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Review Article

Phytochemical and Pharmacological Studies of Traditionally Used Herbal Plants and Their Potential Applications in Nutraceutical Formulations

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Abstract

Herbal plants are being used for therapeutic purposes to cure diverse forms of diseases since centuries ago. Many medicinal therapists across the world utilize these herbs for the treatment of diseases, such as ayurveda and traditional Chinese medicine. The use of herbal based medicines considered as safe with no side effects have increased at an alarming pace as compared to synthetic drugs globally. Medicinal herbs have been validated to eradicate the core of diseased ailments irrespective of age group and are having lesser chances of developing adverse effects due to chemical interactions and microbial resistance as induced by most of the synthetic drugs. Considering the multiple biological activities, which are beneficial for healthy functioning of human body including prevention of cancers, inflammations, infections, antiseptics, antimicrobial, antidiarrheal, antioxidants and innumerable healing characteristics. In this study, we assessed the potential benefits and bioactive compounds present in diverse ranges of medicinal herbs, so that it could provide a valid source for practitioners and those interested in formulation of health promoting supplements and nutraceuticals. The chemical composition of medicinal herbs not only enables a researcher to enhance health by curing a specific disease but also to preserve a formulated food product with natural based remedies. Products developed from herbal combinations have been found to reduce toxicity in human body along with improving efficacy.

Keywords: Bioactive composition; Medicinal herbs; Pharmalogical properties

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Introduction

As man began to explore and expand his knowledge of plants, he discovered the healing properties of plants. He also discovered how they could be utilized to treat a variety of ailments. That has led to the development of herbal and unani medicines, which has been used to treat a variety of illnesses from thousands of years. Using the ancient wisdom of Ayurveda and the advancement of modern medical science, these novel plant-derived drugs have the potential to revolutionize the healthcare industry [1]. Folk or traditional medicine consists of medical aspects developed over generations within a variety of societies before modern medicine took hold [2]. According to the World Health Organization (WHO), traditional medicine is defined as a set of knowledge, skills, and practices that are derived from the theories, beliefs, and experiences of various cultures, regardless of whether they can be explained. They are used to maintain health as well as to prevent, diagnose, improve or treat physical or mental illnesses. WHO has explored about 20,000 medicinal plants all over the world to utilise these for pharmological screening and theraupatic purposes. As per the reports of WHO, 80% population in less developing and some developing countries, still rely on the medicinal herbs for treatments of ailments due to adverse economic conditions and lack of synthetic medicines. In Chile, 71% of the population consumes herbal medicine, while in Colombia, the number is 40%. In India, 65% of those living in rural areas use Ayurveda and medicinal plants for primary health care needs [3]. Mahatma Gandhi once wrote: "Homeopathy cures a larger percentage of cases than any other form of treatment and is beyond doubt safer and more economical" (Figure 1).

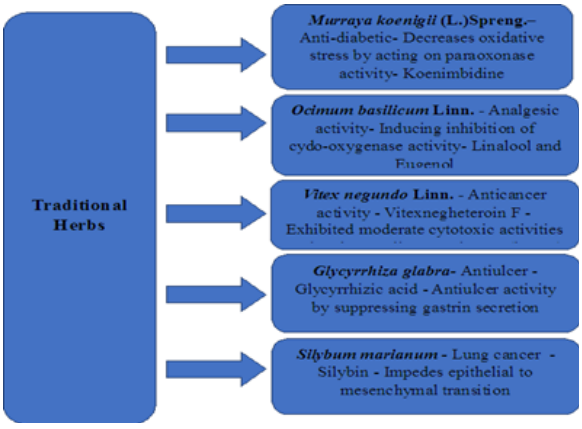

Figure 1: Medicinal properties of some commonly used Himalayan herbs.

Herbal medicines are generally considered to be safe, effective and are having negligible side effects than synthetic drugs, and are particularly beneficial for treatment of chronic conditions. Additionally, plants often contain a variety of compounds that work together to produce therapeutic effects. This can provide a more holistic approach to healing, rather than just targeting a single cause. The use of medicinal plants dates back at least 5,000 years to the Sumerians, but the practice of herbal medicine is thought to date back as

far as 60,000 years ago. Phytochemicals have been found to reduce inflammation, improve metabolic processes, and inhibit the growth of cancer cells. They are also known to protect the body from free radical damage, which is associated with aging and chronic disease. Additionally, they can boost the immune system, reduce cholesterol, and improve overall health. The plethora of benefits from phytochemicals is similar to a multivitamin, providing the body with a variety of nutrients and health benefits essential for maintaining health and vitality. This shows the significant role that these plants play in traditional medicine in industrialized and developing nations. The global market for traditional medicine is expected to continue growing. This paper will discuss several major herbs, including Kadipatta (*Murrayakoenigii*), Bhavadi (*Ocimumbasilicum*), Bana (*Vitex negundo*) and Mulathi (*Glycyrrhiza glabra*). As you may know, these herbs have been used in herbal medicine for ages for their medicinal uses and are known to have numerous health benefits, including reducing inflammation, boosting immunity, lowering blood sugar levels, and aiding digestion. Additionally, these herbs are also believed to help protect against certain types of cancer, support liver health, and act as natural detoxifiers. But don't forget the one benefit that everyone knows and loves - they make excellent seasoning for your cooking.

Description

Murrayakoenigii (M. koenigii) (L) Spreng (Family: Rutaceae) referred to as "curry leaves". In tropical and subtropical regions around the world, M.*koenigii* is widely distributed. Murraya has 14 species worldwide, but only two, *M. koenigii* and M. paniculate, are available in India. Murraya species has a wide range of medicinal properties that make it more important than other species [4]. In Indian Ayurvedic medicine, this plant has been used in a variety of ways for centuries, and is referred to as "krishnanimba". Different parts of *M. koenigii*are shown to promote a wide range of biological activities, including its leaves, roots, bark, and fruit [5]. Despite drying, *M. koenigii* leaves retain their aromatic bioactive constituents. *M. koenigii* leaves have a flavor that is faintly bitter, a pungent odor, and a weak acidity. It is used in Indian cuisine as an antihelminthic, analgesic, digestion aid, and appetizer [6]. The green leaves of *M. koeigii* have anti-inflammatory, itching, and anti-bruise properties, and can be used for piles, inflammation, itching, and fresh cuts. A certain amount of purgative properties can be found in the roots [7]. A common body ache can be alleviated by using them because they are stimulating. It has been found that the bark of this tree is beneficial for treating snakebites. The essential oil derived from *M. koenigii* leaves exhibits antioxidative, antimicrobial, antifungal, anti-inflammatory, and nephroprotective effects in animals [8]. It has been hypothesized that the medicinal properties of different carbazole alkaloids are due to several chemical constituents, including terpenoids, flavonoids, and dihydropyridines, carbohydrates, carotenoids, vitamins, and nicotinic acid were obtained through multiple parts of the *M. koenigii* plant [9,10].

There are many types of plants within the plant family Lamiaceae called Ocimum, most of them aromatic herbs and shrubs, such as, *Ocimumbasilicum* (sweet basil), *O. tenuiflorum* (Tulsi/holy basil), *O. gratissimum* (African basil), *O. campechianum* (Amazonian basil), etc. A number of therapeutic applications, pharmacological applications, and biomedical properties of *O. basilicum* have been reported. Several hundred years have passed since it was used as a medicinal plant, which is cost-effective and easy to obtain. Plants of this species are found throughout the globe, including in tropical, subtropical and temperate climate zones. They grow in India, Pakistan, Nepal (in the Himalayan tract), Sri Lanka, Southeast Asia, and other locations [11]. Since this herb is widely distributed throughout the world, it can be easily found and used in everyday life for its many benefits. Ayurvedic and Unani medicine treat the disease by using it as part of their treatment of various afflictions, both physiological and lifestyle-related. The "God of Spices" (*Ocimumbasilicum*) is regarded as a valuable spice in mythology, particularly for its culinary use. A number of health supplements contain basil, including those that promote and maintain health. In addition to its ornamental properties, this herb is also useful for therapeutic purposes, as a result of its wide range of pharmacological activities [12].

A plant with enormous medicinal properties, *Vitex Negundo* (VN) is often called "chaste tree". Different Vites species produce different phytochemicals due to their varying chemical compositions. In addition to volatile oils, flavonoids, lignans, iridoids, terpenes, and steroids, a number of bioactive compounds have been extracted from leaves, seeds, and roots [13]. There are anti-inflammatory, antioxidant, antidiabetic, anticancer, and antimicrobial properties of these bioactive compounds.

In most cases, VN modulates processes such as apoptosis, cell cycle, motility of sperms, polycystic ovary disease, and menstruation. It has been reported that VN perturbs many cancer-signaling pathways involving p38, p-ERK1/2, and p-JNK in cells stimulated by LPS, as well as N-Terminal Kinase (JNK), COX-1 pathways, MAPK, tumor-necrosis factor, vascular endothelial growth factor, and hypoxia-inducible factor [14].

A perennial herb native to Eurasia, northern Africa, and western Asia*, Glycyrrhiza glabra L* is in the Fabaceae family. The herb is also known as licorice, sweet wood, or mulaithi. More than 30 species are found in the Glycyrrhiza genus globally. The Latin word glaber, meaning bare or slick, is derived from the Greek words glykys, which means sweet, and rhiza, meaning root. Glabra refers to the smooth husks and is derived from the Latin word glaber. A licorice plant grows in fertile, clay, or sandy soil near a river or stream where water is readily available [15]. The medicinal benefits of licorice can be obtained from its roots and roots, which have been reported to be effective in treating digestive system disorders, respiratory tract disorders (e.g., cough and colic). As well as being used in food and beverage flavoring, it can be added to tobacco products to enhance their flavor [16].

Silybum Marianum (SM) is a famous medicinal plant in the family Leucanthemum that is classified as a tree. It belongs to the genus Silybum, and its leaves are characterized by white veins. Due to its hepatoprotective properties, its seeds and fruits have been used as a natural remedy for more than 2000 years. It disperses stagnated liver qi and promotes bile flow in traditional Chinese medicine. Silymarin, a chemical compound found in the seeds of SM, has a variety of pharmacological effects, including hepatoprotective, anti-inflammatory, and antioxidant effects [17].

