



PHARMACOLOGICAL POTENTIAL OF PATHYAKUSTHUMBARADI KWATHA IN COMBATING INFECTIOUS RESPIRATORY DISEASES CAUSED BY AIR BORNE PATHOGENS.

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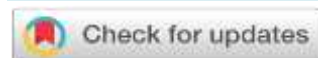
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ABSTRACT

Pathogen induced infectious diseases have always troubled mankind since the ages and has been the root cause for various epidemics /pandemics that plunged societies, ethnicities, countries and claimed millions of lives in the process. These pathogens bring about these infectious diseases mainly because of the compromised immune status of human body and indulgence in various environmental, food and lifestyle habits. The ancient medicinal system of ayurveda has elaborately explained infectious diseases caused by microorganisms under the context of *janapadodhwamsa* along with its reasons. Throughout various ayurvedic literature many drugs and formulations that are potent enough to manage as well as prevent the onset of infectious disease. With each passing day, health sector faces the threat of newer and modified pathogens that are immune to vaccine and in this regard, ayurvedic medicines can prove to be lifesaving. Ayurveda has focused on 2 basic principles when it comes to human health, conserving the health of a healthy individual as well as curing the diseased state in an ill person. Ayurveda in the case of infectious diseases can help to promote the immune status and because of its potent pharmacological properties and actions can prove to be safer and effective alternative to steroidal vaccines. Among the formulations mentioned in the classics, *Pathyakusthumbaradi kwatha* is a well renowned ayurvedic formulation mentioned in the

text *Astangahridaya*, *Chikitsa sthana* in the chapter *Jwara chikitsa*. This study is conducted to assess the pharmacological potential of *pathyakusthumbaradi kwatha* as an effective medicinal remedy to prevent and treat infectious diseases caused by airborne pathogens.

Keywords: *Pathyakusthumbaradi Kwatha*, Infectious disease, Air borne pathogens, *Astangahridaya*, *Janapadodhwamsa*

INTRODUCTION

Recent centuries have witnessed the emergence of large number of infectious diseases caused by various pathogens. Among these some of the infectious diseases prove to be more fatal and create much havoc hampering the life of millions of people around the world creating a worldwide pandemic /endemic. Recently one such infectious disease that plagued all over the world was the Covid 19 virus (SARS-Coronavirus 2). Modern medical system are always engaged in finding out new cures and vaccines that can prevent the recurrence of these infection. In this regard ayurveda opened the knowledge of various herbal medications that helped to improve the health status and proved to be more effective line of treatment for infectious diseases caused by the air borne pathogen.

The concept of infectious diseases is not new to the science of ayurveda. The whole concept of diseases in ayurveda is classified into *Nija* and *agantuja*, referring to the exogeneous and endogeneous factors that are responsible for the onset of disease. The terminologies like *Sankramika roga* and *Aupasargika roga* are the ones that are associated with communicable and infectious diseases(1)

According to ayurveda, infectious disease basically targets the *bala* or immune system of the host, making the *bala* diminish rapidly. *Janapadodhwamsa* has been regarded as fatal by ayurveda due to the invasion of *bhuta*, which resembles the viral invasion in a pandemic outbreak. Considering the ayurvedic aspects mentioned in the context of *janapadodhwamsa*, the symptoms mentioned in this context are similar to the recent pandemic outbreak caused by air borne pathogens mainly including fever, body ache, cough, common cold, respiratory distress(2)

Airborne pathogen induced infections have always troubled mankind and health systems as the progress of the disease is rapid and since it targets the respiratory system, the risk of recurrence and chances of the infection becoming progressing into severe stages are common. In case of management of infectious diseases by air borne pathogens, ayurveda advocates the measures to be both preventative and curative in nature. In this regard, ayurveda offers a variety of formulations composed of drugs having antimicrobial action and immunomodulatory action which could very well combat the ill effects of the pathogen and at the same time be an effective medicine to prevent the recurrence. Hence such formulations that can specifically work on *pranavaha srotas* and respiratory system along with managing the other associated symptoms was the intention of ayurveda.

