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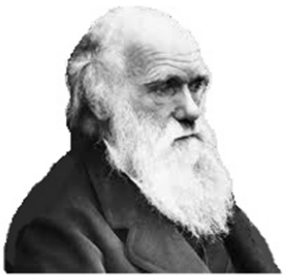

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Potential role of bioactive compounds in the prevention of coronavirus: an overview

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ABSTRACT

This study highlights the importance of natural products in drug development, particularly Indian medicinal herbs with high biological potential. Major immunity-developing plant species were collected from the literature. These substances must be synthesized in the lab to enhance the human immune system to fight new viruses like novel corona to promote sustainable processes with little damage. Nature has bestowed numerous plant species with bioactive chemicals that can be utilized safely and effectively to treat various ailments in all living organisms. India, due to its diverse climate, is home to many plant species that possess medicinal properties. Some of the bioactive compounds found in Indian traditional medicine include tannins, phenols, terpenoids, flavonoids, esters, and other small chemicals. These compounds are known to exhibit biological activity and have been utilized in traditional medicinal practices in India.

Keywords: Medicinal herbs, immunity, Bioactive, Natural products, novel corona, synthetic method

1. INTRODUCTION

Throughout history, India has been known as the world's "spice capital". As early as 6000 BCE, the Rig Veda mentioned the benefits of several spices for therapeutic purposes. Black pepper and turmeric both have therapeutic properties that are detailed in the Vedic texts Ramayana (Great Indian Epic), Yajur, and Atharva Veda. Numerous written historical evidence

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attests to the fact that India exported numerous herbs and spices to Arabia, China, England, and Greece [1]. Since the beginning of Earth's history, nature has provided scientists with a wealth of potential drug candidates. Many scientists, pharmacists, chemical engineers, and chemists are working to develop synthetic versions of natural antimicrobials and medicines. Many infectious, pandemic diseases still kill thousands of people every year all over the world, despite advances in science and technology [2].

Since no treatments or vaccines were available, the world suffered from the coronavirus known as COVID-19. Each person must take responsibility for his or her own health and safety by learning about and using the time-tested remedies recommended in the Vedas and used by our forebears. Morbidity or disability and mortality are caused by major respiratory illnesses. These include asthma, sarcoidosis, pulmonary fibrosis, and chronic obstructive pulmonary disease (COPD). Many individuals have trouble breathing because of things like allergies, pollution, lung diseases, poor lifestyle decisions, being overweight, eating an unhealthy diet, smoking, and so on. World Health Organisation estimates that 13 million people in industrialized countries like the United States suffer from asthma, whereas 42 million people in underdeveloped countries like India are affected by the disease. Histamine, reactive oxygen species, and eicosanoids release bronchoconstriction, vasodilation, and mucus secretion in allergic asthma's early phase. Inflammatory mediators cause airflow obstruction by causing microvascular leakage and plasma exudation. Eosinophils, basophils, macrophages, neutrophils, and CD4* T lymphocytes activate following allergen exposure, causing airway irritation and hyperresponsiveness. Ayurveda and Siddha recommend balanced meals, breathing exercises, and medicinal herbs to boost the immune system. COPD, or chronic obstructive pulmonary disease, is another respiratory condition caused by airflow restriction [3]. Long-term exposure to irritants like cigarette smoke inflames the lungs' alveolar structures. India had around 33 million COVID-19 infections and 440,000 fatalities by September 2021.

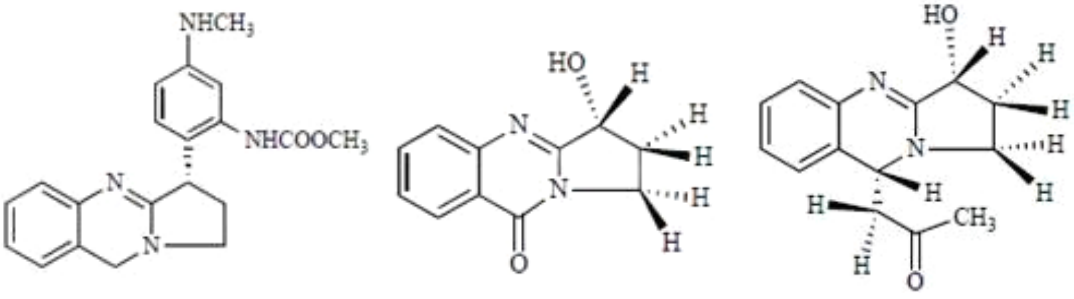
The second wave of the pandemic in India, which began in February 2021, was devastating. Daily case counts and mortality reached record highs. Many parts of the country ran out of hospital beds, medical oxygen, and other essentials due to the surge in cases. To fulfill demand, the government and other organizations increased medical oxygen and other supply production and delivery. Lockdowns, travel restrictions, and vaccination efforts helped the Indian government contain the illness. The government increased the vaccine supply and expanded the immunization program to encompass new age ranges and priority groups. We are protecting and discovering our natural remedies' infinite value. We must teach our children about Ayurveda, Siddha, and holistic botanicals, which have saved countless lives during a pandemic. These traditional medications strengthen the immune system. This review examines the biological activity of *Adhatoda vasica* Nees, *Anacyclus pyrethrum, Andrographis paniculata* Nee, *Anisochilus carnosus, Terminalia chebula, Clerodendrum serratum, Costus speciosus, Tinosporaa serratum, Zingiber oficinale* Roscoe, *Piper longum*, and their role in improving the immune system and fighting respiratory diseases.