Chemical Constituents and Pharmacological Effects

Murrayakoenigii (L.) Spreng. contains substantial amounts of proximate composition, including moisture at 63.2%, protein at 8.8%, carbohydrates at 39.4%, nitrogen at 1.15%, fat at 6.15%, sugars at 18.92%, starch at 14.6%, and crude fiber at 6.8%. Many vitamins can be found in the leaves, including vitamin A (B-carotene),

Taxonomy	*Murrayakoenigii*	*Ocimumbasilicum*	*Vitex negundo*	*Glycyrrhiza glabra*	*Silybum marianum*
Kingdom	Plantae	Plantae	Plantae	Plantae	Plantae
Subkingdom	Tracheobionta	Tracheobionta	Tracheobionta	Tracheobionta	Tracheobionta
Super Division	Spermatophyta	Spermatophyta	Spermatophyte	Spermatophyte	Spermatophyte
Division	Magnoliophyta	Magnoliophyta	Magnoliophyta	Magnoliophyta	Magnoliophyta
Class	Magnoliopsida	Magnoliopsida	Magnoliopsida	Magnoliopsida	Magnoliopsida
Subclass	Rosidae	Asteridae	Asteridae	Rosidae	Asteridae
Family	Rutaceae	Lamiaceae	Verbenaceae	Fabaceae	Asteraceae
Genus	Murraya J. Koenig ex L.	Ocimum	Vitex Linn.	Glycyrrhiza	Silybum
Species	*Murrayakoenigii (L.) Spreng.*	*Ocimumbasilicum Linn.*	*Vitex negundo Linn.*	*Glycyrrhiza glabra*	*Silybum marianum*

Table 1: Taxonomy classification of herbs.

which is found in 6.04mg/100grams, vitamin B3, (niacin), which is found in 2.73 mg/100 grams, vitamin B1 (thiamin), which contains 0.89 mg/100g of 0.89 mg with a level of calcium is found in 19.73 milligrams per 100 g, magnesium in 49.06 milligrams per 100g, and sodium in 16.50 milligrams per 100g. The alcohol-soluble extract has a value of 1.82%, ash has a value of 13.06% acid-insoluble ash has a value of 1.35%, cold water (20°C) extractive has a value of 27.33%, and maximum of hot-water-soluble extractive has a value of 33.45% [18] (Table 1).

Ocimumbasilicum Linn. herb is extremely nutritious - apart from fats, proteins, vitamins, such as C, E, K, A, 3-carotene, vitamins B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6, B9, and choline, it contains many secondary metabolites, including essential oils, phenols, flavonoids, anthocyanins, tannins, and steroids, along with minerals such as Fe, Ca, Mg, P, Mn, Na, K, and Zn. It was found that the plant contains terpenoids, alkaloids, phenolics, flavonoids, tannins, saponin, reducing sugars, cardiac glycosides, steroids, and glycosides according to a preliminary phytochemical analysis. The nutritive elements content/ 100g fresh weight were carbohydrate: 28.84, fat: 0.64g, protein: 3.15g, water: 92.06g, vitamins (vitamin A: 264µg, β-carotene: 3142µg, thiamin: 34µg, riboflavin: 76µg, niacin: 902µg, panthotenic acid: 209µg, vitamin B6: 155µg, vitamin B9: 68µg, choline 11.4mg, vitamin C 18.0 mg, vitamin E: 0.80mg and vitamin K: 414.8µg), and minerals (Ca: 177mg, Fe: 3.17mg, Mg: 64mg, Mn: 1.148 mg, P: 56mg, K: 295mg, Na: 4mg and Zn: 0.81mg) [19-21].

The most common flavonoid glycosides from an ethanolic extract of the leaves of *Vitex negundo* are 5-hydroxy-3, 6, 7-trimethoxy-2-(3, 4-dimtoxypheny)-4H-chrome-4-on and 5, 7-dihydroxy-2-(3, 4-dihydroxyphenyl)-4H-chromen4-one. Negundoside, Agnuside, and Vitegnoside are also present in the methanolic extract. Phytosterol and p-hydroxybenzoic acid have been isolated from the bark of *Vitex negundo* Linn., and identified from methanol and hexane extracts. In the acetoacetate fraction of the seeds , two phenylnaphtha-lene-typel-ignans have been- obtained and identified as 6-hydroxy-4-(4-hydroxy-3- methoxy-phenyl)-3-hydroxy-methyl-7-methoxy-3, 4-dihydro-2-naphthaldehyde and vitedoamine A. Leprosy, dyspepsia, colic, rheumatism, worms, boils, and rheumatism are all treated with it. The roots contain a furanoeremophilane. Methanol extracts of *Vitex negundo* Linn roots contain lignins that inhibit tyrosinase [22,23].

Physicochemical analysis of *Glycyrrhiza glabra* roots revealed that extractive values were (petroleum ether 4.67±0.23%, chloroform 10.56±1.53%, n-butanol, 6.54±0.84% and methanol 13.89±2.42%); ash values were (total ash 4.67 ± 0.35%, acid insoluble ash 0.56 ± 0.34% and water soluble ash 6.54±0.22%); loss on drying 5.87±0.65%, moisture contents 0.56±0.054%, pH of the extract (1% solution) 5.04±0.65, pH of the extract (10% solution) 6.26±0.54 [24].

Among the main compounds of Silybum marianum, flavonoids and fatty oils make up two major groups. Flavonolignans, including silybin, isosilybin, and silychristin, are the main active ingredients of SM. Silybin should constitute 0.6% of standardized SM herbs, according to the Chinese Pharmacopeia. Taxifolin, dihydrokaempferol, and quercetin are also flavonoid compounds in SM. There are a lot of unsaturated fatty acids in SM's fatty oil, including oleic, linoleic, and palmitic acid [25]. SM seeds are commonly extracted with silymarin, a standardized extract. It is composed of 40-65% silybin, 20-45% silychristin, and 10-20% isosilybin, constituting 70-80% of the plant's hydro-alcoholic extract. Silymarin accounts for 70-80% of the plant's hydro-alcoholic extract. SM dry extracts with a nominal silymarin content of 30 to 65% are listed in the European Pharmacopoeia. According to the European Pharmacopoeia and the United States National Formulary, mature fruits of SM yield no less than 1.5-2% silymarin [26].

Tables 2 & 3 summaries the major chemical constituents and pharmacological activities of different herbs.

Herbal medicines contain more bioactive components than synthetic drugs, and possess health benefits superior to those provided by chemically synthesized drugs. Since consumers are increasingly focusing on natural food alternatives as a result of changing lifestyles, the application of herbs extracted bioactive components in the formulation of functional foods and nutraceuticals is gaining immense popularity in the modern era, in addition to basic nutrition. Globally, health organizations are focusing on using natural herbs for their identification, extraction, bioavailability, and pharmacological properties in the light of safety concerns regarding synthetic medicines. Plant phytochemicals in natural medicinal herbs possess higher antioxidant properties than chemically synthesized medicines in terms of radical scavengers, hydrogen donors, and singlet oxygen quenchers. Formulations for treating various ailments can be made from herbal medicines with quality assurance.

Role of Different Herbs in Prevention of COVID-19

Infections of COVID-19 can be minimized by using curry leaves mouthwash containing essential oils and saponin [113]. Inhibitors of

S.No	Compound	Supplied Synonyms	Formula	Molecular Weight(g/mol)	PubChem CID
***Murrayakoenigii* (L.) Spreng.**					
1	Mahanine	1. (R)-3,5-Dimethyl-3-(4-methyl-pent-3-en-1-yl)-3,11-dihydropyra-no[3,2-a]carbazol-9-ol 2. (3R)-3,5-dimethyl-3-(4-meth-ylpent-3-enyl)-11H-pyrano[3,2-a] carbazol-9-ol	C23H25NO2	347.4	36689305
2	Mahanimbine	1. 3,5-dimethyl-3-(4-methylpent-3-enyl)-11H-pyrano[3,2-a]carbazole 2. 3,5-dimethyl-3-(4-methyl-pent-3-en-1-yl)-3,11-dihydropyra-no[3,2-a]carbazole	C23H25NO	331.4	167963
3	Isomahanine	3,8-dimethyl-3-(4-methylpent-3-enyl)-11H-pyrano[3,2-a] carbazol-9-ol	C23H25NO2	347.4	375148
4	Koenimbine	8-Methoxy-3,3,5-trimethyl-3,11-di-hydropyrano[3,2-a]carbazole	C19H19NO2	293.4	97487
5	Girinimbine	3,3,5-trimethyl-11H-pyrano[3,2-a] carbazole	C18H17NO	263.3	96943
6	Isolongifolene	(2S)-1,3,4,5,6,7-Hexa-hydro-1,1,5,5-tetrameth-yl-2H-2,4a-methanonaphthalene	C15H24	204.35	11127402
7	Pyrayafoline D	3,8-dimethyl-3-(4-methylpent-3-enyl)-11H-pyrano[3,2-a] carbazol-9-ol	C23H25NO2	347.4	375148
8	Murrayafoline				
9	Murrayazoline	(14R,17S,19S)-3,13,13,17-te-tramethyl-21-oxa-12-azahexacyc-lo[10.7.1.12,17.05,20.06,11.014,19] henicosa-1,3,5(20),6,8,10-hexaene	C23H25NO	331.4	21770913
10	Koenoline	1-me-thoxy-3-hydroxymethylcar-bazole	C14H13NO2	227.26	375152
11	9-formyl-3-methyl carbazole				
12	O-Methylmurrayamine	9-Methoxy-3,3,5-trimethyl-11H-pyrano[3,2-a]carbazole	C19H19NO2	293.4	14892681
13	Koenine	3,11-Dihydro-3,3,5-trimethylpyra-no[3,2-a]carbazol-8-ol	C18H17NO2	279.3	5318827
***Ocimumbasilicum* Linn.**					
1	Linalool	Linalol Phantol 3,7-dlmethyl-1 ,6-octadi-en-3-ol	C10H18O	154.25	6549
2	Linalyl acetate	Linalool acetate BergamiolPhanteine	C12HO2	196.29	8294
3	Estragole	4-allylanisole p-allylanisole methyl chavicol	C10H12O	148.2	8815
4	Geraniol	Geranyl alcohol trans-Ge-raniol	C10H18O	15425	637566
5	1,8-cineole	Eucalyptol, Cineole, Ca-jeputol, Zineol, 1 ,8-Epoxy-p-menthane	C10H18O	154249	2758
6	Neryl acetate	Neryl ethanoate	C12H20O2	196.29	1549025
7	Bergamotene	trans-α-becgamotene	C15H24	204.35	6429302
8	Eugenol	Engenol Eugenic acid	C10H12O2	164.2	3314
9	Methyl eugenol	Methyl eugenol ether	C11H14O2	178.23	7127
10	Nerol	cis-Geraniol Neryl alcohol	C10H18O	15425	643820
11	a-Cadinol	alpha-Cadinol	C15H26O	222.37	6431302
12	Cyclohexanemethanol	Cyclohexylcarbinol	C7H14O	114.19	7507

