



## PHARMACOLOGICAL POTENTIAL OF VYAGHRADI KWATHA IN COMBATING INFECTIOUS RESPIRATORY DISEASES CAUSED BY AIR BORNE PATHOGENS

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## ABSTRACT

Medical science in the past decade has witnessed a drastic surge in diseases caused due to various pathogens, which have made their way into the body of the person via various modes of transmission. Among them air borne pathogens have been the most common and root cause for various epidemics that has left medical systems around the globe baffled and sent searching for newer and potent medicinal remedies to counteract microbial infection. Ayurveda in this regard has offered tremendous help in controlling and improving the health of the infected and preventing the further transmission into the uninfected by focusing on improving the immunity status and microbial response of the body by the usage of herbal drug preparations. This herbal drug approach from ayurveda was supported and stood up for by the authentic classical ayurvedic literature which has abundance of drug therapies and formulations that has been refined by centuries and centuries of usage. Among the various drug formulations prescribed by the acharyas in the ayurvedic literature, *Vyaghradi kwatha* is one renowned ayurvedic formulation mentioned in the classical literature in the context of respiratory disorders and used by ayurvedic physicians to fight respiratory system infections and to improve respiratory health. The formulation is mentioned in the ayurvedic literature *Astanga Hridaya*, *Chikitsa sthana* indicated for *Vatika* and *kaphaja jwara*, *Swasa*, *Kasa*, *pinasa* and *shula*. Individual analysis of the drugs in the formulation shows each of the drugs within the formulation are indi-

cated in disorders associated with the respiratory tract. In order to assess the pharmacological potential of the formulation, all relevant ayurvedic literature related to the formulation and literature corresponding to their individual pharmacological evaluations conducted, phytochemical constituents present are collected in the study. This study is hereby conducted to assess the pharmacological potential of the formulation to act as an effective medicine helpful in preventing, mitigating, and combating microbial infections or conditions caused due to air-borne pathogens.

**Keywords:** *Vyaghradi kwatha*, Microbial infection, Airborne pathogens, Prevention , Treatment

## INTRODUCTION

Ayurvedic system of medicine being one of the oldest and established system of medicine has always been a deep pool of knowledge when it comes to discovery of medications that can either help combat, manage, or prevent various health issues affecting human and animal health. The science as well as the knowledge contained within been refined through generations of research and scrutiny ultimately allowing the ayurvedic physicians of the current generation to successfully tap various effective therapies, drugs and compound formulations and use them against various health issues.

Infections are increasing day by day throughout the world no matter how many vaccines and remedial measures are adopted. Cultural and ethnic diversity in food habits, exotic foods and improper hygiene has been shown to be the evident cause for the recent epidemic outbreak of Covid 19. Even though medical systems all over the world have been successful in managing the condition, the compromise that had to be made was beyond the imagined. The Indian medicinal system of ayurveda throughout the episode of this pandemic focused on resorting to the promoting and using of classical medicines that had antimicrobial action and that which could improve the immunity and combat the effects of the virus. Ayurveda has always given foremost importance to preventive aspects and the research to find out the pharmacological potential of various ayurvedic formulations mentioned in the classics is ever continuing.

*Vyaghradi kwatha* is an ayurvedic formulation mentioned in one of the *Brihatrayi* of ayurveda *Astanga Hridaya* in the section *Chikitsa sthana*, 1<sup>st</sup> chapter(1). *Vyaghradi kwatha* is a renowned and well appreciat-

ed ayurvedic herbal medicine used in patients suffering from fever as well as respiratory tract diseases and infections. Classical indication of the formulation includes its usage in *Vataja* and *kaphaja jwara*, *Swasa*, *Kasa*, *Pinasa* and *Shula*(2). Looking through the ingredients in the formulation there is an indication of each ingredient that indicates its high efficacy and usage in disorders of the respiratory tract including microbial infections. The pharmacological activity of the drug can always be attributed to the phytochemical constituents and the pharmacological property of the plant. The usage of these drugs can be seen individually as well as included in a compound formulation for a cumulative effect.

### Aim of the Study

Aim of this study is to mainly assess and understand the pharmacological potential of the drugs as well as the formulation *Vyaghradi kwatha* as a whole for its antimicrobial action mainly in infectious diseases caused by air borne pathogens.