In this regard, *Pathyakusthumbaradi kwatha* is a well renowned ayurvedic formulation mentioned in one of the important ayurvedic classical literature *Astangahridaya*, in the section *Chikitsa sthana*, chapter 1(3). *Pathyakusthumbaradi Kwatha* is a renowned and well appreciated formulation in patients suffering from fever as well as infections pertaining to the respiratory tract manifesting with associated symptoms like cough, Throat pain, Swelling of the throat, Dyspnea etc. Classical indication of the sloka from the text include *Vatakapha jwara* (Fever caused by *vata* and *kapha dosha*), Excessive accumulation of mucus within the respiratory tract and lungs, cough, dyspnea, swelling of face, body ache. Going through the ingredients of the formulation itself, it is evident that the formulation would perform excellent in diseases associated with the respiratory tract. The pharmacological activity exhibited by each drug within the formulation can be attributed to their pharmacologi-

cal properties and phytochemical constituents of the drugs.

Aim of the study

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

Materials and Methods

Relevant sections of ayurvedic literature including the *samhitas* and *nighantus* were referred and all the information regarding the botanical name, family, 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 pharmacological evaluation were also collected from research articles published mainly through PubMed search engine. Phytochemicals responsible for the assessed pharmacological actions were carefully evaluated to understand their actions. Pharmacological activities other than antimicrobial activity were also assessed for the study.

Ingredients of Pathyakusthumbaradi Kwatha(4)

1. *Pathya / Hateetaki – Terminalia chebula [Gaertn.]Retz*
2. *Kusthumbari (Dhanyaka) – Coriandrum sativum Linn.*
3. *Mustha – Cyprus rotundus Linn.*
4. *Sunthi – Zingiber officianale Rosc.*
5. *Kathrina – Cymbopogon martinii [Roxb.] Wats*
6. *Parpata – Fumaria parviflora Lam**
7. *Kasmari – Gmelina arborea Roxb.*
8. *Vacha – Acorus calamus Linn.*
9. *Bhargi – Clerodendrum serratum [Linn.] Moon*
10. *Devadaru – Cedrus deodara [Roxb.ex D,Don] G.Don*

Indications of Pathyakusthumbaradi Kwatha(5)

1. *Kaphavatajwara*
2. *Asthiva*
3. *Kukshihritparshva vedana*
4. *Kantha Amaya*
5. *Asya shvayathu – Swelling of the face.*
6. *Swasa – Dyspnoea / Breathing distress.*
7. *Kasa - Cough*

Table 1 : Drugs with their Botanical Name, Family and Part used.

Drugs	Botanical name	Family	Part used
<i>Pathya</i>	<i>Terminalia chebula [Gaertn.]Retz</i>	Combretaceae	Dried fruit
<i>Dhanyaka</i>	<i>Coriandrum sativum Linn.</i>	Apiaceae	Dried fruit
<i>Musta</i>	<i>Cyprus rotundus Linn.</i>	Oleaceae	Rhizome and tubers
<i>Sunthi</i>	<i>Zingiber officianale Rosc.</i>	Zingiberaceae	Dried Rhizome
<i>Kathrina</i>	<i>Cymbopogon martinii [Roxb.] Wats</i>	Poaceae	Whole plant
<i>Parpata</i>	<i>Fumaria parviflora Lam*</i>	Fumariaceae	Whole plant
<i>Kasmari</i>	<i>Gmelina arborea Roxb.</i>	Verbenaceae	Heartwood /Root
<i>Vacha</i>	<i>Acorus calamus Linn.</i>	Araceae	Stem
<i>Bhargi</i>	<i>Clerodendrum serratum [Linn.] Moon</i>	Verbenaceae	Heartwood/Root
<i>Devadaru</i>	<i>Cedrus deodara [Roxb.ex D,Don] G.Don</i>	Pinaceae	Heartwood

Method of Preparation

12 grams of each drugs 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 mixed with *hingu and madhu*.

Pharmacological properties of drugs in Pathyakusthumbaradi Kwatha(6)

Pharmacological properties of a drug give us an insight into the mode of action of drug on various diseases, since ayurveda considers that the action is mainly brought about by the virtue of its pharmacological properties. Hence for the proper understanding and assessment of the pharmacological potential

of the formulation, the pharmacological property(Rasa panchaka)has been studied. On analysis of the pharmacological properties of the individual drugs, all the drugs in the formulation are having predominance of *katu rasa, tikta rasa ,Kashaya rasa*. 8 among 10 drugs have *Ushna virya* . the drugs equally possess *katu vipaka and Madhura vipaka*.