13	a- Terpineol	Terpineol 1 -Menthene-8-ol	C10H18O	15425	17100
14	Elemol	ALPHA-ELEMOL	C15H26O	222.37	92138
15	Methyl cinnamale	Methyl 3-phenylpropenoate trans-Cinnamic acid methyl ester (E)-Methyl cinnamate	C10H10O2	162.18	637520
***Vitex negundo* Linn.**					
1	Linalool	3,7-Dimethyl-1,6-octadien-3-ol	C10H18O	154.25	6549
2	Vanillic acid	3-Methoxy-4-hydroxybenzoic acid	C8H8O4	168.15	8468
3	Casticin	5-hydroxy-2-(3-hydroxy-4-methoxy-phenyl)-3,6,7-trimethoxychromen-4-one	C19H18O8	374.3	5315263
4	Luteolin	2-(3,4-Dihydroxyphenyl)-5,7-dihydroxy-4H-chromen-4-one	C15H10O6	286.24	5280445
5	Leucoanthocyanidin	2-(3,4,5-Trihydroxyphenyl)chromane-3,4,5,7-tetraol	C15H14O8	322.27	3081374
6	Betulinic acid	3beta-Hydroxy-20(29)-lupaene-28-oic acid	C30H48O3	456.7	64971
7	Friedelin	(4R,4aS,6aS,-6aS,6bR,8aR,12aR,14aS,14bS)-4,4a,6a,6b,8a,11,11,14a-octamethyl-2,4,5,6,6a,7,8,9,10,12,12a,13,14,14b-tetradecahydro-1H-picen-3-one	C30H50O	426.7	91472
8	Squalene	2,6,10,15,19,23-Hexamethyltetracosa-2,6,10,14,18,22-hexaene	C30H50	410.7	638072
9	Epifriedelinol	4,4a,6b,8a,11,11,12b,14a-Octamethyldocosahydropicen-3-ol	C30H52O	428.7	119242
Glycyrrhiza glabra					
1	Glycyrrhizin	(3β,20β)-20-carboxy-11-oxo-30 -norolean-12-en-3-yl 2-O-β-D-glucopyranuronosylα-D-glucopyranosiduronic acid	C42H62O16	822.9	14982
2	Glycyrrhizic acid	(2S,3S,4S,5R,6R)-6-[(2S,3R,4S,5S,6S)-2-[[(3S,4aR,6aR,6bS,8aS,11S,12aR,14aR,14bS)-11-carboxy4,4,6a,6b,8a,11,14b-heptamethyl14-oxo-2,3,4a,5,6,7,8,9,10,1-2,12a,14a-decahydro-1H-picen3-yl] oxy]-6-carboxy-4,5-dihydroxyoxan-3-yl] oxy-3,4,5-trihydroxyoxane-2-carboxylicacid	C42H62O16	822.9	14982
3	Isoliquiritigenin	(E)-1-(2,4-Dihydroxyphenyl)-3-(4-hydroxyphenyl)prop2-en-1-one	C15H12O4	256.25	638278
4	Licochalcone A	(E)-3-[4-Hydroxy-2-methoxy5-(2-methylbut-3-en-2-yl) phenyl]-1-(4-hydroxyphenyl) prop-2-en-1-one	C21H22O	338.4	5318998
5	Liquiritigenin	(2S)-7-Hydroxy-2-(4-hydroxyphenyl)-2,3-dihydro4H-chromen-4-one	C15H12O4	256.25	114829
6	Prenyllicoflavone A	7-Hydroxy-2-[4-hydroxy-3-(3-methyl-2-buten-1-yl)phenyl]-6-(3-methyl-2-buten-1-yl)-4H-1-benzopyran-4-one	C25H26O4	390.5	11349817
7	Glabridin	4-[(3R)-8,8-Dimethyl-3,4-dihydro-2H,8H-pyrano[2,3-f]chromen-3-yl]-1,3-benzenediol	C20H20O4	324.4	124052
8	Glabrene	8-(7-hydroxy-2H-chromen3-yl)-2,2-dimethylchromen5-ol	C20H18O4	322.4	480774

9	Licocoumarin A	3-[2,4-dihydroxy-3-(3-methylbut-2-enyl) phenyl]-7-hydroxy-8-(3-methylbut-2-enyl) chromen-2-one	C25H26O5	406.5	5324358
10	18-β-Glycyrrhetinic acid	(2R,4aS,6aS,6bR,8aR,10S,12aS,14bR)-1 0-hydroxy-2,4a,6a,6b,9,9,12a-heptameth-yl-13-oxo3,4,5,6,6a,7,8,8a,10,11,12,14bdo-decahydro-1H-picene2-carboxylic acid	C30H46O4		3230
11	Liquiritin	(2S)-7-hydroxy-2-[4-[(2S,3R,4S,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl] oxyphenyl]-2,3-dihydrochromen-4-one	C21H22O9	418.4	503737
12	Kanzonol R	3-[2-hydroxy-4-methoxy-3-(3-methylbut-2-enyl)phenyl]-5-methoxy-3,4-dihydro2H-chromen-7-ol	C22H26O5	370.4	131753027
13	α-Terpineol	2-(4-Methylcyclohex-3-en1-yl)propan-2-ol	C10H18O		
14	Glisoflavone	3-[3,4-dihydroxy-5-(3-methylbut-2-enyl) phenyl]-7-hydroxy-5-methoxychromen-4-one	C21H20O6	368.4	5487298
15	Shinpterocarpin	(2R,10R)-17,17-dimethyl-3,12,18-trioxapenta-cyclo[11.8.0.02,10.04,9.014,19]henicosa1(13),4 (9),5,7,14(19),15,20-heptaen-6-ol	C20H18O4	322.4	10336244
16	Isoangustone A	3-[3,4-dihydroxy-5-(3-methylbut-2-enyl) phenyl]-5,7-dihydroxy-6-(3-methylbut-2-enyl) chromen-4-one	C25H26O6	422.5	21591148
17	2,3-Butanediol	Butane-2,3-diol	C4H10O2	90.12	262
18	1-Methoxyficifolinol	(6aR,11aR)-1-methoxy-2,8-bis(3-methylbut-2-enyl)-6a,11a-dihydro-6H-[1]benzofuro[3,2-c] chromene-3,9-diol	C26H30O5	422.5	480872
19	Licoriphenone	1-(2,4-dihydroxyphenyl)-2-[6-hydroxy-2,4-dimethoxy-3-(3-methylbut-2-enyl)phenyl] ethanone	C21H24O6	372.4	21591149
Silybum marianum					
1	2, 3-dehydrosilybin	3,5,7-trihydroxy-2-[3-(4-hydroxy-3-methoxyphenyl)-2-(hydroxymethyl)-2,3-di-hydro-1,4-benzodioxin-6-yl] chromen-4-one	C25H20O10	480.4	5467200
2	Dehydrodiconiferyl alcohol	4-[3-(hydroxymethyl)-5-[(E)-3-hydroxyprop-1-enyl]-7-methoxy-2,3-dihydro-1-benzofuran-2-yl]-2-me-thoxyphenol	C20H22O6	358.4	5372367
3	Silybin	(2R,3R)-3,5,7-trihydroxy-2-((2R,3R)-3-(4-hydroxy-3-methoxyphenyl)-2-(hy-droxymethyl)-2,3-dihydro-benzo[b][1,4]dioxin-6-yl) chroman-4-one	C25H22O10	482.4	31553
4	Silymarin	3,5,7-trihydroxy-2-[3-(4-hy-droxy-3-methoxyphenyl)-2-(hydroxymethyl)-2,3-dihy-dro-1,4-benzodioxin-6-yl]-3,4-dihydro-2H-1-benzopy-ran-4-one	C25H22O10	482.4	5213

Table 2: Phytochemical compounds identified in different herbs.

Uses	Chemical Constituent	Pharmacological Action on	References
Murrayakoenigii (L.) Spreng.			
Anti-diabetic	Koenimbidine, murrayacine, murraya-zolinine.	Decreases oxidative stress by acting on paraoxonase i activity	Patel et al. [27]
Anti-trichomonal	Ginnimbine, mahanimbilol, girinimbiol	Act against trichomonas gallinae	Adebajo et al. [28]
For oral health	Essential oil	By stimulating the salivation process	Utaipan et al. [29]
Vasodilation	Mahanimbilol, murrayazolinine.	By acting on negative chronotropic effect	Shinde et al. [30]
Anti-oxidation activity	Mahanimbine, koenigine	Increases the ash content in the liver and reduction in hepatic malondialdehyde in kidney	Gajaria et al. [10]
Anti-cancer activity	Mahanimbine, girinimbine, mahanine. Murrayafoline	Increase the death of cancerous cell protea-some inhibitor	Samantha et al. [31]
Effect on bronchial disorders	Girinimbine, mahanine	By blocking 5-lipooxygenase activity	Reddy et al. [32]
Effect on dental caries	Isomahanine, murrayanol and mahanine	Inhibition of cavity formation	Prabhakar et al. [33]
Anthelmintic activity	Mahanine, koenimbidine	Cause paralysis	Afzal et al. [34]
Wound healing effect	Mahanine, mahanimbicine, mahanimbine and essential oil	Act against inflammatory cells and the collagen deposition was reduces	Bhandari et al. [8]
Protects the eyes and improves eyesight	Essential oil, vitamin a	Eye sight improvement	Chaudhary et al. [35]
Anti-ulcer activity	Mahanimbine and essential oil	Effect against lesion index, area and per-centage of lesion and on ulcer	Shinde et al. [36]
Anti-microbial activity	Mahanimbine, murrayanol and mahanine,	Inhibition of topoisomerase I	Ramsewak et al. [37]
Anti-diarrheal activity	Kurryam, koenimbine, koenine	Prostaglandin E2-induccd enter pooling and reduction in gastrointestinal motility	Irinmwinuwa et al. [38]
Immunomodulatory activity	Mahanimbine, mahanince	Increase in phagocytic index by removing carbon partical from blood	Dubey et al. [39]
Antipyretic activity	Murrayacine, murrayazolinine.	Decrease in fever	Goel et al. [40]
Anti-alzheimer's activity	Isomahanimbine, murrayazolidine.	Improves the values of protective antiox-idants	Tan et al. [41]
Anti-analgesic activity	Girinimbine, mahanine, mahanimbine, isomahanimbine	Anti -nociceptive effects	Bhandari et al. [8]
Effective digestive system	Mahanine, murrayafoline	Stimulates digestive enzymes	Bhowmik et al. [42]
Anti-inflammatory activity	Ginnimbine, mahanine, mahanimbine, isornahanimbine	Cox-inhibitory property	Pandya et al. [43]
Ocimumbasilicum Linn.			
Analgesic activity	Linalool and Eugenol	Inducing inhibition of cydo-oxygenase activity. Inhibition of pain mediators biosyn-thesis like prostaglandin, prostacyclin and oploid receptor interactions	Govindarajan et al. [44]
Anti-inflammatory activity	Estragole, methyl cinnamate, methyl eugenol, α-bergamotene, α-cadlnol, linalool, eugenol and linoleic acid	Inhibition of pro-inflammatory mediators along with the Stimulation of anti-Inflam-matory cytokines. Decreased production of nitric oxide. Inhibition of lipoxygenase and cyclooxygenase enzymes	Mueller et al. [45], Umamageswari et al. [46], Eftekhar et al. [47]
Antimicrobial activities	Eugenol, linalool and Estragole	Showed broad spectrum antimicrobial activity against various pathogenic strains of bacteria, virus, fungus, and parasites.	Sakkas et al. [48]
Anti-bacterial activity	Eugenol, linalool, Estragole, 1,8-cineole and α-terpineol	The degradation of the cell wall of bacteria, damage to cytoplasmic membrane proteins, the binding of proteins, leakage of cell contents, and coagulation of cytoplasm and depletion of the proton motive force.	Opalchenova et al. [49], Adiguzel et al. [50]
Antiviral activity	Eugenol, apigenin, linalool and ursolic acid	The inhibitory activity by preventing the viral attachment and thereby preventing its entry Into the host cell. Inhibits the produc-tion of hepatitis B virus through the Interfer-ing with viral infection and replication.	Chiang et al. [51], Chattopadhyay et al. [52]
Anti-fungal activity	Estragole, linalol, eugenol and methyl cinnamate	Reducing DNA binding formation of aflatoxins, secondly by reacting with ROS increased by aflatoxins. Inhibition of the growth of mycelium, spore germination, and elongation of germ tube	Gucwa et al. [53], Nugroho et al. [54]