### Materials and Methods

Relevant sections of ayurvedic literature including *Samhita* and *Nighantu* were referred and all the information regarding the botanical name , family all taxonomical details, pharmacological actions, properties was collected from reliable authentic sources. Pharmacological evaluation conducted with the used part of the ingredient drugs from the formulation, details regarding their phytochemical constituents were collected from research articles published online mainly through PubMed search engine. Phytochemicals responsible for the assessed pharmacological actions were carefully evaluated to understand their action. Pharmacologic activities other than antimi-

crobal action were also considered to assess their effect on various other systems.

### Ingredients of Vyaghradi kwatha(3)

1. *Vyaghri* – *Solanum xanthocarpum* Schrad & Wendl / *Solanum surattense* Burm.F
2. *Amrita* – *Tinospora cordifolia* (Willd.) Miers ex Hook.F. & Thomas
3. *Shunthi* – *Zingiber officinale* Rosc.

### 4. *Pipali* – *Piper longum* Linn

#### Indications of Vyaghradi kwatha

1. *Vatakaphaja jwara* – Fever due to vata and kapha dosha aggravation
2. *Swasa* – Respiratory distress
3. *Pinasa* – Rhinitis
4. *Kasa* - Cough
5. *Shula /Udara shula* -abdominal colic

**Table 1 :Drugs with Botanical names and part used.(4)**

Drugs	Botanical Name	Family	Parts Used
<i>Vyaghri</i>	<i>Solanum xanthocarpum</i> Schrad & Wendl <i>Solanum surattense</i> Burm.F	Solanaceae	Root, Stem, Leaves, Flowers, Fruits, Seeds
<i>Guduchi</i>	<i>Tinospora cordifolia</i> (Willd.) Miers ex Hook.F. & Thomas	Menispermaceae	Stem
<i>Shunthi</i>	<i>Zingiber officinale</i> Rosc.	Zingiberaceae	Rhizome
<i>Pippali</i>	<i>Piper longum</i> Linn	Piperaceae	Root, Dried Spikes

### Method of Preparation

12 grams of each drug are to be taken, washed well, dried and crushed. The whole amount is mixed with 1.5 liter of water in an earthen pot and boiled with low flame until it reduces to 180ml. It is then filtered and used lukewarm.

### Dosage

90 ml of Kashaya/kwatha has to be taken before food twice daily.

### Pharmacological properties (Rasa panchaka) of drugs in Vyaghradi kwatha(5).

Pharmacological properties or Rasa panchaka of every drug gives us an insight into the properties of the drug and explains various action mechanisms put forward by the drug. According to *acharya Vagbhata*, Action of a drug can be brought about by the virtue of its *rasa(taste)*, *Guna (Qualities)*, *Virya (Potency)*, *Vipaka (Post digestive taste)* or even its *prabhava*. Hence for the evaluation as well as for the purpose of understanding, the *rasa panchaka* of the individual properties have been studied. On assessment of the *rasapanchaka*, three of four drugs have *laghu guna*, *ushna virya* and *Madhura vipaka*. All the four drugs include *Katu Rasa*.

**Table 2 : Pharmacological properties (Rasa panchaka) of drugs in Vyaghradi kwatha**

Drug	Rasam (Taste)	Gunam	Virya	Vipaka (Post-digestive taste)
<i>Vyaghri</i>	<i>Katu, Tiktam</i>	<i>Ruksham, Laghu, Saram</i>	<i>Ushnam</i>	<i>Katu</i>
<i>Guduchi</i>	<i>Kashayam, Tiktam, Katu, Madhuram</i>	<i>Laghu</i>	<i>Ushnam</i>	<i>Madhuram</i>
<i>Shunthi</i>	<i>Katu</i>	<i>Snigdham, Laghu</i>	<i>Ushnam</i>	<i>Madhuram</i>
<i>Pippali</i>	<i>Katu</i>	<i>Snigdham, Laghu</i>	<i>Anushna</i>	<i>Madhuram</i>

### Pharmacological action of the drugs(6)

To assess the pharmacological potential of the formulation *Vyaghradi kwatham*, pharmacological actions of the drugs on various components of body like *Dosha, dhatu, mala, Srotas, manas* etc has been ob-

served. On analysis of the data regarding the pharmacological action of individual drugs of the formulation, *Vyaghri, Guduchi and Pippali* are *tridoshahara* in action. *Shunthi* and *pippali* are *pittakara* in nature. All the drugs are *deepana* in nature. Except *Vyaghri*, all other drugs possess *vrishya and Rasayana* action.

