, respectively). Ethanolic extracts of liquorice leaves at concentrations of 4 and 8 mg have been reported to be effective against Candida albicans and gram-positive bacteria Bacillus subtilis and Staphylococcus aureus, while root extracts in ether, chloroform and acetone were not only effective against gram-positive bacteria (Bacillus subtilis and Staphylococcus aureus), but also against gram-negative ones (Escherichia coli and Pseudomonas aeruginosa).126

Anti-inflammatory properties

Five flavonoids isolated from liquorice extracts have shown anti-inflammatory potential by reducing the production of nitric oxide, interleukin-6 and prostaglandin E2 in LPS-induced macrophage cells. In another study based on the same model (LPS-induced macrophage cells), liquorice extracts at concentrations of 0.2-0.5 mg mL-1 were found to improve the secreted cytocine profile by reducing tumor necrosis factor-alpha, interleukin-6 and interleukin-10.[127].

NUTMEG

Nutmeg (Myristica fragrans) is an evergreen tree belonging to family Myristicaceae, a family of flowering plants indigenous to Asia, Africa, Pacific islands, and America 128 and has been known by most taxonomists. It is occasionally called the nutmeg family, due to its wellknown member, Myristica fragrans, the source of the spices nutmeg and mace. Myristica fragrans is an annual spice. It has been cultivated throughout the world and used for food flavoring, essential oil applications and in traditional medicines. Mostly nutmeg contains terpenes and phenylpropenes. Chemical composition of these constituents varies due to different cultivation conditions. Nutmeg is considered as essential ingredient of numerous industrial applications ranging from food to cosmetics. Its pharmaceutical products are also important due to its antioxidant and antimicrobial properties2. Nutmeg is used as a constituent in preparations of medicines such as for dysentery, flatulence, stomachache, nausea, vomiting, rheumatism, sciatica, malaria and early stages of leprosy[129].

Antioxidant activity

Nutmeg possesses antioxidant activity due to the presence of various compounds including β-caryophyllene and eugenol, having hydrogen atoms in the allylic or benzylic positions. Because of the comparatively simple abstraction of atomic hydrogen from these functional groups, these compounds have high antioxidant activity. The abstraction of atomic hydrogen is done by peroxy radicals that produced under oxidative stress. Calliste et al (2010) stated that lignan derivatives are considered as a class of compounds that shows the antioxidant potential of nutmeg seeds [130].

Immuno-modulatory and radio-protective activities

The lignans present in fresh nutmeg and mace show radio modifying and immune modulatory properties, present in the aqueous extract of fresh nutmeg maceThese properties found in cell free systems and protected PUC18 plasmid against radiation that induced DNA damage. The mammalian splenocytes in response to polyclonal T cell mitogen concanavalin A (Con A) proliferate. This process is inhibited by these mace lignans which was due to G1 phase

of cell cycle and augmentation of apoptosis as presented by increase in pre G1 cells.

Antimicrobial activity

The essential oil and different extracts of aromatic plants have shown strong antimicrobial activity against variety of fungi as well as bacteria [131]. Narasimhan et al (2006) demonstrated the antibacterial activity by preparing chloroform extract of nutmeg against both gram negative and gram positive bacteria. They found myristic acid and trimyristin are the main antibacterial compounds extracted from nutmeg seeds.

Anti-carcinogenic and hepatoprotective activity

Nutmeg shows resistance against carcinogenic elements.[132] reported that, in Swiss albino mice uterine cervix, 3-methylcholanthrene -induced carcinogenesis could be prohibited by mace oral administration [133]. Kyriakis et al (1994) studied on the activities of hepatic carcinogen-metabolizing enzymes, like aryl hydrocarbon hydroxylase, cytochrome P450, and acid soluble sulphhydryl and glutathione-Stransferase level in albino mice and checked the influence of essential oil from nutmeg [134].

Anti-inflammatory activity

Several authors reported anti-inflammatory activity of nutmeg as well as its oil [135]. Similar to non-steroidal anti-inflammatory drugs, pharmacological activities also exhibited by nutmeg oil [136]. But anti-inflammatory activity is shown only by petroleum ether extracts. The total extract of nutmeg activated an enzyme that is AMP-activated protein kinase enzyme (potential therapeutic target) for curing the metabolic syndrome including type-2 diabetes and obesitys.