Larvicidal, Insecticidal and Anti-parasitic activity	Linalool, ketones (2-Dodecanone, Pulegone)	Acts upon biosynthesis of isoprenoid that has been shown to restrict the growth of malarial parasite. Acts as a defense mechanism against herbivorous insects and as a repellent against various arthropods	Cardoso et al. [55]
Anti-neoplastic and anticancer properties	Eugenol, ursolic acid, linalool, isoeugenol	Restriction of the growth of cancer cells by induction of apoptosis and cellular blockade. The activity against cell proliferation in Michigan Cancer Foundation-i cells. Inhibition of synthesis of DNA and possess potent cytotoxic activity against tumour cell.	Dasgupta et al. [56], Torres et al. [57]
Anti-osteoporotic effect	Apigenin, linalool and eugenol	Induces apoptosis in mature osteodasts and inhibits bone resorption and induces osteoblastic differentiation.	Rasheed et al. [58], Horcajada et al. [59]
Antioxidant activity	Rosmarinic acid, estragole, linalool, eugenol, methyl cinnamate, linoleic acid, α-cadinol and α-bergamotene	The scavenging of free radicals. The protection against oxidative stress by increasing the level of antioxidative defence enzymes.	Jayasinghe et al. [60]
Anti-ulcer activity	Eugenol, linalool, methyl eugenol, anthocyanins and 1,8-cineone	The decrease in the pepsin and acid production, lipoxygenase inhibitory, histamine antagonistic and antisecretory effects.	Akhtar et al. [61], Rashidian et al. [62]
Cardioprotective and hepatoprotective properties	Eugenol, linalool, rosrnarlnic acid	The preventing hyperlipidemia, protecting hepatic tissue from oxidant damage, and preventing hepatic fibrosis	Tabassum et al. [63], Fathiazad et al. [64]
Hypoglycemic action	Apigenin, diosmetin, genistein, kaempferol, luteolin and rosmarinic acid	Glucose utilization, enhanced production of glycogen in liver due to Increase in the level of regulatory enzymes expression, and stimulation of secretion of insulin from pancreas	Mousavi et al. [65]
Immunomodulatory activity	Eucalyptol, linalool, methyl eugenol, estragole, germacrene, and α-becgamoten	Immune cell proliferation; thereby modulating both cell-mediated and humoral immune responses. Stimulation of anti-inflammatory cytokines.	Morshedy et al. [66]
Vitex negundo Linn.			
Antioxidant activity	Vitexnegheteroins	Iridoid glycosides 19–20 exhibited weaker antioxidant effects with IC50 values >20 µm.	Singh et al. [67]
Antioxidant activity	Nishindacin A and Isonishindacin A	Compounds showed weak radical-scavenging effects on stable free radical, with scavenging activity (%) of 27.14% and 25.80%, respectively.	Kamal et al. [68]
Antioxidant activity	(3S,5R,10S)-3-[(β-D-glucopyranosyl) oxy]- labd-8,13-dien-16,15-olide and (3S,5R,10S)-3-hydroxy-labd-8,13-dien16,15-olide	Possessed inhibitory activities on LPS-induced NO production. Compounds exhibited strong the activity of inhibition against NO production, and was the strongest inhibitor with IC50 value of 15.8 ± 1.38 µm. Compounds also showed significant inhibition of IL-1β and IL-6 level. The anti-inflammatory mechanism of compound was associated with its inhibition on inos, COX-2 and NF-κb signal pathways.	Neha et al. [14]
Antimicrobial activity	9-epivitexnegundin	Evaluated for its antimicrobial activity but the activity was not mentioned. No significant activity in cytotoxicity assays (IC50 > 100 µm) was reported.	Sichaem et al. [69]
Antifungal activity	Vitegnoside	Exhibited antifungal activity against T. Mentagrophytes and C. Neoformans with MIC value of 6.25 µg/ml.	Sathiamoorthy et al. [70]
Antifilarial activity	4,5-diethyl-30 -ethoxy-pyro flavone	Exhibited significant antifilarial activity in dose dependent manner	Rana et al. [71]
Antioxidant activity	Vitexdoin F	Exhibited stronger activity than ascorbic acid using DPPH radical-scavenging assays	Lou et al. [72]
Antioxidant activity	Vitexnegheteroin E	Exhibited antioxidant and inhibitory activities on lipopolysaccharide-induced NO.	Hu et al. [73]
Anticancer activity	Vitexnegheteroin F	Exhibited moderate cytotoxic activities against human liver carcinoma (hepg2) cell lines	Xu et al. [74]

Antioxidant activity	Vitexnegheteroin G	Exhibited antioxidant activities using ABTS scavenging activities.	Xu et al. [74]
Anti-inflammatory activity	(9R)-O-β-D- glucopyranosyloxy-2,5-megastigmen-4-one and (3S,4R)-dihydroxy-7,8-dihydro-β-ionone 4-O-β-D-glucopyranoside	All compounds showed anti-inflammatory activity and obvious inhibitory activity (IC50 > 100 μm), respectively.	Hu et al. [73]
Glycyrrhiza glabra			
Antiulcer	Glycyrrhizic acid and glabridin, glabrene	Antiulcer activity by suppressing gastrin secretion	Masoomeh et al. [75]
Antimycobacterial	Isoliquiritigenin	The antibacterial efficacy of glabridin towards Gram-negative and Gram-positive bacteria was registered and the highest efficacy was shown towards Gram-positive bacteria as well as H37Ra and H37Rv mycobacterial strains.	Gupta et al. [76]
Uterine relaxant and analgesic	Licocoumarin, licochalcone, isoliquiritigenin, and glabridin	Roots and rhizomes extract exhibited an aphrodisiac efficacy in vivo and this activity is attributed to the presence of glycyrrhizin as the active ingredient	Awate et al. [77]
Corticosteroidal activity	Liquiritigenin, glycyrrhizin, and 18-glycyrrhetinic acid	Glycyrrhizin is broken down in the intestine and exhibits an anti-inflammation effect comparable with that of corticosteroid hormones, including hydrocortisone.	Yang et al. [78]
Antiallergic	Glycyrrhizin	Glycyrrhizin, liquiritigenin, and 18 - glycyrrhetinic acid are the main components responsible for the antiallergic effects of licorice and they act by inhibiting Immunoglobulin E (IgE) production in ovalbumin-induced asthmatic mice and effectively prevented the scratching behavior and passive cutaneous anaphylactic reaction in mice. Therefore, they can be used to treat allergic diseases caused by IgE, such as dermatitis and asthma.	Shin et al. [79]
Hepatoprotective	Liquiritoside and glycyrrhetic A	Glycyrrhizin has been reported to be used in the treatment of acetaminophen-induced hepatotoxicity and it acts by inhibiting CCl4-induced membrane lipid peroxidation	Xu-ying et al. [80]
Anti-inflammatory	Glycyrrhizin and glycvrrhetic A	Glycyrrhizic acid suppresses the activity of cyclooxygenase and the formation of prostaglandin E2, preventing platelet aggregation indirectly	Harwansh et al. [81]
Anticancer	Licochalcone A	Licochalcone E that was isolated from G. inflate root extract, showed potent cytotoxic activity in comparison with the famous antineoplastic drugs	Yoon et al. [82]
Antimalarial	Glycyrrhizin, Iicohkone,glycvrrhetinic acid	The antimalarial efficacy of chalcones as they found that chalcones completely eradicated P. yoelii parasite in mice without any toxic side effects	Mi-Ichi et al. [83]
Antiviral activity	Glycyrrhizin and 18-glycyrrhetinic acid	Methanolic licorice extract exhibits potent anti-fungal effectiveness towards Chaetomium funicola M002 and Arthriniumsaccharl M001 and this activity is due to the glabridin active compound	De Simone et al. [84]
Antihyperglycemic	Glycyrrhizin	Root extract of G. glabra exhibited antidiabetic and lipid-lowering activities when administered to albino mice at low doses	Mustafa et al. [85]
Antitussive activity	Isoliquiritigenin and glycyrthizin	Pharmacologically, it was reported to treat bronchial cough, catarrh, and sore throat and these activities may be attributed to the existence of glycyrrhizin, which helps relieve congestion in the upper respiratory tract by accelerating the secretion of the bronchial mucosa	Kuang et al. [86], Dhingra et al. [87]
Anti-HIV	Glycyrrhizin	Glycocoumarin, licopyranocoumarin, and licochalcone A exhibited growth inhibition of the giant cell structure in cell cultures infected with HIV without any cytotoxic activity	De Simone et al. [84]