**Table 3 : Pharmacological action of the drugs in Vyaghradi kwatha**

Actions	Vyaghri	Amrutha	shunthi	Pippali
<b>Dosha - Pacifying actions</b>				
Ekadoshajam	Kaphapaham, Vatajit	Pitta visoshanam,	Anilapaham	Vatapaham, Kaphapaham
Dwidoshajam		Kaphavatakhnam, Rakta vata prasamanam, Vatapittanut	Kaphavatanut, Vatakapaham,	Vatakaphapaham
Tridoshajam	Tridoshakhnam	Tridosha haram		Tridoshajit
<b>Dosha - Aggravating actions</b>				
Ekadoshajam			Pittalam	Pittaprakopanam
<b>Dhatu</b>		Medo vishoshanam		
<b>Mala</b>	Bhedanam, Rechanam	Mala Samgrahi		
<b>Agni</b>	Deepanam	Agnideepani	Deepanam	Deepanam
<b>Ama</b>	Pachanam	Ama haram	Pachanam	
<b>Srotas</b>			Vibandhanut, Vata vibandhanut	
<b>Indriya</b>			Ruchyam	Ruchyam
<b>Budhi</b>		Medhyam		
<b>Manas</b>				
<b>Sthanam</b>			Swaryam	
<b>Avayavam</b>		Hridayam	Hridayam	Hridayam
<b>Sarva Sareeram</b>		Samgrahini, Balyam, Ayushyam, Rasayanam	Vrishyam, Grahi	Vrishyam Rasayanam

**Therapeutic indication of the Drugs(7)**

With reference to the literature available on the drugs of Vyaghradi kwatha, it is evident that the drugs are useful in the Nijavikaras or diseases of pranavaha srotas (Respiratory system), Raktavaha srotas (Circulatory system), Annavaha srotas (Gastrointestinal

system). On analysis of the therapeutic action of drugs in Agantuja vikara, it can be observed that the drugs also have been indicated to have therapeutic action on agantuja vikara including krimi and jantu which can be corelated to modern day microorganisms.

**Table 4 : Therapeutic indication of drugs in Vyaghradi kwatha**

Disease/Condition	Vyaghri	Amrutha	Shunthi	Pippali
<b>I. Nija vikaras (Endogenous diseases )</b>				
<b>a. Doshic condition</b>				
Vatadosham	Y			
Rakta dosham		Y		
<b>b. Pranavaha srotas</b>				
Kasam (Cough)	Y	Y	Y	Y
Kaphavatakasam (Cough due to Kaphaand vata predominance)	Y			
Swasam (Dyspnoea)	Y		Y	Y
Kaphavataswasam (Dyspnoea due to Kaphaand vata predominance)	Y			

Peenasam	Y			
Parswapeeda	Y			
Hidma			Y	
Kshayam				Y
<b>c. Udkavaha srotas</b>				
Trid		Y		Y
Daham		Y		
<b>d. Annavaha srotas</b>				
Aruchi	Y		Y	
Amadosham	Y			Y
Vami		Y	Y	
Anaham			Y	
Udaramarutam			Y	
Adhmanam			Y	
Gulmam				Y
Kaphagulmam				Y
<b>e. Rasavaha srotas</b>				
Jwaram	Y	Y		Y
Kakphavata jwaram	Y			
Amavatam			Y	Y
Sleepadam			Y	
Sopham			Y	
Kaphasopham			Y	
Pandu			Y	
<b>f. Raktavaha srotas</b>				
Hridamayam	Y		Y	
Pandu		Y		
Kamila		Y		
Kushtam		Y		Y
Vatasram		Y		
Raktavatam		Y		
Kandu		Y		
Visarpam		Y		
Bhramam		Y		
Pleeharogam				Y
<b>g. Mamsavaha srotas</b>				
Arsas			Y	Y
Raktarsas		Y		
<b>h. Medovaha srotas</b>				
Medas		Y		
Meham		Y		Y
<b>i. Mootravaha srotas</b>				
Asmari	Y			
Mootrakrichram	Y			
<b>j. other diseases/conditions</b>				
Soolam			Y	Y
Udaram			Y	Y

Vatodaram			Y	
<b>k. Condition of patient</b>				
Arti (Pain due to illness)	Y	Y		
<b>II. Agantuka vikaras (Exogenous diseases)</b>				
Krimi	Y	Y		
Jantu		y	y	Y

### Pharmacological evaluation of drugs

To have an understanding about the pharmacological potential of a particular formulation, an understanding of the pharmacological activities of the ingredient drug proved in different disease conditions will be

helpful. This provides an insight into the involvement of secondary metabolites, other phytochemical constituents and pharmacological properties of the drug that could help understand better how the drug brings about its desired action.

