

A REVIEW ON EXTRACTS OF PLANTS WITH ANTIVIRAL PROPERTIES AS NATURAL SANITISERS

Vyshnavi V Rao ^{1*}, Varsha.N ², Malavika.B ³, Yashas M ⁴, Yamuna M ⁵, Harish B ⁶,
Harshavardhana R ⁷, Dhanushri A ⁸

¹Assistant Professor, Department of Chemistry, MES College of Arts, Commerce and Science, India.

^{2,3,4,5,6,7,8} Student, Department of Chemistry, MES College of Arts, Commerce and Science, India.

*For correspondence: Vyshnavi V Rao ^{MSc, CSIR-NET}, Email: vyshu.23vrao@gmail.com

Abstract —

Nature is one of the best sources of medicine since ages. Plants play a significant role in maintaining human health and improving the quality of life. The current situation has seen a sudden inflation of viral pandemic. Treatment of viral contaminations with accessible antiviral medications frequently prompts the issue of viral resistance and an expanding requirement for herbal substances with antiviral activity. One of the several methods to combat this deadly disease is to maintain a good hygiene. Hand hygiene plays an important role in preventing the spread of viral transmission. There are many chemical sanitizers already established and widely in use across the world. However a natural replacement to these chemicals is any day a safe prerogative that needs attention of new age scientists and clinicians. Herbs were considered as a natural treatment from ancient times against several diseases including the viral infections. The specific concentration and composition of active phytochemicals in herbs helps them possess antiviral effects. This review aims to evaluate the antiviral properties of several plants such as Basil, *Spirulina platensis*, Ginseng, peppermint, rosemary, sage, ginger, garlic, licorice and their extracts that can be extended to synthesize natural sanitizers with a potential to replace the chemical ones.

Key words — Hand hygiene, Herbs, Medicinal plants, Natural sanitizers, viral disease.

1. INTRODUCTION

Contagious viral infections are a major global cause of distress and fatality affecting three to five million patients annually [1]. Antivirals are the substance

which can produce either a protective or therapeutic effect to clear the detectable changes induced by the virus or inhibit vital viral protein machinery in the infected host [2]. Antivirals substance can be extracted and isolated from a variety of sources such as algae, bacteria, fungi, animals, plants or it can also be obtained by chemical synthesis [3].

Medicinal plants have been widely used to treat a variety of infectious and non-infectious ailments. The World Health Organization estimates that 80% of people living in developing countries depend on traditional medicinal practices for their primary health care. Historically natural products, either as pure compounds or as standardized plant extracts, have been sources of inspiration for the development of new drugs [4]. According to one estimate, 25% of the commonly used medicines contain compounds isolated from plants [5]. Plants possess a broad spectrum of defense mechanisms to tackle viral diseases. Their endogenous proteins of the plant defense responses are mediated against viruses and can function as virus suppressors [6] [7].

India has prosperous and unique collection of flora, with an estimated 45000 plant species, among which majority are medicinal plants spread throughout the country [8]. The nation has herbal medicine as an integral part of the traditionally followed conspicuous practices of Ayurveda, Unani and others. Ancient books like Charaka Samhita and Sushruta Samhita mention about seven hundred herbal drugs with their diverse properties and clinical effects and as a cure for many deadly diseases [2].

The search for antiviral agents began accidentally in the 1950s with little or no scientific basis [6].

Research activities for development of antiviral agent started only after the Second World War in Europe and in 1952, the Boots drug company at Nottingham, England, examined the action of 288 plants against influenza A virus in embryonated eggs. Canadian researchers in the 1970s reported antiviral activities against herpes simplex virus (HSV), poliovirus type 1, coxsackievirus B5 and echovirus 7 from grape, apple, strawberry and other fruit juices [9].