Silybum marianum			
Antimicrobial activity	Silymarin	Destabilizes mature biofilm; inhibits tbe secretion of hydrolases; mediates destruction of membrane - Candida albicans	Yun et al. [88]
Antimicrobial activity	Silymarin	Interacts with beme - Plasmodium falciparum	Mina et al. [89]
Antimicrobial activity	Dehydroisosilybin	Inhibits Leishmania infantum promastigotes - Leishmania infantum	Olias-Molero et al. [90]
Antimicrobial activity	Silymarin	Reduces the granulomatous periovularreactionintbe liver and decreases hepatic fibrosis in mice infected with S.mansonii– schistosomiasis	Mata-Santos et al. [91]
Antimicrobial activity	Silymarin	Exerts antibacterial, antiadherence, and antibiofilm effects - MRSA 43300	Evren et al. [92]
Antimicrobial activity	Silybin	Inhibits RNA and protein synthesis in gram-positive bacteria - B. Subtilis	Lee et al. [93]
Antimicrobial activity	Silybin	Inhibits RNA and protein synthesis in gram-positive bacteria - S. Epidermidis	Lee et al. [93]
Antimicrobial activity	Silymarin	Inhibits the expression of the HCV core gene in the 3a genotype; blocks viral entry and transmission – HCV	Ashfaq et al. [94]
Antimicrobial activity	Silybin	Attenuates cellular functions involved in T-cell activation, proliferation, and HIV-I infection - HIV-I	McClure et al. [95]
Antimicrobial activity	Silymarin	Inhibits MAYV replication and attenuates MAYV-induced oxidative stress - Mayaro virus	Camini et al. [96]
Gastric cancer	Silymarin	Inhibits growth and apoptosis through modulation of the MAPK signaling pathway	Kim et al. [97]
Prostate cancer	Silymarin	Induces cytotoxicity	Gioti et al. [98]
Hepatocarcinoma	Silybin	Downregulates the Slit-2/Robo-1 pathway and mir-92-3p; upregulates mir223-3p and mir16-5p	Zappavigna et al. [99]
Lung cancer	Silybin meglumine	Impedes epithelial to mesenchymal transition	Cufi et al. [100]
Breast cancer	Silybin	Induces autophagy via ROS-dependent mitochondrial dysfunction and loss of ATP involving BNIP3; prevents 12-O-tetradecanoylphorbol- 13-acetate (TPA) and phorbol 12-myristate 13-acetate (PMA) induced MMP-9 expression and VEGF secretion via inactivation of the Raf/MEK/ERK pathway and blockade of AP-1 activation via MAPK signaling pathways	Wang et al. [101]
Breast cancer	Silybin	Reduces the migratory and adhesive capacities of MDA-MB-231 cells, as evidenced by evaluation of the levels of b1-integrin and the downstream molecules Cdc42, Raf-1 and D4GDI; impairs mitochondrial dynamics and biogenesis	Sharifi et al. [102]
Wound healing	Silymarin	Exerts antioxidative and anti-inflammatory effects	Samanta et al. [103]
	Silybin gel	0.2% silybin gel treated wounds showed more collagen fibers, fibroblasts, and proliferating blood capillaries	Hu et al. [104]
	Dehydrodiconiferyl alcohol	Exerts anti-inflammatory activity through inactivation of NF-kb pathways	Katiyar et al. [105]
UVA-induced skin damage	Silymarin	Targets infiltrating CD11b+ cells in mouse skin, prevents UV radiation-induced	Li et al. [106]
	Silymarin, silybin, and 2,3-dehydrosilybin	Immunosuppression and oxidative stress in mouse skin	Katiyar et al. [107]
	Silymarin	Prevents apoptosis partially through inhibition of the caspase-8 pathway	Rajnochova Svobodova et al. [108]
	2,3dehydrosilybin	Reduces UV radiation-induced DNA damage	Li et al. [106]

	Silymarin	Partially reduces UV-induced apoptosis by activating the Akt, SIRT1, and MAPK pathways	Cheon [109]
Hair loss	Silybin	Increases hair-inductive properties via Akt and Wnt/-catenin signaling activation in human dermal papilla cells	Karbasforooshan et al. [110]
Skin aging	Silybin	Prevents or manages advanced glycation end product (AGE)-mediated pathologies	Shin et al. [111]
Skin irritation	Silybin	Exhibits retinoic acid like activity in keratinocytes	Kitajima et al. [112]

Table 3: Pharmacological activities of different herbs.

S.NO.	Product name	Ingredients	Health Benefits
1	HealthKart HK Vitals Multivitamin with Multimineral, Taurine & Ginseng Extract	100% RDA of vitamins like Vitamin C, Vitamin A, Biotin and Vitamin B12, 8 essential minerals including iron, magnesium, copper, zinc, manganese, chromium, iodine and selenium, Standardised ginseng extracts derived from Panax ginseng, Special amino acids blend including essential amino acids and branched chain amino acids.	• Get 3 times the amount of Zinc and Calcium for enhanced immunity • Fortified with amino acids to aid muscle development • Complete With Anti-Oxidising Natural Extracts Like Ginseng • Contains all essential vitamins and 8 essential minerals to conveniently balance your diet.
2	Nutrabay Wellness Curcumin Extract with Piperine 1000mg	Curcumin Extract, Piperine Nigrum Extract (Piperine), Glidant (INS 553 (iii)) and Diluent (INS 460 (i))	• Anti-inflammatory • Powerful antioxidant • Mental health support
3	Carbamide Forte Garcinia Cambogia 3000mg for Weight Loss Supplement, 60% HCA & Chromium	Garcinia Cambogia Extract, Piper Nigrum Extract, Binder (INS 1404), Firming Agent (INS 341), Anticaking Agent (INS 460 (i) & INS 551), Stabilizer (INS 1201), Thickener (INS 464), Emulsifier (INS 466), Antifoaming Agent (INS 1521)	• Rapid Fat Burn, • Appetite Suppression, • NaturalWeight Loss, • Carb Blocker, • Reduce Emotional Cravings, • Improve Metabolism
4	Nutrabay Wellness Milk Thistle Extract (Silymarin Marianum)1000mg	Milk Thistle Extract (Silymarin Marianum), Glidant (INS 553 (iii)) and Diluent (INS 460 (i))	• Liver Care • Boost Metabolism • Powerful Antioxidant
5	Fast&Up Ashwagandha (KSM-66) 600mg, 5% Withanolides – Natural Vitality Booster	Ashwagandha (KSM-66) (Withaniasomnifera)- (5% Withanolides) Root Extract	• Promotes Vitality, Energy and Vigor • Promotes Muscle Strength and Endurance • Supports Immune System and general wellness
6	Wellbeing Nutrition Slow Liver Health | High Strength Milk Thistle, Arjuna &Berberry	Milk Thistle, Kasani, Himsra, Vitamin D, Vitamin E, Berberry, Daruharidra, Arjuna	• Liver protection • Reduces Inflammation • Control Cholestrol • Improves Fat Metabolism • Improve Digestion
7	Healthyhey Nutrition Panax Ginseng 400Mg	Panax Ginseng Root Extract 400mg (20% Ginsenosides)	• Supports physical & intellectual work capacity
8	Foresta Organics Brain Health with Brahmi, Shankhpushpi& Gingko Biloba	Shankhpushpi, Brahmi, Ginkgo Biloba	• Improves Alertness • Reduce Anxiety • Control Mood Swings • Better Eye Health • Enhanced Memory Retention

9	Wellbeing Nutrition Apple Cider Vinegar w/ Mother & Garcinia Cambogia	Himalayan Red and Gold Apples, Pomegranate, Garcinia Cambogia	• Heathy Weight Loss • Boosts Metabolosm • Improves Heart Health • Supports Glowing Skin • Helps Digestion
10	Bigmuscles Nutrition Spirulina Organic Tablets (1500mg)	Organic Spirulina, Black Pepper Extract	• Skin & Hair • Blood Pressure • Anti-Imflammatory • Lowers Cholestrol
11	Doctor's Choice Trans4orm | 4 Forms of CARNITINE Blend | CLA | Garcinia Cambogia	Black Pepper Extract, CLA, Garcinia Cambogia, Vitamins, TRANS4ORM Blend	• Promotes Fat Burning • Regulates Cravings • Weight Management • Increases Metabolism
12	Neuherbs Plant Based Green Coffee Instant Charge in Classic Coffee Flavour (20 Effervescent tablets)	Green Coffee Beans Extract, Cholorogenic Acid, Natural Caffeine, Vitamin B6, Vitamin B12	• Helps boost up metabolism • Helps fuel up daily energy level instantly, Aids in reducing fatigue & daily body exhaustion
13	Foresta Organics Menz-X Health with Shilajit, Ashwagandha, Kaunch & Safed Musli	Shilajit, Kaunch, Akarkara, Ashwagandha & Safed Musli	• Helps boost stamina • Helps enhance male libido • Helps improve energy levels • Helps improve potency • Manages stress and fatigue
14	Dr Vaidya's Stress Relief	Ashwagandha, Tagar, Brahmi, Jatamansi	• Helps combat anxiety & promote sound sleep
15	Bigmuscles Nutrition Natural Neem Extract (800mg)	Organic Neem Extract	• Promotes Radiant Skin • Supports Immune System • Acne Relief • Improves Mood
16	Bigmuscles Nutrition Natural Neem Extract (800mg)	Tila (Sesamum indicum) seed powder, Fructo-oligosaccharides, Honey,Water, Amino acid blend 7% (Glycine, L- Proline, L- Alanine, L-Hydroxyproline, L-Arginine, L-Lysine), Rose hips extract, Aloe vera extract, Gajar (Daucus carota) powder, Glutathione, Badam (Prunus amygdalus) Kernel powder, Tila (Sesamum indicum) oil, Pumpkin seed powder, Agathi (Sesbania grandiflora) flower extract, Nature Identical flavouring substances, Flaxseed powder, Cranberry extract, Sodium Hyaluronate, Moringa leaf extract, Blueberry extract, Vitamin E, Zinc, Green tea extract, Preservatives (INS 202, INS 211), Sitawar powder	• Beneficial for skin elasticity • Skin moisture • Advanced anti-aging formula

17	Patanjali Nutrela Diabetic Care	Fructo-oligosaccharides, High Oleic, Sunflower Oil, Stabilizer (INS 414), Caseinates, Hydrolysed whey peptide, Diluent (Maltodextrin), Emulsifier {INS 322(i), INS 415}, Anti-caking agent (INS 551), Mineralsn 0.4% (Phosphorus, potassium, Zinc, Tricalcium phosphate, Maganesium, Ferrous fumarate, Manganese, Copper, Iodine, Selenium, Molybdenum, Chromium), Nature-identical flavouring substances, Bitter gourd, Gudmar (Gymnerasytvestre) Extract (0.1%), Kokam (Garcinia indica) Powder (0.1%), Giloy (Tinosporacardifolia), Taurine, Banaba leaves extract (0.1 %), Vitamin Premix (0.06%) {Vitamin B1, Vitamin B2 (Bio-fermented), Vitamin B3, Vitamin B5, Vitamin B6, Vitamin B7, Vitamin B12 (Bio-fermented)} Sweetener (INS 950), INS 955), Jamun seed powder, Licorice extract 0.01%, Fenugreek, Rosemary Extract (0.01 %), Cinnamon Extract (0.01%), Myo- inositol, Alpha-lipoic acid, L-camitine, Vitamin D (Bio-fermented) (0.01%)	• Diabetic Care is a scientifically designed formulation to help manage blood sugar levels and weight.
18	Himalayan Organics Pcos Multivitamin Supplement 2000Mg	Myo-Inositol, Alpha Lipoic Acid, AlgasCalcareas, Caonositol, Vitamin D2, Folate, Chromium Picolinate	• Acne Control • Weight Management • Hormonal Balance • Minimizes Facial Hair
19	Wellbeing Nutrition Melts Testo Power Testofen, Himalayan Shilajit, Ginkgo Biloba – Plant Based (30 Oral Strips)	Testofen*(A patented Fenugreek extract), Pure Himalayan Shilajit, Ginkgo Biloba, Saffron	• Increases Testosterone Production • Reduce Stress & Uplifts Mood • Supports Lean Muscle Gain • Enhance Performance • Improve Stamina • Boosts Energy Levels
20	Nutrova Complete Omega 3	Algal extract containing 17% DHA	• DHA is an omega-3 fat that forms structures of our brain, nerves, eyes and skin and also regulates inflammation

Table 4: Commonly available herbal supplements in market.

glycoprotein adhesion on the surface of SARS-CoV-2 found in essential oils and extracts of Ocimum genus species prevent viral replication and therefore strengthen the immune system. COVID-19 can be managed with Ocimum species [114]. As a potential drug molecule for treating SARS CoV-2 (COVID-19), phyto-compounds from Vitex negundo including oleanolic acid, ursolic acid, 3b-acetoxyolean-12-en-27-oic acid, and isovitexin interact with the PLpro via hydrogen bonds [115]. A significant decrease in ACE2 expression in the small intestine is observed after treatment with Glycyrrhiza glabra root extract, which may represent an entry point for transport of nutrients SARS CoV-2.Silybin, an active constituent found in *Silybum marianum* exhibited higher binding affinity with targets in SARS-CoV-2 in comparison to the drugs against SARS-CoV-2 [116].