Table 2 : Pharmacological properties (Rasa panchaka) of drugs

Drug	Rasam (Taste)	Gunam	Virya	Vipaka									
Haritaki	<table border="0"> <tr> <td>ha.pr – Pancharasa Lavana varjita</td> <td rowspan="4">}</td> <td>Su.sa</td> </tr> <tr> <td>Dha. Ni - Pancharasa Lavana varjita</td> <td>Cha.sa</td> </tr> <tr> <td>Ra.Ni – Pancharasa Lavana varjita</td> <td>A.hr.</td> </tr> <tr> <td>Ni. Ra – Pancharasa Lavana varjita</td> <td>Kai.Ni</td> </tr> </table>	ha.pr – Pancharasa Lavana varjita	}	Su.sa	Dha. Ni - Pancharasa Lavana varjita	Cha.sa	Ra.Ni – Pancharasa Lavana varjita	A.hr.	Ni. Ra – Pancharasa Lavana varjita	Kai.Ni	Ruksha, ushna laghu Ni Ra - Sara	Ushna	Madhura
ha.pr – Pancharasa Lavana varjita	}	Su.sa											
Dha. Ni - Pancharasa Lavana varjita		Cha.sa											
Ra.Ni – Pancharasa Lavana varjita		A.hr.											
Ni. Ra – Pancharasa Lavana varjita		Kai.Ni											
Dhanyaka	<table border="0"> <tr> <td>Ma. Ni – Katu, Tikta, Madhura, Bha.pr – Tikta, Katu</td> </tr> <tr> <td>Dha. Ni – Madhura, Kashaya, Tikta</td> </tr> <tr> <td>Ra. Ni – Madhura, Kashaya</td> </tr> <tr> <td>Su. Sa – Madhura, Kai.ni – Kashaya, Katu, Madhura</td> </tr> </table>	Ma. Ni – Katu, Tikta, Madhura, Bha.pr – Tikta, Katu	Dha. Ni – Madhura, Kashaya, Tikta	Ra. Ni – Madhura, Kashaya	Su. Sa – Madhura, Kai.ni – Kashaya, Katu, Madhura	Laghu , Snighdha	Ushna	Madhura					
Ma. Ni – Katu, Tikta, Madhura, Bha.pr – Tikta, Katu													
Dha. Ni – Madhura, Kashaya, Tikta													
Ra. Ni – Madhura, Kashaya													
Su. Sa – Madhura, Kai.ni – Kashaya, Katu, Madhura													
Musta	<table border="0"> <tr> <td>Ma.ni – Tikta Kashaya , Bha.pr – Katu Kashaya</td> </tr> <tr> <td>Ra.Ni – Kashaya Tikta, Kai.Ni – Tikta Katu Kashaya</td> </tr> <tr> <td>Ni.Ra – Tikta Katu, Sha.sa – Kashaya, Katu</td> </tr> </table>	Ma.ni – Tikta Kashaya , Bha.pr – Katu Kashaya	Ra.Ni – Kashaya Tikta, Kai.Ni – Tikta Katu Kashaya	Ni.Ra – Tikta Katu, Sha.sa – Kashaya, Katu	-	Sita	Madhura						
Ma.ni – Tikta Kashaya , Bha.pr – Katu Kashaya													
Ra.Ni – Kashaya Tikta, Kai.Ni – Tikta Katu Kashaya													
Ni.Ra – Tikta Katu, Sha.sa – Kashaya, Katu													
Sunthi	<table border="0"> <tr> <td>Bha. Pr - Katu</td> <td>Ra.Ni – Katu</td> </tr> <tr> <td>Su.Sa – Katu</td> <td>Kai.Ni -Katu</td> </tr> <tr> <td>Dha.Ni – Katu</td> <td></td> </tr> </table>	Bha. Pr - Katu	Ra.Ni – Katu	Su.Sa – Katu	Kai.Ni -Katu	Dha.Ni – Katu		Laghu , Snighdha	Ushna	Madhura			
Bha. Pr - Katu	Ra.Ni – Katu												
Su.Sa – Katu	Kai.Ni -Katu												
Dha.Ni – Katu													