**Table 5: Antimicrobial pharmacological activities conducted of drugs in *Vyaghradi kwatha*.**

Pharmacological Activity	<i>Vyaghri</i>	<i>Guduchi</i>	<i>Shunthi</i>	<i>Pippali</i>
Antiviral	Phytochemical and antimicrobial studies of extracts of <i>solanum xanthocarpum</i> (8)		Fresh ginger ( <i>zingiber officinale</i> ) has antiviral activity against human respiratory syncytial virus in human respiratory tract cell lines(9)	Antiviral activities and cytotoxicity assay of seed extracts of piper longum and piper nigrum on human cell lines(10).
Anti-Dengue study	Mosquitocidal activity of <i>solanum xanthocarpum</i> fruit extract and copepod <i>mesocyclops thermocyclopoides</i> for the control of dengue vector <i>aedes aegypti</i> (11)		<i>Zingiber officinale</i> roscoe aqueous extract modulates matrix metallo proteinases and tissue inhibitors of metalloproteinases expressions in dengue virus-infected cells: implications for prevention of vascular permeability(12)	Larvicidal effect of pepper plants on <i>aedes aegypti</i> (L.) (diptera: culicidae)(13).
Anti-Malarial	<i>In vitro</i> and <i>in vivo</i> anti-malarial activity of <i>boerhavia elegans</i> and <i>solanum surrattense</i> (14).			Methanolic Leaf extract of Piper species(15)
Antipyretic		In vivo study - Aqueous extract(16)		Anti-inflammatory, analgesic, and antipyretic activities of the ethanol extract of piper interruptum opiz. And piper chaba linn(17).
Antibacterial	Antibacterial activity of <i>solanum xanthocarpum</i>	In vitro study - Ethanol	The antibacterial effect of ginger and gar-	Antibacterial activity of isolates from piper



	leaf extract(18)	extract(19).	lic extracts on some pathogenic bacteria isolated from patients with otitis media(20)	longum and taxus baccata(21)
Anti-Tubercular	Assessment of anti-tuberculosis activity of extracts of cinnamomum verum and solanum surattense along with isoniazid(22)			Invitro antioxidant and antimycobacterial activity of seeds of piper longum linn: a comparative study(23)
Antioxidant	Medicinal attributes of <i>solanum xanthocarpum</i> fruit consumed by several tribal communities as food: an <i>in vitro</i> antioxidant, anti-cancer and anti-HIV perspective(24).	Invitro study- Ethanolic Extract.(25).	Composition and Comprehensive Antioxidant Activity of Ginger ( <i>Zingiber officinale</i> ) Essential Oil from Ecuador(26)	Antioxidant activities of pippali ( <i>piper longum</i> ) proteins(27)
Immunomodulatory	Evaluation of comparative immunomodulatory potential of <i>solanum xanthocarpum</i> root and fruits on experimental animal(29)	Invitro study- Aqueous extract(28)	Garlic and ginger extracts modulated broiler chicks innate immune responses and enhanced multidrug resistant <i>escherichia coli</i> o78 clearance(30)	Review on anti-tumor activity, immunomodulatory and neuromodulatory properties of <i>piper longum</i> linn(31)

### Benefits of Vyaghradi Kwatham in diseases caused due to airborne pathogens and its pharmacological breakdown.

Air-borne pathogens have been the cause for the majority of epidemics that has struck mankind in the last few centuries including the plague, Covid -19 etc. Among them, recent major microbial outbreak include Covid 19 caused by SARS -COV-2 (severe acute respiratory syndrome -corona virus 2) which has been included under HG3 organisms.(32)

Airborne pathogens as the name itself suggests mainly transmit the infection from one person to another through direct or indirect contact, saliva droplets, spray or aerosol. In the case of transmission of pathogens through air, the pathogens/ microorganisms mainly target the respiratory system, making their way into the body via nasal or oral route between inhalation and exhalation. In such cases, once the pathogens enter the body via the mentioned routes of entry, it induces diseases or disease symptoms related

to upper respiratory tract. Upon entry, the pathogens have an incubation period of 2- 14 days which can even extend up to 28 days.