Application of Herbal Plants in Formulation of Functional Foods and Nutraceuticals

Large amounts of food formulation based on functional benefits of medicinal plants are marked throughout the world depending on nutrigenomics of inhabitants in a particular region. These food products ranging from baked items, snacks, ready to eatables and beverages are fetching higher marginal profits due to their therapeutic properties besides nutrition.A variety of developed food products have depicted to reduce the incidence of chronic and other commonly prevailing disabling disorders among consumers and thus have proved to potential contributors of enhancing health and wellness of consumers. A number of herbal plant infusion available in market as ready to serve drinks, instant tea, or squashes have been found to possess

antidiabetic properties due to presence of functional ingredients including phenols, flavonoids, tannins, alkaloids, essential oils that have been validated in increasing sugar metabolism by stimulating excessive insulin secretion and maximising excretion of sugar by causing excessive renal dieresis [117]. The nutraceuticals made from derivatives of medicinal plants have revealed to possess antimicrobial, anti-depressant, anti-anxiety, anti-dementia, anti-convulsions, anti-inflammatory effects and prevent the body from metabolic diseases that leads to different types of complications. Nutritional therapist has becoming an emerging discipline with promising impact focusing on utilisation of plant-based nutraceuticals and functional foods for treatment of chronic ailments. Some of the commonly available herbal based nutraceuticals are discussed in table 4.

Conclusion

An overview of the distribution, ethnobotany, metabolites, ethno pharmacology, and potential medicinal uses of different herbs was provided in this review. It is also important to explore and discuss the clinical efficacy and toxicity studies. Due to the controversy surrounding herbal drug characterization, the secondary metabolites in extracts of all herbs must be identified and characterized analytically. Considering that herbal drugs may interact with other drugs and with foods, the effects of herbal extracts on drug-food interactions must be experimentally validated in a clinical setting. A study of high-throughput experiments and DNA microarrays may also provide a platform for researching and developing drugs from natural products thanks to advances in experimental research.

Conflict of Interest

The authors are having no conflict of interest with anyone related to publishing this review paper.

References

1. Gunjan M, Naing TW, Saini RS, Ahmad A, Naidu JR, et al. (2015) Marketing trends & future prospects of herbal medicine in the treatment of various disease. World J Pharm Res 4: 132-155.

2. Wojdyło A, Oszmian´ski J, Czemerys R (2007) Antioxidant activity and phenolic compounds in 32 selected herbs. Food Chem 105: 140-149.

3. World Health Organization (2023) Food safety. World Health Organization, Geneva, Switzerland.

4. Yankuzo H, Ahmed QU, Santosa RI, Akter SFU, Talib NA (2011) Beneficial effect of the leaves of *Murrayakoenigii* (Linn.) Spreng (Rutaceae) on diabetes-induced renal damage *in vivo*. J Ethnopharmacol 135: 88-94.

5. Husna F, Suyatna FD, Arozal W, Poerwaningsih EH (2018) Anti-diabetic potential of *Murrayakoenigii* (L) and its antioxidant capacity in nicotinamide-streptozotocin induced diabetic rats. Drug Res (Stuttg) 68: 631-636.

6. Amna U, Halimatussakdiah PW, Saidi N, Nasution R (2019) Evaluation of cytotoxic activity from Temurui (*Murrayakoenigii* [Linn.] Spreng) leaf extracts against HeLa cell line using MTT assay. J Adv Pharm Technol Res 10: 51-55

7. Yeap SK, Abu N, Mohamad NE, Beh BK, Ho WY, et al. (2015) Chemopreventive and immunomodulatory effects of Murraya koenigii aqueous extract on 4T1 breast cancer cell-challenged mice. BMC Complement Altern Med 4: 306.

8. Bhandari PR (2012) Curry leaf (*Murrayakoenigii*) or cure leaf: Review of its curative properties. Journal of Medical Nutrition and Nutraceuticals 1: 92.

9. Desai SN, Patel DK, Devkar RV, Patel PV, Ramachandran AV (2012) Hepatoprotective potential of polyphenol rich extract of *Murrayakoenigii* L.: An *in vivo* study. Food Chem Toxicol 50: 310-314.

10. Gajaria TK, Patel DK, Devkar RV, Ramachandran AV (2015) Flavonoid rich extract of *Murrayakoenigii* alleviates in-vitro LDL oxidation and oxidized LDL induced apoptosis in raw 264.7 Murine macrophage cells. J Food Sci Technol 52: 3367-3375.

11. Sestili P, Ismail T, Calcabrini C, Guescini M, Catanzaro E, et al. (2018) The potential effects of *Ocimum Basilicum* on health: A review of pharmacological and toxicological studies. Expert Opin Drug Metab Toxicol 14: 679-692.

12. Abdoly M, Farnam A, Fathiazad F, Khaki A, Ibrahimi A, et al. (2012) Antidepressant-like activities of *Ocimum Basilicum* (Sweet Basil) in the forced swimming test of rats Exposed to Electromagnetic Field (EMF). Afr J Pharm Pharmaco l6: 211-215.

13. Khan MF, Arora P, Dhobi M (2021) A prospective review on phyto-pharmacological aspects of *Vitex negundo* Linn. Current Traditional Medicine 7: 138-150.

14. Neha B, Jannavi R, Sukumaran P (2021) Phyto-pharmacological and biological aspects of *vitex negundo* medicinal plant-A review. Cardiovasc Dis 6: 17-32.

15. El-Saber BG, Beshbishy AM, El-Mleeh A, Abdel-Daim MM, Devkota HP (2020) Traditional uses, bioactive chemical constituents, and pharmacological and toxicological activities of *Glycyrrhiza glabra* L. (Fabaceae). Biomolecules 10: 352.

16. Hasan MK, Ara I, Mondal MSA, Kabir Y (2021) Phytochemistry, pharmacological activity, and potential health benefits of *Glycyrrhiza glabra*. Heliyon 7: 07240.

17. Abdel-Latif HM, Shukry M, Noreldin AE, Ahmed HA, El-Bahrawy A, et al. (2023) Milk thistle (*Silybum marianum*) extract improves growth, immunity, serum biochemical indices, antioxidant state, hepatic histoarchitecture, and intestinal histomorphometry of striped catfish, *Pangasianodon hypophthalmus*. Aquaculture 562: 738761.

18. Jan R, Shah AJ, Wani TU, Farooq S, Jachak SM, et al. (2021) Curry leaf: An insight into its Pharmacological Activities, Medicinal Profile, and Phytochemistry. Science of Spices and Culinary Herbs-Latest Laboratory, Pre-clinical, and Clinical Studies 4: 145-168.

19. McCance KR, Flanigan PM, Quick MM, Niemeyer ED (2016) Influence of plant maturity on anthocyanin concentrations, phenolic composition, and antioxidant properties of 3 purple basil (*OcimumBasilicum* L.) cultivars. J Food Compos Anal 53: 30-39.

20. Ilić AS, Antić MP, Jelačić SC, Knudsen TMS (2018) Chemical Composition of the Essential Oils of Three *Ocimum Basilicum* L. Cultivars from Serbia. Notulae Botanicae Horti Agrobotanici Cluj-Napoca 47: 347-351.

21. Li H, Ge Y, Luo Z, Zhou Y, Zhang X, et al. (2017) Evaluation of the chemical composition, antioxidant and anti-inflammatory activities of distillate and residue fractions of sweet basil essential oil. J Food Sci Technol 54: 1882-1890.

22. Gautam LM, Shrestha SL, Wagle P, Tamrakar BM (2008) Chemical constituents from *Vitex negundo* (Linn.) of Nepalese origin. Scientific world 6: 27-32.

23. Koirala N, Dhakal C, Munankarmi NN, Ali SW, Hameed A, et al. (2020) *Vitex negundo* Linn.: phytochemical composition, nutritional analysis, and antioxidant and antimicrobial activity. Cell Mol Biol 66: 1-7.

24. Husain A, Ahmad A, Mujeeb M, Khan SA, Alghamdi AG, et al. (2015) Quantitative analysis of total phenolic, flavonoid contents and HPTLC fingerprinting for standardization of *Glycyrrhiza glabra* Linn. roots. Herb Med 1: 1-9.

25. Wang X, Zhang Z, Wu SC (2020) Health benefits of *Silybum marianum*: Phytochemistry, pharmacology, and applications. J Agric Food Chem 68: 11644-11664.

26. Marceddu R, Dinolfo L, Carrubba A, Sarno M, Di Miceli G (2022) Milk thistle (*Silybum Marianum* L.) as a novel multipurpose crop for agriculture in marginal environments: A review. Agronomy 12: 729.

27. Patel OPS, Mishra A, Maurya R, Saini D, Pandey J, et al. (2016) Naturally Occurring Carbazole Alkaloids from *Murrayakoenigii* as Potential Antidiabetic Agents. J Nat Prod 79: 1276-1284.

28. Adebajo AC, Ayoola OF, Iwalewa EO, Akindahunsi AA, OmisoreNOA, et al. (2006) Anti-trichomonal, biochemical and toxicological activities of methanolic extract and somecarbazole alkaloids isolated from the leaves of *Murraya koenigii* growing in Nigeria. Phytomedicine 13: 246-254.