2. MATERIALS AND METHODS

Analyses are conducted on the many different herbal medicines obtained from a wide variety of plant sources. The indigenous treatments that have proven effective in India are dissected here.

2. 1. *Adhatoda vasica*

Since the beginning of Ayurveda, which dates back over two thousand and five hundred years, the practice of Adhatoda has been utilized in numerous locations across India and the rest of the world. Yogis and sadhus, who are revered in India, have conducted research on the potential therapeutic benefits of the adosa plant's leaves. Chewing the leaves with ginger helps to activate the respiratory system, particularly the lungs. It is also known as adosa, and its primary application in medicine is the treatment of respiratory conditions. Due to the high concentration of an alkaloid found in the plant known as vasicine (quinazoline alkaloid), the plant's antispasmodic properties play an important part in the treatment of chronic bronchitis, respiratory disease, and asthma [4]. Figure 1 presents the chemical structures of adhatodine (a), vasicinone (b), and peganidine (c) respectively. The presence of main alkaloid components such vasicine and vasicinone, which are the active chemicals used to treat asthma and other respiratory diseases, is necessary for the treatment of these conditions. Roots and leaves are the primary components of the medicinal preparation that are utilised for the treatment of bronchitis, bronchiole problems, dry cough, and the common cold. The juice extracted from the adhatoda leaf successfully soothes the inflammation in the throat. Epitaraxerol, Peganidine [5], Adhatodine [6], Vasicinone [7], Proline, Sitiosterol [8], Daucosterol, Vasicine from the roots, Vitamin C about 1.5% from leaves and 5.2% from its roots [9], are some of the primary bioactive chemicals that have been identified from adhatoda. A main chemical component referred to as ambroxol and bromhexine that is derived from vasicine is used to treat TB, which is a condition that can ultimately be deadly. In an acidic environment, the development of the mycobacterium tuberculosis bacteria is inhibited. These chemical components fall into this category. In order to treat TB in a roundabout way, it is necessary to promote the production of rifampicin and lysozyme levels in the lung tissue, sputum, and bronchitis [10, 11].



(a) **(b)** **(c)**

Figure 1. Chemical structure of **(a)** Adhatodine, **(b)** Vasicinone, **(c)** Peganidine [12]

2. 2. *Anacyclus pyrethrum*

Due to its therapeutic and insecticidal properties, Ayurvedic medicine uses Akarkara or *Anacyclus pyrethrum*, which is overexploited. The root-secreted pyrethrum medicine comprises ester pyrethrins, pellitorine (N-alkyl amides), triterpenes, coumarins, gallic acids, sterols, tannins, holosids, and mucilage. Anti-inflammatory [13], anti-catarrh, analgesic, antiviral, vermifuge, enhance digestion, molluscicidal, and febrifuge [14]. Iron, nickel, zinc, traces of

cadmium, and chromium are active metals. The leaf ethanolic extract contains polyphenols, flavonoids, anthraquinones, amino acids, and reducing sugar. Chewing the root heals neuralgic infections, tooth pain, headaches, and local stimulants in the throat or tongue epilepsy [15]. Finely powdered Akarkara root treats chronic nasal catarrh, nasal mucus flow, and headache [16]. The plant's ethanolic extract contains Sitosterol (5.49%), Benzofuran-2-carboxaldehyde (5.50%), Palmitic acid (13.39%), and Naphthalene (7-Tetradecenal, (Z)) (7.08%).

2. 3. *Andrographi spaniculata* Nees

Plant bioactive chemicals may heal AIDS [17]. Deoxyandrographolide, andrographolide, and neoandrographolide (diterpenoid lactones) are medium-sized bioactive compounds in plant matrices [18]. Polyphenols, diterpenoids, and flavonoids in *Andrographis paniculata* Nee treat lung infections, sore throat, fever, heart disease, and infectious illnesses [19]. Andrographolide (diterpenoid) adds 4% to the plant, leaf extracts 0.6%, and stem 12%.