There is currently a large and ever expanding global population that prefers the use of natural products in treating and preventing medical problems. This has influenced many pharmaceutical companies to produce new antimicrobial formulations extracted from plants or herbs [10]. The abundantly rich flora found in a variety of environments, offer an enormous source of potential plant derived compounds with anti-microbial and therapeutic uses. With the advancement of high performance and efficient tools and techniques it has now become possible to isolate highly pure plant compounds with ease and of good quality grade, which eventually become handy in treating existing and emerging diseases [11]. The abundant use of anti-infective agents resulted in the emergence of drug-resistant bacteria, fungi, and viruses. To overcome the rampant rise in resistance of pathogenic microbes, a variety of medicinal plants have been screened worldwide for their antimicrobial properties aiming to find effective antimicrobial agents with novel modes of actions [12].

Co-evolution between plants and their natural enemies including insects, bacteria, fungi, nematodes, animals, humans, and viruses are considerably far more reaching than any current theory of reciprocal interactions. In order to adapt to environmental distress, plants produce a vast number of natural products that have antimicrobial and immunomodulating potential. Counter-resistance, genetic adaptability and polymorphic immune capacity among microbial agents attribute to the immense diversity of species and endless biochemical possibilities. These biosynthetic capacity and complex characteristics of their bioactive components allow humans to use plants as promising antiviral and immunomodulating phototherapeutics [11] [13]. The extracts of the medicinal plants are

viewed boost essential antiviral defence of human body and the mechanism may vary among different virus [6]. Some of the antiviral components present in higher plants include tannins, flavones and alkaloids and have displayed in vitro activity against numerous viruses [14].

The emergence of antiviral resistant viral strains is the most important issue that should be addressed while development of therapeutics. It is significant to isolate less toxic and more specific antiviral molecules with multiple targets to overcome antiviral resistance [15]. Disposal of resistant viral strains is another area of concern that may be a fundamental reason for therapeutic failure [16]. Thus, it would be desirable to produce antimicrobial compositions from plants infused with the antiviral phytochemicals which are easy to formulate into a homogenous aqueous mixture or into essential oils to treat hard surfaces. Such a formulation would aid their application and efficacy of the resulting antimicrobial composition. Moreover, the environmental concerns demand the need to use more natural and environmentally acceptable antimicrobial ingredients in consumer products such as sanitizers, disinfectants and disinfectant cleaners [17].

2. PRELUDE TO VIRUSES

Viruses are submicroscopic infectious particles which contain a core of nucleic acid enclosed within a protein coat [see **FIG 1**]. They are non-functional or remain dormant outside the host tissue. They are usually known as pathogens but they are not usually regarded as genuine microorganisms. The nucleic acid core or the genetic information encodes all the essential viral protein machinery required for transcriptions and replications taking place in the host cell. Some viruses even exploit the host biochemical machinery for the same. The viruses do not store or capture free energy.

Most of the viruses are specified to a distinct type of host. The bacteriophages are viruses that infect bacteria, whereas others are known to infect protozoa, algae, micoviruses etc. The viruses can be transmitted between a plant host and animal host through a feeding invertebrate intermediate vector. The virus possesses ability to sustain and replicate within both their vector and their host.

Viruses and their infections are largely associated with delirious after effects in animal hosts leading to death and plant host causing huge loss in production of crop and quality in all parts of the plants. Some infections caused by viruses in animal host are smallpox, common cold, influenza, measles, chicken pox, hepatitis, herpes, polio, rabies, Ebola, AIDS, most recent COVID-19 and many more. Some common plant viruses infecting plant host are Tobacco Mosaic Virus, Cucumber Mosaic Virus, Potato Virus Y, Cauliflower Mosaic Virus, African Cassava Mosaic Virus and Plum Pox Virus. However some viruses proved to be beneficial and have recently been deployed in production of vaccines and as a competent biotechnological tool in drug delivery systems.

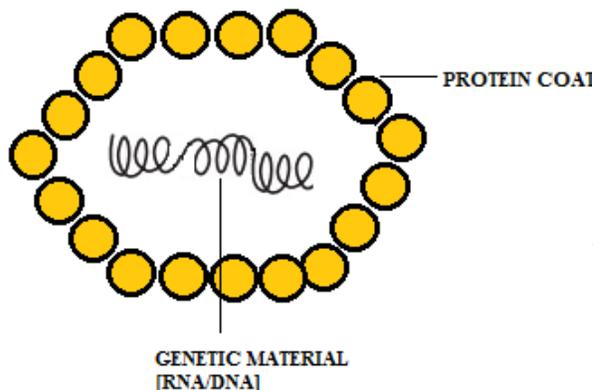


FIG 1: Simple representation of viral particles.