29. Utaipan T, Athipornchai A, Suksamrarn A, Jirachotikoon C, Yuan X, et al. (2017) Carbazole alkaloids from *Murraya koenigii* trigger apoptosis and autophagic flux inhibition in human oral squamous cell carcinoma cells. J Nat Med 71: 158-169.

30. Shinde J (2016) Advances in disease protecting ingredients of M*urraya koenigii* (curry leaves)-a textual herbal medicine with newer approach. International Journal of Innovative Pharmaceutical Sciences and Research 4: 1-6.

31. Samanta SK, Kandimalla R, Gogoi B, Dutta KN, Choudhury P, et al. (2018) Phytochemical portfolio and anticancer activity of *Murraya koenigii* and its primary active component, mahanine. Pharmacol Res 129: 227-236.

32. Reddy GBS, Saini SC (2018) A review on curry leaves (*Murraya koenigii*): Versatile multi-potential medicinal plant. Int J Adv Pharm Med Bioallied Sci 6: 31-41.

33. Prabhakar AR, Ahuja V, Basappa N (2009) Effect of curry leaves, garlic and tea tree oil on *Streptococcus* mutans and *Lactobacilli* in children: A clinical and microbiological study. Pesquisa Brasileiraem Odontopediatria e Clínica Integrada 9: 259-263.

34. Afzal F, Shaukat SS (2013) Antibacterial, antifungal and anthelmintic activity of curry leaves *Murraya koenigii* (L.) spreng. Int J Biol Biotech 10: 537-546.

35. Chaudhary A (2020) A review on the culinary uses and therapeutic properties of *Murraya koenigii*. Journal of Advancement in Pharmacognosy 1: 1-8.

36. Shinde J (2016) Advances in disease protecting ingredients of *murraya koenigii* (curry leaves)-a textual herbal medicine with newer approach. International Journal of Innovative Pharmaceutical Sciences and Research 4:1-6.

37. Ramsewak RS, Nair MG, Strasburg GM, DeWitt DL, Nitiss JL (1999) Biologically active carbazole alkaloids from *Murraya koenigii*. J Agric Food Chem 47: 444-447.

38. Omo IE, Adolphus MC, Ibeabuchi KC, Benard GO (2023) Evidence based medicinal plant possessing anti-diarrhea activity: A review.

39. Dubey A, Gupta V (2021) A review on immunomodulatory medicinal plants. International Journal of Pharmacy & Life Sciences 12.

40. Goel A, Sharma A, Kulshrestha S (2020) A phytopharmacological review on *Murraya koenigii*: An important medicinal plant. Int J Pharm Sci Rev Res 62: 113-119.

41. Tan MA, Sharma N, An SSA (2022) Multi-target approach of *Murraya koenigii* leaves in treating neurodegenerative diseases. Pharmaceuticals 15: 188.

42. Bhowmik R, Roy S, Sengupta S, Sharma S (2021) Biocomputational and pharmacological analysis of phytochemicals from *zingiber officinale* (Ginger), *allium sativum* (garlic), and *murraya koenigii* (curry leaf) in contrast to type 2-diabetes. Int J App Pharm 13: 280-286.

43. Pandya PN, Kumar SP, Bhadresha K, Patel CN, Patel SK, et al. (2020) Identification of promising compounds from curry tree with cyclooxygenase inhibitory potential using a combination of machine learning, molecular docking, dynamics simulations and binding free energy calculations. Molecular Simulation 46: 812-822.

44. Govindarajan M, Sivakumar R, Rajeswary M, Yogalakshmi K (2013) Chemical composition and larvicidal activity of essential oil from *Ocimum Basilicum* (L.) against culex tritaeniorhynchus, Aedes albopictus and Anopheles subpictus (Diptera: Culicidae). Exp Parasitol 134: 7-11.

45. Mueller M, Hobiger S, Jungbauer A (2010) Anti-inflammatory activity of extracts from fruits, herbs and spices. Food Chem 122: 987-996.

46. Umamageswari A, Kudagi B (2015) Anti-inflammatory and Analgesic Properties of *Ocimum Sanctum*: A comparative study using animal models. Int J Basic Clin Pharmacol 4: 981-986.

47. Eftekhar N, Moghimi A, Roshan NM, Saadat S, Boskabady MH (2019) Immunomodulatory and anti-inflammatory effects of hydro-ethanolic extract of *Ocimum Basilicum* leaves and its effect on lung pathological changes in an ovalbumin-induced rat model of asthma. BMC Complement Altern Med 19: 349.

48. Sakkas H, Papadopoulou C (2017) Antimicrobial activity of basil, oregano, and thyme essential oils. J Microbiol Biotechnol 27: 429-438.

49. Opalchenova G, Obreshkova D (2003) Comparative studies on the activity of basil-an essential oil from *Ocimum Basilicum* L.-against multidrug resistant clinical isolates of the genera staphylococcus, enterococcus and pseudomonas by using different test methods. J Microbiol Meth 54: 105-110.

50. Adiguzel A, Gulluce M, Sengul M, Ogutcu H, Sahin F, et al. (2005) Antimicrobial effects of *Ocimum Basilicum* (Labiatae) extract. Turk J Biol 29: 155-160.

51. Chiang LC, Ng LT, Cheng PW, Chiang W, Lin CC (2005) Antiviral activities of extracts and selected pure constituents of *Ocimum Basilicum*. Clin Exp Pharmacol Physiol 32: 811-816.

52. Chattopadhyay D, Naik TN (2007) Antivirals of ethnomedicinal origin: Structure-activity relationship and scope. Mini Rev Med Chem 7: 275-301.

53. Gucwa K, Milewski S, Dymerski T, Szweda P (2018) Investigation of the antifungal activity and mode of action of thymus vulgaris, citrus limonum, pelargonium graveolens, cinnamomum cassia, ocimumbasilicum, and eugenia caryophyllus essential oils. Molecules 23: 1116.

54. Nugroho C, Mirnia E, Cumagun CJR (2019) Antifungal activities of sweet basil (*Ocimum Basilicum* L.) aqueous extract against sclerotium rolfsii, causal agent of damping-off on tomato seedling. Agrivita J Agri Sci 41: 149-157.

55. Cardoso NN, Alviano CS, Blank AF, Arrigoni-Blank MF, Romanos MT, et al. (2017) Anti-cryptococcal activity of ethanol crude extract and hexane fraction from *Ocimum Basilicum* Var. Maria Bonita: Mechanisms of action and synergism with amphotericin B and *Ocimum Basilicum* essential oil. Pharm Biol 55: 1380-1388.

56. Dasgupta T, Rao AR, Yadava PK (2004) Chemomodulatory efficacy of basil leaf (*Ocimum Basilicum*) on drug metabolizing and antioxidant enzymes, and on carcinogen-induced skin and forestomach papillomagenesis. Phytomedicine 11: 139-151.

57. Torres RG, Casanova L, Carvalho J, Marcondes MC, Costa SS, et al. (2018) *Ocimum Basilicum* but Not *Ocimum Gratissimum* Present Cytotoxic Effects on Human Breast Cancer Cell Line MCF-7, Inducing Apoptosis and Triggering mTOR/Akt/p70S6K Pathway. Journal of Bioenergetics and Biomembranes 50: 93-105.

58. Rasheed WI, Oraby FS, Hussein JS (2009) Therapeutic efficacy of garlic oil with 1, 25 dihydroxy Vit D and calcium in osteoporotic ovariectomized rats. Aust J Basic Appl Sci 3: 977-981.

59. Horcajada MN, Offord E (2012) Naturally plant-derived compounds: Role in bone anabolism. Current Molecular Pharmacology 5: 205-218.

60. Jayasinghe C, Gotoh N, Aoki T, Wada S (2003) Phenolics composition and antioxidant activity of sweet basil (*Ocimum basilicum* L.). J Agric Food Chem 51: 4442-4449.

61. Akhtar MS, Munir M (1989) Evaluation of the gastric antiulcerogenic effects of *Solanumnigrum*, *Brassica Oleracea* and *Ocimum Basilicum* in Rats. J Ethnopharmacol 27: 163-176.

62. Rashidian A, Roohi P, Mehrzadi S, Ghannadi AR, Minaiyan M (2015) Protective effect of *Ocimum Basilicum* essential oil against acetic acid-induced colitis in rats. J Evid Based Comp Altern Med 21: 36-42.

63. Tabassum N, Ahmad F (2011) Role of natural herbs in the treatment of hypertension. Phcog Rev 5: 30-40.

64. Fathiazad F, Matlobi A, Khorrami A, Hamedeyazdan S, Soraya H, et al. (2012) Phytochemical screening and evaluation of cardioprotective activity of ethanolic extract of *Ocimum Basilicum* L. (Basil) against isoproterenol induced myocardial infarction in rats. Daru 20: 87.

65. Mousavi L, MohdSalleh R, Murugaiyah V (2018) Phytochemical and bioactive compounds identification of *Ocimum Tenuiflorum* leaves of methanol extract and its fraction with an anti-diabetic potential. Int J Food Propert 21: 2390-2399.

66. Morshedy SA, Hasan S, Zweil S, Zahran M, Ahmed MH, et al. (2019) Growth performance, carcass traits, immune response and antioxidant status of growing rabbits supplemented with peppermint and basil essential oils. Egypt Poult Sci 39: 61-79.

67. Singh P, Mishra G, Srivastava S, Sangeeta K, Khosa R (2011) Phytopharmacological review of *Vitex negundo* (Sambhalu). Pharmacology online 2: 1355-1385.

68. Kamal N, Asni NSM, Rozlan INA, Mohd Azmi MAH, Mazlan NW, et al. (2022) Traditional medicinal uses, phytochemistry, biological properties, and health applications of *Vitex sp*. Plants 11: 1944.

69. Sichaem J, Nguyen HH, Nguyen VH, Mac DH, Mai DT, et al. () A new labdane-type diterpenoid from the leaves of *Vitex negundo* L. Natural Product Research 35: 2329-2334.

70. Sathiamoorthy B, Gupta P, Kumar M, Chaturvedi AK, Shukla PK, et al. (2007) New antifungal flavonoid glycoside from *Vitex negundo*. Bioorg Med Chem Lett 17: 239-242.

71. Rana G (2018) Inhibition efficiency of a newly isolated flavonoid compound from *Vitex negundo* L. leaves against cattle-endosymbiont Setariacervi: Phytomedicine for lymphatic filariasis. Parasite Epidemiology and Control 3: 88-95.

72. Lou ZH, Li HM, Gao LH, Li RT (2014) Antioxidant lignans from the seeds of *Vitex negundo* var. cannabifolia. J Asian Nat Prod Res 16: 963-969.

73. Hu P, Li DH, Hu X, Li SG, Sai CM, et al. (2016) Lignans and triterpenoids from *Vitex negundo* var. heterophylla and their biological evaluation. Fitoterapia 111: 147-153.