Kathrina	<table border="0"> <tr> <td>Ma.ni –Kashaya</td> <td>Bha.pr – Tikta</td> </tr> <tr> <td>Ra.Ni – Tikta</td> <td>Ma.p.Ni – Tikta</td> </tr> <tr> <td>So.Ni – Katu, Tikta</td> <td></td> </tr> </table>	Ma.ni –Kashaya	Bha.pr – Tikta	Ra.Ni – Tikta	Ma.p.Ni – Tikta	So.Ni – Katu, Tikta			Ushna	Katu			
Ma.ni –Kashaya	Bha.pr – Tikta												
Ra.Ni – Tikta	Ma.p.Ni – Tikta												
So.Ni – Katu, Tikta													
Parpata	<table border="0"> <tr> <td>Ma. Ni – Tikta</td> <td>Ra. Ni – Tikta</td> </tr> <tr> <td>Kai.ni – Tikta</td> <td>Ni. Ra - Tikta</td> </tr> <tr> <td>Bha.pr – Tikta</td> <td>Dha. Ni –Tikta</td> </tr> </table>	Ma. Ni – Tikta	Ra. Ni – Tikta	Kai.ni – Tikta	Ni. Ra - Tikta	Bha.pr – Tikta	Dha. Ni –Tikta	Laghu	Sita	Katu			
Ma. Ni – Tikta	Ra. Ni – Tikta												
Kai.ni – Tikta	Ni. Ra - Tikta												
Bha.pr – Tikta	Dha. Ni –Tikta												
Kasmari	<table border="0"> <tr> <td>Ma.Ni – Kashaya, Tikta</td> <td>Bha.Pr – Tikta</td> </tr> <tr> <td>Dha.Ni – Tikta</td> <td>Ra.Ni – Katu, Tikta</td> </tr> </table>	Ma.Ni – Kashaya, Tikta	Bha.Pr – Tikta	Dha.Ni – Tikta	Ra.Ni – Katu, Tikta	Guru, Snigdha	Ushna	Madhura					
Ma.Ni – Kashaya, Tikta	Bha.Pr – Tikta												
Dha.Ni – Tikta	Ra.Ni – Katu, Tikta												
Vacha	<table border="0"> <tr> <td>Bha. Pr – Katu, Tikta</td> <td>Ma.Ni – Tikta</td> </tr> <tr> <td>Ra.ni – Katu, Tikta</td> <td>Kai.Ni – Tikta, Katu</td> </tr> <tr> <td>MA.Pa.ni – Katu, Tikta</td> <td></td> </tr> </table>	Bha. Pr – Katu, Tikta	Ma.Ni – Tikta	Ra.ni – Katu, Tikta	Kai.Ni – Tikta, Katu	MA.Pa.ni – Katu, Tikta		Laghu, Ruksha	Ushna	Katu			
Bha. Pr – Katu, Tikta	Ma.Ni – Tikta												
Ra.ni – Katu, Tikta	Kai.Ni – Tikta, Katu												
MA.Pa.ni – Katu, Tikta													
Bharangi	<table border="0"> <tr> <td>Ma.Ni – Kashaya, Tikta, Katu</td> </tr> <tr> <td>Bha.Pr – Katu, Tikta, Ra.ni – Katu, Tikta</td> </tr> <tr> <td>Dha.Ni – Tikta, Kai.ni – Tikta, Kashaya</td> </tr> </table>	Ma.Ni – Kashaya, Tikta, Katu	Bha.Pr – Katu, Tikta, Ra.ni – Katu, Tikta	Dha.Ni – Tikta, Kai.ni – Tikta, Kashaya	Laghu	Ushna	Katu						
Ma.Ni – Kashaya, Tikta, Katu													
Bha.Pr – Katu, Tikta, Ra.ni – Katu, Tikta													
Dha.Ni – Tikta, Kai.ni – Tikta, Kashaya													
Devadaru	<table border="0"> <tr> <td>MA.Ni – Katu</td> <td>Ra.Ni – Tikta</td> </tr> <tr> <td>Bha.pr – Tikta</td> <td>Ni. Ra – Tikta,</td> </tr> <tr> <td>Dha. Ni – Tikta</td> <td>Su. Sa – Tikta, Katu, Kashaya</td> </tr> <tr> <td>Kai. Ni - Tikta, Katu</td> <td></td> </tr> </table>	MA.Ni – Katu	Ra.Ni – Tikta	Bha.pr – Tikta	Ni. Ra – Tikta,	Dha. Ni – Tikta	Su. Sa – Tikta, Katu, Kashaya	Kai. Ni - Tikta, Katu		Laghu , Snighdha	Ushna	Katu	
MA.Ni – Katu	Ra.Ni – Tikta												
Bha.pr – Tikta	Ni. Ra – Tikta,												
Dha. Ni – Tikta	Su. Sa – Tikta, Katu, Kashaya												
Kai. Ni - Tikta, Katu													