TULSI

Tulsi is an aromatic shrub in the basil family Lamiaceae (tribe ocimeae) that is thought to have originated in north central India and now grows native throughout the eastern world tropics.Within Ayurveda, tulsi is known as “The Incomparable One,” “Mother Medicine of Nature” and “The Queen of Herbs,” and is revered as an “elixir of life” that is without equal for both its medicinal and spiritual properties.3studies reveal that tulsi has a unique combination of actions that include: Antimicrobial (including antibacterial, antiviral, antifungal, antiprotozoal, antimalarial, anthelmintic), mosquito repellent, anti-diarrheal, anti-oxidant, anti-cataract, anti-inflammatory, chemopreventive, radioprotective, hepato-protective, neuro-protective, cardio-protective, anti-diabetic, anti-hypercholesterolemia, anti-hypertensive, anti-carcinogenic, analgesic, anti-pyretic, anti-allergic, immunomodulatory, central nervous system depressant, memory enhancement, anti-asthmatic, anti-tussive, diaphoretic, anti-thyroid, anti-fertility, anti-ulcer, anti-emetic, anti-spasmodic, anti-arthritic, adaptogenic, anti-stress, anti-cataract, anti-leukodermal and anti-coagulant activities. These pharmacological actions help the body and mind cope with a wide range of chemical, physical, infectious and emotional stresses and restore physiological and psychological function [137].

Anticancer Activity

OS L. or OT L contains phytochemicals such as eugenol, rosmarinic acid, apigenin, myretenal, luteolin, β-sitosterol, and carnosic acid prevented chemical-induced skin, liver, oral, and lung cancers and to mediate these effects by increasing the antioxidant activity, altering the gene expressions, inducing apoptosis, and inhibiting angiogenesis and metastasis.[138]

Antioxidant Activity

Leaves of different species of Tulsi (Ocimum basilicum var. Purpurascens, Ocimum basilicum, OG, Ocimum micranthum, and OT (syn. OS) showed variable yield of EO s and types of chemical constituents. These chemotypic variations also reflect variable antioxidant and free radical scavenging capacity. The yield of oils obtained was greater in OG (3.5%) and least from Ocimum basilicum var. Purpurascens (0.5%). Antioxidant capacity was positively correlated ($r = 0.92$, $P < 0.05$) with a high proportion of compounds possessing a phenolic ring such as eugenol, while a strong negative correlation ($r = -0.77$, $P > 0.1$) with other major volatiles was observed [139].

Antidiabetic

OS L. or OT L. shows antidibetic.[139] Aqueous extract of OT decreases levels of blood glucose in induced hyperglycemic tilapia (Oreochromis niloticus). Extracts/fractions of AM and MC were found to inhibit significantly ($P < 0.05$) α-glucosidase activity, with IC50 comparable to the drug 1-deoxynojirimycin. When same treatment was given in vivo on glycogen-loaded mice showed significant ($P < 0.05$) depressive effect on elevation of postprandial blood glucose following ingestion of AM and MC extracts. Both floral and leafy parts can be used in alternative nutritional therapy mainly for management of diabetes because these inhibit carbohydrate hydrolyzing enzymes.Similar antidiabetic activity is reported in tetracyclic triterpenoid (16-hydroxy4,4,10,13-tetramethyl-17-(4-methyl-pentyl)-hexadecahydrocyclopentaaphenanthren-3-one isolated from aerial parts of OS.

Antimicrobial activity

OT (Lamiaceae), unripe OT fruit extract was found highly effective against a resistant strain of Staphylococcus aureus. Its leaf extract in combination with chloramphenicol (C) and trimethoprim (Tm) strong antibacterial activity against drug resistant S. enterica serovar Typhi (S. typhi). Eugenol (1-hydroxy-2-methoxy-4-allylbenzene), the active constituent present in OS L., has been found to be largely responsible for the antimicrobial therapeutic potential of Tulsi. Solvents and water extracts of Tulsi have shown antibacterial activity multi-drug resistant *S. aureus* and MIC was noted 1.56-6.25 mg/ml, whereas higher values (6.25-25 mg/ml) were obtained

against the multi-drug resistant isolates *Klebsiella pneumoniae* and *Escherichia col*i [140].

Anti-inflammatory

Seeds of OS contain oil that possesses anti-inflammatory activity due to dual inhibition of arachidonate metabolism supplemented by antihistaminic activity.[141] Seed oil also possesses antipyretic activity due to prostaglandin inhibition and peripherally acting analgesic activity. It also shows hypotensive, anticoagulant and immunomodulatory activities. Lipoxygenase inhibitory, histamine antagonistic and antisecretory activities of the oil contribute toward antiulcer activity.142 Methanolic extract of OS (Tulsi) leaves showed antiinflammation effect in isoproterenol (ISP) induced MI in rats.[143]

Antistress activity

Fresh leaves of OS cut down oxidative stress that led to a lesser depletion of reduced glutathione (28.80%) and plasma SOD (23.04%) in OS-treated rabbits. This antistressor activity of OS is partly attributable to its antioxidant properties [144].