Clinical spectrum of diseases caused by airborne pathogens affecting the respiratory system can always range from mild to severe, even including multiple organ failure. Covid 19 is a typical example of diseases caused by air borne pathogens that have similar clinical spectrum like mentioned above. In diseases or infections like covid 19 caused by air borne pathogens, Respiratory system is primarily affected, and symptoms basically include Fever, cough, increased phlegm production, fatigue, hemoptysis, dyspnea, lymphopenia etc. which further advances towards pneumonia, Acute respiratory distress even leading to fatality.(33)

In cases of respiratory infections, the blood profile of the patients usually exhibits higher level of leukocytes, inflammatory cytokines, chemokines whose higher levels can be seen as the infection progresses throughout the body.(34) In case of such infectious diseases, invasion of the virus hampers the immune

system and decreases the immune response to the microorganism which eventually leads to the microorganisms colonizing and increasing overall load within the body.(35) Pharmacological evaluation of the proved activity of the ingredient drugs were conducted with special emphasize on their antimicrobial activity. The pharmacological activity analysis suggest that the ingredient drugs have excellent command over microbials, and all of the drugs have proven immunomodulatory action as well. When it comes to the ayurvedic aspect, the foremost symptom exhibited by the body in response to the invasion of a foreign pathogen includes *Jwara* (Fever). Summarizing the factors responsible for the onset of diseases, acharya has specified two main terms “*Nija*” and “*Agantuja*” which can be referred to endogenous and exogenous factors. Infectious diseases caused by microorganisms is classified under “*Abhisanga Jwara*” which has its manifestation attributed to the vitiation of tridoshas in addition to the infection(36) In case of infectious diseases caused by air borne pathogens targeting the respiratory system primarily, it brings forth symptoms like *jwara*, *Swasa*, *kasa* which further progresses following multiorgan involvement. These symptoms basically denote the involvement of *Vata* and *kapha* doshas basically along with association of *pitta dosha*. The Formulation *Vyaghradi kwatham* has been mentioned in chapter I by *acharya Vagbhata* in the context of medicinal formulations useful in *jwara*. Basic indication of the formulation itself involves usage of the medicine in case of fever, and respiratory system disorders like cough, dyspnea, rhinitis which are the foremost symptoms that manifest in case of infectious diseases especially caused by air-borne pathogens. Taking into consideration the pharmacological activities exhibited by each of the drugs within the formulation, all the drugs are having *dipana* and *pachana* action which helps to improve the digestive fire. The drug *guduchi* in the formulation poses *amahara* property along with *agnideepana* which helps in bringing down the fever and its associated symptoms. The drugs *Vyaghri / Kantakari* and *Shunthi* possess *pachana* action in addition to *dipana* action which makes sure the ama generated during

the manifestation of fever is removed and digestive fire is well promoted and maintained.

On consideration of the pharmacological properties (*Rasa panchaka*) of the drugs, all the drugs within the formulation have *Katu rasa* with 2 drugs having *Tikta rasa* also. All the drugs have *ushna virya* which combined with the *katu rasa* helps in preventing production of phlegm in the lungs and preventing the formation of ama and finally preventing the progress of respiratory distress symptoms. The pharmacological actions of these drugs indicates that two among four drugs (*Vyaghri* , *Guduchi*) are beneficial for krimi and drugs *Shunthi*, *Pippali*, *guduchi* possess *jantughna* action which can be correlated to antimicrobial property.

## CONCLUSION

Taking into consideration the above validated effects and details of the individual drugs, their properties, and actions, it is evident that *Vyaghradi kwatham* is a potent antimicrobial that can be included in the foremost list of medicines that can be given in case of infectious diseases caused by air borne pathogens. The medicine can also be used as an addon treatment along with other potent formulations in such cases. Since infectious diseases caused by air borne pathogens has increased in great extent due to various environmental, lifestyle habits etc, such medicines that can target the microbial organisms and alleviate the symptoms associated with infection should be used and researched upon. The stated facts and details associated with the formulation substantiate its usage in both prevention and treatment of infectious diseases caused by air borne pathogens.

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