3. ANTIVIRAL PROPERTIES OF SOME PLANT EXTRACT

3.1 TULSI (*Ocimum tenuiflorum*)

Tulsi most commonly called as the sacred basil or holy basil, is an aromatic perennial plant belonging to the family Lamiaceae. Tulsi is one of the most important medicinal plants mentioned in the ayurvedic literature. Tulsi is one plant that has been used for its anti-infective and antiviral properties since ages. Decoctions made from the plant have proven antimicrobial effects as mentioned in the ancient literature. Essential oils from *ocimum* species are responsible for its antifungal, antibacterial and antiviral properties. Many bioactive compounds

present in tulsi like eugenol, citrulin, feruldehyde, oleanolic acid, uric acid can be attributed to its antiviral properties [18]. Bioactive compounds present in tulsi also show haemagglutination activity of the orthomyxo and paramyxo virus, Haemorrhages in the chicken embryos. Studies have proved that Tulsi extract exhibits antiviral activity against Newcastle Disease Virus (NDV) [19] and specifically *Oscimum basilicum* acts as strong antiviral agent against DNA viruses like Herpes virus, adenovirus and Hepatitis B virus and RNA viruses like enterovirus 71 [20].

3.2 ASHWAGANDHA (*Withania samnifera*)

Ashwagandha is also known as Indian ginseng, poison gooseberry or winter cherry. It is a tender short perennial shrub from the family Solonaceae. It has a sweet root that is a powerful immune booster and adaptogen, helps to fight off stress. Among its various medicinal properties, it is also used as antiviral herb for the treatment of genital disease caused by Herpes simplex virus among the African tribes. It also shows antiretroviral activity against HIV infection [21].

3.3 ALOE VERA

Aloevera is a succulent cacti species of the genus Aloe. It belongs to a family Asphodelaceae. It is also called as Kumari in Sanskrit, Kumari refers to young girl. Since in ancient times, it has been in use to cure disesaes of young girls like pimples and menstrual discomfort. It is reported that Aloevera gel contains more than seventy five active ingredients. Studies have reported inhibitory effects of aloevera against viruses such as human cytomegalo virus, herpes simplex virus type-2 (HSV-2) and also against Polio virus [22].

3.4 GINGER (*Zingiber officinale*)

Ginger is a flowering herb whose rhizome is widely used as a spice and a folklore medicine. The Ayurveda mentions, Ginger to be used to combat cold and as an excellent remedy for flue. The active compounds in ginger can ease morning sickness, travel sickness and nausea. One of the study reports revealed that fresh ginger is effective against Human

Respiratory Syncytial Virus (HRSV) that interferes with plaque formation on airway epithelium by blocking attachment and internalization of viral particles [23].

3.5 PEPPERMINT (*Mentha piperita*)

The Peppermint is a hybrid between watermint and spearmint belonging to the family Lamiaceae. It is a wild perennial herb indigenous to Middle Eastern and European nations. It is known to have powerful antiviral qualities and commonly added to tea, extracts and tinctures meant to naturally treat viral infection. Its leaves and essential oils contain active components that possess antiviral and anti-inflammatory activity. The peppermint oil shows inhibitory activities against herpes simplex virus type-1 (HSV-2), herpes simplex virus type-2 (HSV-2). It is also active against an acyclovir resistant strain of HSV-1 and has shown to significantly reduce Plaque formation [24].

3.6 GARLIC (*Allium sativum*)

Garlic is a prominent member of family Amaryllidaceae, the onion family. It is closely related to onion, shallot and leek. Ayurveda mentions garlic to reduce inflammation and blood pressure. It is also used for lowering body weight. Organo Sulphur compounds like Allicin, Diallyl Trisulphide and ajoene are the main biochemicals extracted from garlic which are associated with antiviral activities. Studies report that Allicin can pass through Phospholipid membrane of cell and inhibits viral multiplication. Garlic has shown prominent inhibitory effect against Enterovirus and Influenza virus [25].