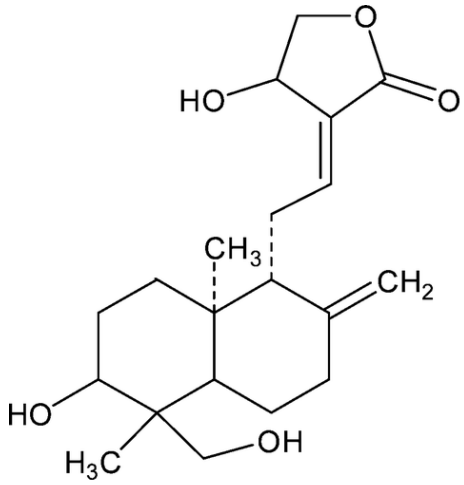


Figure 2. Chemical structure of andrographolide

2. 4. *Anisochilus carnosus*

Karpooravalli, or *Lamiaceae*, grows in India, Malaysia, Myanmar, and Sri Lanka. Annual plant with gel-like leaves. α-cisbergamotene, carvacrol, and camphor help treat liver, stomach, sore throat, and colds. Traditional medicine uses the herb to treat fever, influenza, toxic bites, respiratory issues, and gastrointestinal issues [20]. Gram-negative K. pneumoniae is more susceptible to the plant extract [21].

2. 5. *Terminalia chebula*

Flavins, steroids, polyphenols, flavonoids, and glycosides cure fever, dry cough, diarrhea, candidiasis, wounds, skin impairments, and urinary infections [22]. This is one of India's three-thousand-year-old medicinal plants. China, Tibet, and Pakistan have this plant. Eugenol, terflavin A, B, C, D, casuarinin, Punicalagin, pyrogallol, trihydroxy benzene [23], and phloroglucinol cure throughout therapy.

2. 6. *Clerodendrum serratum*

Since five millennia, India has used Bharngi for various ailments. Ayurveda has 8,000 treatments. Samhitakala says this plant's medicine treats dyspnea, swelling, wounds, coughs, colds, and neurological issues. This plant is rich in sodium, aluminium, potassium, magnesium, calcium, vanadium, manganese, iron, nickel, and cobalt [24]. Figure 3 shows Punicalin, Chebulinic acid, and Shikimic acid structures. Clerosterol, Stigmasterol, Saponins, Queretaroic acid, B-sitosterol from the roots, 7-o-gluconoids of hispidulin, Catchin, Luteoline, and carbohydrates from the plant leaf [25]. Cleroflavone and hispidulin flavonoids fight bacteria, asthma, tumours, and carbon, nitrogen, and sulphur binding. Pectolinarigenin, scutellarein, and apigenin are isolated flavonoids. Acteoside, verbascoside, serratagenic acid, and indolizine are antimicrobial, hypertensive, and anti-inflammatory phenols [26]. Isolated terpenes such clerodermic acid, friedelin, betulin, clerosterol, and campesterol have strong molluscicidal and fungitoxid activity. Guinea pig lung tests showed antiasthmatic potential. Icosahydropicenic acid, a novel root chemical, protects mast cells by 59.62%.

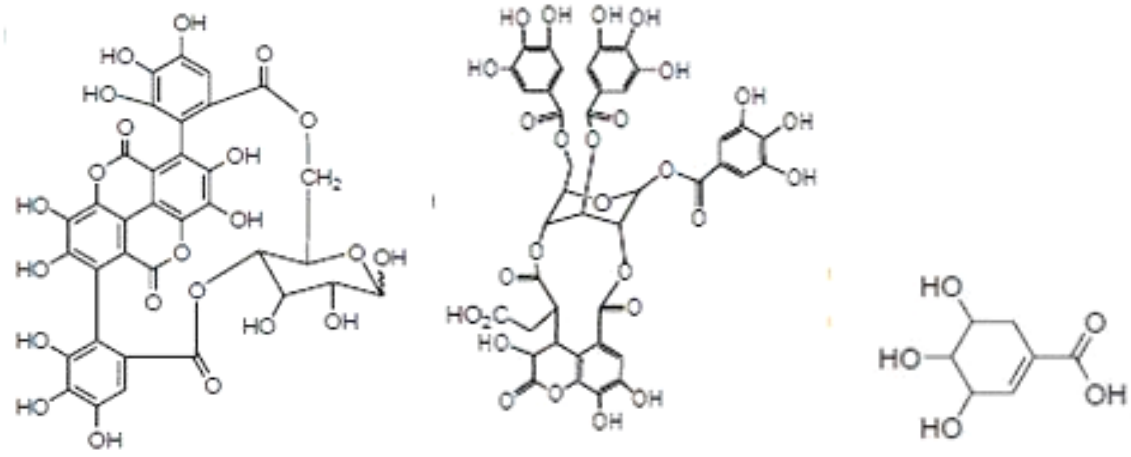


Figure 3. Chemical structure of (a) Punicalin (b) Chebulinicacid (c) Shikimic acid

2. 7. *Costus speciosus*

In India, pancake ginger is called Shura, Kushta, Kottam or Koshtam. South Indian tribes eat it for medical purposes [27]. It protects against colds, coughs, snake bites, arthritis, wounds, and jaundice. It also treats skin infections, bronchitis, constipation, and anemia. Ayurveda calls pancake ginger acidic, anthelmintic, febrifuge, cooling, purgative, and aphrodisiac. The herb treats asthma, anemia, and inflammation. Curcumin from turmeric (Zingiberaceae species) treats colon, breast, and lung cancer [28, 29].