Anti-arthritis

OS Linn. oil has been found to be effective against formaldehyde or adjuvant induced arthritis and turpentine oil induced joint edema in animals.[145] It is also used for the treatment of skin diseases and arthritis.

ADULSA

Adhatoda zeylanica Medic. (Adulsa) is an evergreen herb belonging to the family Acanthaceae. It is indigenous to India in Sub-Himalayan tracks up to an altitude of 1000 m. In Maharashtra, it is found in Konkan, Marathwada, Vidarbha and other regions. The entire plant parts i.e. roots, leaves and fruits are used against various infections and diseases in rural populations of Subcontinent and many centuries because of its medicinal values [146]. It is source of important phytochemicals i.e. vasicine, vasicinone, vasicolone, anthroquinones and other alkaloids. The plant also has potential anti-diabetic activity in albino rat after administration of extract of *Adhatoda zeylanica* (Meenakshi B, et al 2010). It is also reported to be an expectorant, abortificient, antimicrobial, antitussive and anticancerous.

Antibacterial

In a study Anti-bacterial activity of *Glycyrrhiza glabra* was determines by using disc diffusion methods. Because of the presence of secondary metabolites such as; saponins, alkaloids, flavonoids in hydro-methanolic root extract of *Glycyrrhiza glabra*, the extract exhibits potent antibacterial activity against both gram positive and gram negative bacteria [147].

Anticancer

G. glabra extract has been used in herbal formulations for combating cancers like PC-SPES, a polyherbal composition used for prostate cancer. The licorice extract induced the Bcl2 phosphorylation and G2/M cycle arrest in tumour cell lines as done by clinically used antimicrotubule agent Paclitaxel. 1-(2, 4- dihydroxyphenyl) -3-hydoxy- 3-(4'-hydroxyphenyl)1- propanone (β-hydroxy-DHP) was identified in the licorice extract, which induced Bcl2 phosphorylation in breast and prostate tumour cells, G2/M cell cycle arrest, apoptosis demonstrated by Annexin V and TUNEL assay, decreased cell viability demonstrated by tetrazolium (MTT) assay, and altered microtubule structure 44. 70% Methanol soluble fraction of licorice acetone extract was found to induce apoptosis in human monoblastic leukaemia U937 cells [148].

Anticoagulant

In a study Glycyrrhizin isolated from Glycerrhiza glabera was identified as inhibitor of thrombin. It is found to prolong the thrombin and fibrinogen clotting time. It also increases plasma recalcification duration. Glycyrrhizin causes inhibition in thrombin induced platelet aggregation. But there was no effect of glycyrrhizin on Platelet Aggregating Factor (PAF) and Collagen induced agglutination. Antifungal Methanolic extract of liquorice was reported to have fungicidal activity against Arthrinium sacchari M001 and Chaetomium funicola M002. Glabridin was found to be the active compound giving anti-fungal activity [149].

Antihyperglycemic

A study was carried out to evaluate the anti-hyperglycemic effects of 18 β- glycerrhetinic acid, aglycone of glycyrrhizin, on streptozotocin-diabetic rats. Diabetes was induced in adult male albino rats of the Wistar strain, weighing 180-200 g, by administration of streptozotocin (40 mg/kg of body weight) intraperitoneally. Diabetic rats showed increase of plasma glucose and glycosylated haemoglobin (HbA1c) and a decrease of plasma insulin and haemoglobin (Hb). Activities of gluconeogenic enzymes such as glucose 6- phosphatase, fructose 1, 6-biphosphatase increased and glucokinase, glucode 6-phosphate dehydrogenase decreased in the liver along with glycogen. Oral administration of 18βglycerrhetinic acid (50, 100, or 200 mg/kg of body weight) or glibenclamide (600 µgm/kg of body weight) in 5% dimethyl sulfoxide, for 45 days, prevented the above changes and improved towards normalcy [150].

ASAFOETIDA

Ferula asafoetida Linn. is a main source of asafoetida, a strong, tenacious and sulfurous odor, and oleo-gum resin of medicinal and nutritional importance. Three major sulfur constituents that have been identified include 2-butyl 1-propenyl disulfide, 1-(methyl thio) propyl 1-propenyl disulfide and 2-butyl 3-(methyl thio)-2-propenyl disulfide. Asafoetida has been consumed as a spice and a folk medicine for centuries. Out of more than 170 species, sixty spices of *Ferula* are widely distributed in Central Asia, particularly West Afghanistan, Iraq, Turkey and Eastern Iran, Europe and North Africa.5*F. asafoetida* is one of the important species of *Ferula* and is more native to

Afghanistan and Iran than grows about 2 m in height and is in two types bitter and sweet.Asafoetida is called Hing or Hingu in India. Recent studies have shown several promising activities particularly relaxant, neuroprotective, memory enhancing, digestive enzyme, antioxidant, antispasmodic, hypotensive, hepatoprotective, antimicrobial, anticarcinogenic, anticancer, anticytotoxicity, antiobesity, anthelmintic and antagonistic effect [151].