3.7 *Spirulina Platensis*

Spirulina is a biomass of cyanobacteria that can be consumed by humans and animals. Spirulina contains amino acids that provide digestive enzymes which facilitate healthy digestion. It helps to fight intestinal infections and to fight off viruses promoting digestion. It is a rich source of carotenoid which is world's most powerful antioxidant. It showed inhibitory effect against non-enveloped RNA and DNA enteric viruses, bacteria such as *Enterococcus*

faecalis and fungal species such as *Candida albicans* [26].

3.8 POKEWEED (*Phytolacca americana*)

Phytolacca americana, also known as American pokeweed or dragonberries is a poisonous, herbaceous perennial plant of the pokeweed family, Phytolaccaceae that grows up to 8 feet (2.4m) in height. The pokeweed antiviral protein has previously been identified as two forms (PAP and PAP II) in the leaves of the plant [27]. These proteins prevent replication of several viruses and inactivate ribosomes, thus inhibiting their protein synthesis [28].

3.9 *Phyllanthus amarus*

Phyllanthus amarus. belongs to the family Euphorbiaceae and is a small herb well known for its medicinal properties worldwide. It is an important plant of Indian Ayurvedic system of medicine which is used to treat disorders of stomach, genitourinary system, liver, kidney and spleen. It is a bitter tasting, astringent, stomachic, diuretic, febrifuge and antiseptic. The whole plant is used to treat gonorrhoea, menorrhagia and other genital infections. It is also useful in treating gastropathy, diarrhoea, dysentery, intermittent fevers, ophthalmopathy, scabies, ulcers and wounds. Phytochemical studies have revealed the presence of significant bioactive compounds such as lignans, flavonoids, hydrolysable tannins, polyphenols, triterpenes, sterols and alkaloids. The extracts and the compounds isolated from *P. amarus* show a wide range of pharmacological activities including antiviral, antibacterial, antiplasmodial, anti-inflammatory, antimalarial, antimicrobial, anticancer, antidiabetic, hypolipidemic, antioxidant, hepatoprotective nephroprotective and diurectic properties [29].

3.10 BITTER GOURD (*Mormordica charantia*)

Mormordica charantia commonly called as bitter gourd or bitter melon belongs to the family Cucurbitaceae. Every part of bitter gourd has its own herbal value. *Mormordica charantia* extracts inhibition of growth of many virus which including

HIV, Epstein Barr virus and Herpes simplex. The fruit and seed part of the plant contains antiviral proteins Momordica anti-HIV-protein which inhibits HIV in vitro [30]. Studies have shown that bitter gourd extracts exhibit inhibition against HIV replication by preventing cell to cell infection. The main components of *Momordica charantia* are triterpene, protein, steroid, alkaloid, inorganic, phenolic and lipid compounds. In Guyana tradition the leaf of bitter gourd is used to make leaftea that is used as a cure for diabetes, gastro-intestinal problems, menstruation, and as an antiviral for measles and Hepatitis [31].

4. CONCLUSION

Natural products and herbal medicine has been a major alternative to the conventional medication for several ages. They have been and continue to be major sources of bioactive components that are used to synthesize drugs and pharmaceuticals. Many traditional medicinal plants and herbs have strong antiviral activity and are used to fight a range of viral infections. Several plants and their extracts have been studied to possess a broad spectrum antiviral activity. However the scientific evidence for their activity and the mechanism of action needs data validation by In-Vitro and In-Vivo studies. An ever increasing population of pathogens resistant to the customary medication compels the scientific fraternity to undertake studies to search for novel potential solutions from easily available plant sources. There is an immediate requirement to develop natural remedies in the present scenario which has seen an outburst of viral pandemic. Bioactive antiviral phytochemicals prove to be the only alternatives in crisis like this where development of vaccination or conventional medication might be protracted. The easy access and cost effectiveness of herbal products add to their benefits. The current review provides supportive data on the use of some medicinal plants for the treatment and emphasizes need for future research to elucidate the active constituents of these plants which may be useful in the development of new and effective antiviral agents.

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