2. 8. *Tinosporia serratum*

Many Tinospora species are used in folk medicine to treat pharyngitis, cold, ulcer, respiratory diseases, fever, digestion, arthritis, and diabetes [30]. Tinospora powder prevents upper respiratory illness as an antioxidant, anti-inflammation, anticancer, and immunostimulator [31]. *Tinospora capillipes* fine powder treats asthma, bronchitis, and pneumonia [32].

2. 9. *Zingiber oficinale* Roscoe

Polyphenols such as gingerol, zingerone, 6-dehydrogingerdione, and quercetin have made ginger a medicinal since the Vedic time [33]. Ginger, from the *Zingiberaceae* family, is the main spice in Indian food because it can fight colds, emesis, head pain, respiratory issues, cardiovascular diseases, antioxidants, anti-inflammatory activity in albino rats, immunomodulation, and microbes. Due to its terpenes, ginger oil boosts immunity.

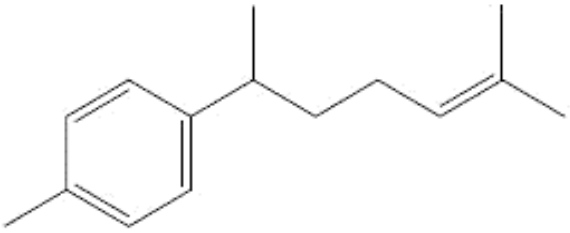


Figure 4. Chemical structure of curacumene

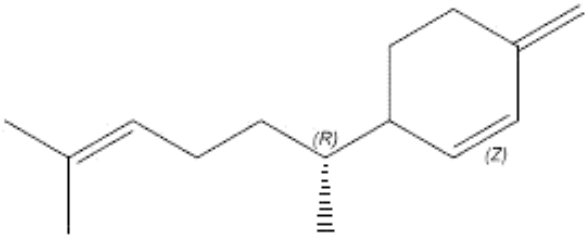


Figure 5. Chemical structure of zingiberene

2. 10. *Piper longum*

Indian cuisine uses long pepper (1-piperoylpiperidine) from the *Piperaceae* family because of its therapeutic properties. Sri Lanka, tropical India, Eastern nations, and America are its key locations. Pepper roots include piperlongumine [34], tetrahydropiperlongumine, and trimethoxycinnamoyl-piperidine. Alkaloids such as piperine, brachystamide, piperettine, pellitorine, refractomide, pipercide, methyl piperine, and brachystine [35].

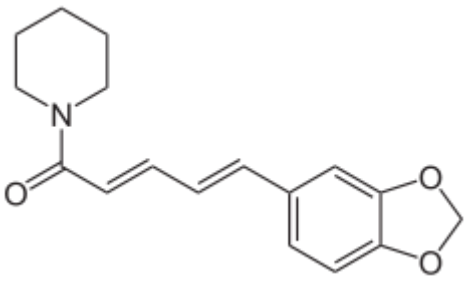


Figure 6. Structure of Piperine

Fargesin, sesaminlignans, and esters such Z-12-octandecenoic –glycerol-monoester and tridecyl-dihydro-pcoumaarate are in pepper fruit. Piperine irritated morphine-induced respiratory depression. Immunoregulatory peperinic acid from Piper longum decreased lymphocytes and cytokine levels.

2. 11. Yogasana

Savasana, Paschimotasana, Bhujangasana, and Shalabhasana increase lung circulation. Pranayama cleanses nadi and increases or decreases pranic energy flow. Easy diaphragmatic breathing increases lung airflow [36].

3. CONCLUSIONS

Traditional medicine, used since the Vedic period and detailed in Ayurveda and Siddha, was helpful during the pandemic worldwide shutdown, and the practice of strengthening one's immune system should be given more consideration. In order to defend ourselves against the dangerous Coronavirus and ensure that we do not fall victim to it, we need to fortify our immune systems. Because of the significant number of lives that have already been lost, we should no longer place our hope in the development of a vaccine or treatment. By that time, we ought to follow the path of our traditional and sacred herbs, which were brought up earlier, and the biological potential of which has been uncovered by a great number of researchers.

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