Relaxant effect

The relaxant effects of various preparations of *F. asafoetida* and its constituents on different types of smooth muscles were demonstrated. Bayrami et al investigated the relaxant effects of oleo-gum-resin of asafoetida and its coumarin constituent umbelliprenin on tracheal chains of guinea pigs. It is indicated that a potent relaxant effect of the asafoetida extract on tracheal smooth muscle, which is due to its constituent umbelliprenin. The relaxant effect of asafoetida and essential oil from asafoetida seed was investigate in isolated ileum of rat after three doses. Asafoetida produced an antispasmodic effect on acetylcholine (Ach) induced contraction in 0.2% and 0.3%. Spasmolytic evaluation showed that the essential oil derived from *F. asafoetida* seed in concentrations of 0.2 and 0.3%, significantly reduced Ach from 10 to 4 M induced concentrations.

Neuroprotective effect

Traditional usages and some recent findings suggested that *F. asafoetida* can exert some effects on the function of the nervous system particularly in neuroprotective and nerve stimulating effects. *F. asafoetida* extract treatment on glutamate-induced cell damaged in primary culture of rat cerebellar granule neurons was investigated by Tayeboon et al. [152] *In vitro* studies were carried to identify the response of isolated sciatic nerves to various concentrations of oleo gum resin of asafoetida solved in Lock's solution. *In vitro* experiments authenticated that incubating the nerves in aqueous extract of the oleo-gum-resin of asafoetida increased the amplitude and decreased the latent period of nerve compound action potential.

Antispasmodic and hypotensive activity

It was demonstrated that *F. asafoetida* gum extract was effective in reducing blood pressure in anaesthetized normotensive rats. The effects of *F. asafoetida* gum extract on the contractile responses of the isolated guinea-pig ileum stimulated by histamine, acetylcholine, and KCl, and on the mean arterial blood pressure of rat were investigated. The average amplitude of spontaneous contractions of the isolated guinea-pig ileum was decreased when compared with control. Exposure of the precontracted ileum by acetylcholine to *F. asafoetida* gum extract caused relaxation in a dose-dependent manner. *F. asafoetida* gum extracts significantly reduced the mean arterial blood pressure in anaesthetized rat.

Hepatoprotective effect

In 2008, Dandagi et al., explored the hepatoprotective activity of a variety of extracts of *Momordica charantia* Linn., *Nardostachys jatamansi* and *F. asafoetida* against experimental hepatotoxicity. These extracts were formulated as polyherbal suspensions and they were showing significant activity and evaluated for both hepatoprotective and physicochemical activity in evaluation with LIV-52 as standard. Three different formulations were prepared, among these Formulation 3 (containing chloroform, petroleum ether and aqueous extracts of *F. asafoetida*, petroleum ether and ethanol extracts of *M. charantia* Linn. and *N. jatamansi*) has shown a significant hepatoprotective effect by decreasing the elevated serum enzyme levels such as glutamate pyruvate transaminase, glutamate oxaloacetate transaminase and alkaline phosphatase.

Anti-quorum sensing activity

F. asafoetida was tested for its anti-quorum sensing activity against *P. aeruginosa*. Essential oil of *F. asafoetida* exhibited anti-quorum activity at 25 µg/mL of concentration and fully abolished the violacein production by *Chromobacterium violaceum*. Pyocyanin, pyoyerdine, elastase and biofilm production were decreased in *F. asafoetida* oil treatments. Expression analysis of quorum sensing dependent genes confirmed asafoetida as novel anti-quorum sensing and virulence inhibitors.

CONCLUSION

Herbal-derived remedies need a powerful and deep assessment of their pharmacological qualities and safety issues due to the large and growing use of natural-derived substances all over the world, which cannot rely only on the tradition or supposed millenarian beliefs; explanatory and pragmatic studies are useful and complementary in the acquisition of reliable data both for health caregiver and patients,

Medicinal herbs as potential source of therapeutics aids has attained a significant role in health care system all over the world for human beings not only in the diseased condition but also as potential material for maintaining proper health. It is clear that the herbal industry can make great strides in the world. With the increased use of herbal products, the future worldwide labeling practice should adequately address quality aspects. Standardization of methods and quality control data on safety and efficacy are required for understanding of the use of herbal drugs. To solve this trouble of the society where herbs and medicine intake are not justified amount specificity and which herb should be taken and which not to be taken is still a conflict. Renatus Wellness Kadhaayu is one such unique product in which each entity of herb implemented has been assessed and well-studied. It is highly advised to forego kitchen remedies and rely on scientist developed formulation.

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