74. Xu JM, Hu BC, Yuan L, Wu YL, Luan SS, et al. (2019) Labdanes and megastigmanes from *Vitex negundo* var. heterophylla. Fitoterapia 137: 104265.

75. Masoomeh MJ, Kiarash G (2007) In vitro susceptibility of Helicobacter pylori to licorice extract. Iran J Pharm Res 6: 69-72.

76. Gupta VK, Fatima A, Faridi U, Negi AS, Shanker K, et al. (2008) Antimicrobial potential of *Glycyrrhiza glabra* roots. J Ethnopharmacol 116: 377-380.

77. Awate SA, Patil RB, Ghode PD, Patole V, Pachauri D, et al. (2012) Aphrodisiac activity of aqueous extract of *Glycyrrhiza glabra* in male wistar rats. WJPR 1: 371-378.

78. Yang EJ, Min JS, Ku HY, Choi HS, Park M, et al. (2012) Isoliquiritigenin isolated from *Glycyrrhiza uralensis* protects neuronal cells against glutamate-induced mitochondrial dysfunction. Biochem Biophys Res Commun 421: 658-664.

79. Shin YW, Bae EA, Lee B, Lee SH, Kim JA, et al. (2007) *In vitro* and *in vivo* antiallergic effects of *Glycyrrhiza glabra* and its components. Planta Med 73: 257-261.

80. Xu-ying W, Ming L, Xiao-dong L, Ping H (2009) Hepatoprotective and anti-hepatocarcinogenic effects of glycyrrhizin and matrine. J Chemico-Biological Interact 181: 15-19.

81. Harwansh RK, Patra KC, Pareta SK, Singh J, Biswas R (2011) Pharmacological studies on *Glycyrrhiza glabra*: A review. Pharmacology 2: 1032-1038.

82. Yoon G, Jung YD, Cheon SH (2005) Cytotoxic allyl retrochalcone from the roots of *Glycyrrhiza* inflate. Chem Pharm Bull 53: 694-695.

83. Mi-Ichi F, Miyadera H, Kobayashi T, Takamiya S, Waki S, et al. (2005) Parasite mitochondria as a target of chemotherapy: Inhibitory effect of licochalcone A on the Plasmodium falciparum respiratory chain. Ann NY Acad Sci 1056: 46-54.

84. De Simone F, Aquino R, De Tommasi N, Mahmood N, Piacente S, et al. (2001) Anti-HIV aromatic compounds from higherplants. Bioactive Compounds from Natural Sources 305: 305-336.

85. Mustafa SB, Akram M, Asif HM, Qayyum I, Hashmi AM, et al. (2019) Antihyperglycemic activity of hydroalcoholic extracts of selective medicinal plants Curcuma longa, Lavandula stoechas, Aegle marmelos, and *Glycyrrhiza glabra* and their polyherbal preparation in alloxan-induced diabetic mice. Dose Response 17: 1559325819852503.

86. Kuang Y, Li B, Fan J, Qiao X, Ye M (2018) Antitussive and expectorant activities of licorice and its major compounds. Biol Org Med Chem 26: 278-284.

87. Dhingra D, Parle M, Kulkarni SK (2004) Memory enhancing activity of *Glycyrrhiza glabra* in mice. J Ethnopharmacol 91: 361-365.

88. Yun DG, Lee DG (2016) Silibinin triggers yeast apoptosis related to mitochondrial Ca (2+) influx in Candida albicans. Int J Biochem Cell Biol 80: 1-9.

89. Mina PR, Kumar Y, Verma AK, Khan F, Tandon S, et al. (2020) Silymarin, a polyphenolic flavonoid impedes Plasmodium falciparum growth through interaction with heme. Nat Prod Res 34: 2647.

90. Olias-Molero AI, Jimenez-Anton MD, Biedermann D, Corral MJ, Alunda JM (2018) In-Vitro activity of silybin and related flavonolignans against *Leishmania Infantum* and *L donovani*. Molecules 23: 1560.

91. Mata-Santos HA, Lino FG, Rocha CC, Paiva CN, Branco MTC, et al. (2010) Silymarin treatment reduces granuloma and hepatic fibrosis in experimental schistosomiasis. Parasitol Res 107: 1429-1434.

92. Evren E, Yurtcu E (2015) *In vitro* effects on biofilm viability and antibacterial and antiadherent activities of silymarin. Folia Microbiol (Dordrecht, Neth.) 60: 351-356.

93. Lee DG, Kim HK, Park Y, Park SC, Woo ER, et al. (2003) Gram-positive bacteria specific properties of silybin derived from Silybum marianum. Arch Pharmacal Res 26: 597-600.

94. Ashfaq UA, Javed T, Rehman S, Nawaz Z, Riazuddin S (2011) Inhibition of HCV 3a core gene through Silymarin and its fractions. Virology Journal 8: 1-7.

95. McClure J, Lovelace ES, Elahi S, Maurice NJ, Wagoner J, et al. (2012) Silibinin inhibits HIV-1 infection by reducing cellular activation and proliferation. PLoS One 7: 41832.

96. Camini FC, da Silva TF, da Silva Caetano CC, Almeida LT, Ferraz AC, et al. (2018) Antiviral activity of silymarin against Mayaro virus and protective effect in virus-induced oxidative stress. Antiviral Res158: 8-12.

97. Kim SH, Choo GS, Yoo ES, Woo JS, Han SH, et al. (2019) Silymarin induces inhibition of growth and apoptosis through modulation of the MAPK signalling pathway in AGS human gastric cancer cells. Oncol Rep 42: 1904-1914.

98. Gioti K, Papachristodoulou A, Benaki D, Havaki S, Beloukas A, et al. (2019) Silymarin enriched extract (*Silybum marianum*) additive effect on DoXorubicin-mediated cytotoxicity in PC-3 prostate cancer cells. Planta Med 85: 997-1007.

99. Zappavigna S, Vanacore D, Lama S, Potenza N, Russo A, et al. (2019) Silybin-induced apoptosis occurs in parallel to the increase of ceramides synthesis and miRNAs secretion in human hepatocarcinoma Cells. Int J Mol Sci 20: 2190.

100. Cufi S, Bonavia R, Vazquez-Martin A, Corominas-Faja B, Oliveras-Ferraros C, et al. (2013) Silibinin meglumine, a water-soluble form of milk thistle silymarin, is an orally active anti-cancer agent that impedes the epithelial-to-mesenchymal transition (EMT) in EGFR-mutant non- small-cell lung carcinoma cells. Food Chem Toxicol 60: 360-368.

101. Wang HJ, Jiang YY, Wei XF, Huang H, Tashiro S, et al. (2010) Silibinin induces protective superoxide generation in human breast cancer MCF-7 cells. Free Radical Res 44: 90-100.

102. Sharifi R, Pasalar P, Kamalinejad M, Dehpour AR, Tavangar SM, et al. (2013) The effect of silymarin (*Silybum marianum*) on human skin fibroblasts in an in vitro wound healing model. Pharm Biol 51: 298-303.

103. Samanta R, Pattnaik AK, Pradhan KK, Mehta BK, Pattanayak SP, et al. (2016) Wound healing activity of silibinin in mice. Pharmacogn Res 8: 298-302.

104. Hu X, Qin N, Xue J, Li S, Huang X, et al. (2020) Dehydrodiconiferyl alcohol from *Silybum marianum* (L.) Gaertn accelerates wound healing via inactivating NF-kappaB pathways in macrophages. J Pharm Pharmacol 72: 305-317.

105. Katiyar SK, Meleth S, Sharma SD (2008) Silymarin, a flavonoid from milk thistle (*Silybum marianum* L.), inhibits UV-induced oxidative stress through targeting infiltrating CD11b+ cells in mouse skin. Photochem Photobiol 84: 266-271.

106. Li LH, Wu LJ, Tashiro SI, Onodera S, Uchiumi F, et al. (2006) The roles of Akt and MAPK family members in silymarin's protection against UV-induced A375-S2 cell apoptosis. Int Immunopharmacol 6: 190-197.

107. Katiyar SK, Mantena SK, Meeran SM (2011) Silymarin protects epidermal keratinocytes from ultraviolet radiation-induced apoptosis and DNA damage by nucleotide excision repair mechanism. PLoS One 6: 21410.

108. Svobodova AR, Gabrielova E, Ulrichova J, Zalesak B, Biedermann D, et al. (2019) A pilot study of the UVA- photoprotective potential of dehydrosilybin, isosilybin, silychristin, and silydianin on human dermal fibroblasts. Arch Dermatol Res 311: 477-490.

109. Cheon HI, Bae S, Ahn KJ (2019) Flavonoid Silibinin Increases Hair-Inductive Property Via Akt and Wnt/beta-Catenin Signaling Activation in 3-Dimensional-Spheroid Cultured Human Dermal Papilla Cells. J Microbiol Biotechnol 29: 321-329.

110. Karbasforooshan H, Hosseini S, Elyasi S, Pakdel AF, Karimi G (2019) Topical silymarin administration for prevention of acute radiodermatitis in breast cancer patients: A randomized, double-blind, placebo-controlled clinical trial. Phytother Res 33: 379-386.

111. Shin S, Lee JA, Kim M, Kum H, Jung E, et al. (2015) Anti-glycation activities of phenolic constituents from *Silybum marianum* (Milk Thistle) flower in vitro and on human explants. Molecules 20: 3549-3564.

112. Kitajima S, Yamaguchi K (2009) Silybin from *Silybum marianum* seeds inhibits confluent-induced keratinocytes differentiation as effectively as retinoic acid without inducing inflammatory cytokine. J Clin Biochem Nutr 45: 178-184.

113. Gautam S, Shirolkar S, Ahamed SE, Banerjee S, Pal AK, et al. (2022) Preprocedural Mouth Rinse in COVID-19 Era-Chemical and Phytotherapeutic Approach. Journal of Primary Care Dentistry and Oral Health 3: 1-4.

114. Tshilanda DD, Ngoyi EM, Kabengele CN, Matondo A, Bongo GN, et al. (2020) Ocimum species as potential bioresources against COVID-19: A review of their phytochemistry and antiviral activity. International Journal of Pathogen Research 5: 42-54.

115. Mitra D, Verma D, Mahakur B, Kamboj A, Srivastava R, et al. (2022) Molecular docking and simulation studies of natural compounds of *Vitex negundo* L. against papain-like protease (PLpro) of SARS CoV-2 (coronavirus) to conquer the pandemic situation in the world. J Biomol Struct Dyn 40: 5665-5686.

116. Armanini D, Fiore C, Bielenberg J, Sabbadin C, Bordin L (2020) Coronavirus-19: possible therapeutic implications of spironolactone and dry extract of *Glycyrrhiza glabra* L. (licorice). Frontiers Pharmacol 11: 558418.

117. Purohit P, Mishra B (2017) Systematic review on interaction studies of synthetic antidiabetic drugs and herbal therapies. J Pharm Res16: 86-94.

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