Pharmacological action of the drugs in Pathyakusthumbaradi Kwatha(7)

To assess the pharmacological potential of the formulation, which can be a cumulative action of the drug potential of all the drugs within the formulation. For the assessment of the drug action of ingredient drugs, their action of dosha, dhatu, mala, budhi, srotas has

been assessed and reviewed. On assessment of the pharmacological action of the drugs, Haritaki, Kashmiri, bharngi was found to be tridosahara, drugs like Kathrina, parpata are kaphapittahara in nature. Drugs Haritaki, Dhanyaka, musta are kaphavatahara in nature.

Table 3 : Pharmacological action of the drugs in Pathyakusthumbaradi kwatha

Actions	Haritaki	Dhanyaka	Mustha	Sunthi	Kathrina	Parpata
Dosha - Pacifying actions						
Ekadoshajam	Vatahrit Kaphahara	Kaphahara Vatakaphagna	Kaphaghna Kaphapithahrt		kaphapaha	Sleshmasoshana pithaha
Dwidoshajam	Kaphavata- Prashamani			Kaphavathanut	Kapha- pittaghna	Pithakaphahara
Tridoshajam	Tridoshanut				Kaphapitta- sranashana	
Dosha - Aggravating actions						
Ekadoshajam	pittakrit	Pithakrit				Vatakopana
Dhatu	Rasayana Brihmani Lekhana	Avrishya	Raktajit Raktarujapaha	Vrishya Panduhara		Rakthadoshahara Rakthapithahara Pramehahara
Mala	Anuloma Mala- Sodhani Grahi	Mutrala Grahi	Grahi Athisaraghni	Grahi Vibandhanut Bhedini		Samgrahi
Agni	Agnikrit	Vahnikrit	Agnikrit	Agnikrit		
Ama	Dipana Pachana	Dipana Pachana	Dipana Pachana	Dipana Pachana		
Srotas		Srotoshodhan	Jwarahara			
Indriya	Chakshushya Indriyaprasadini Varya	Chakshusya Ruchya	Aruchinut	Ruchya Svadupaki		Netrahita
Budhi	Medhya Smritikari		Medhya			Madahara
Sthanam		Svarya Rochana		Svarya	Sulaghna	Dahanut Pipasahara
Avayavam	Hridya	Ahridhya Hrit Daha Hara	Trushnahara Dahahara Janthuhrut	Hridya	Hridya	
Sarva Sa- reeram	Ayusya Yogavahi Vayasthapan Balya	Hridya Dourgandhya- nasana	Kantiprada			

Actions	Kashmari	Vacha	Bharngi	Devadaru
Dosha - Pacifying actions				
<i>Ekadoshajam</i>			<i>kaphaghna</i>	
<i>Dwidoshajam</i>	<i>Vatapittanut</i> <i>Vatakaphahara</i>	<i>kaphavataghna</i>		<i>Kaphavatahara</i> <i>Sleshmavatajit</i>
<i>Tridoshajam</i>	<i>Tridoshashamani</i>		<i>Tridoshahara</i>	
Dosha - Aggravating actions				
<i>Ekadoshajam</i>				
Dhatu	<i>Rasayana -vrishya</i> <i>Brihmana</i> <i>Raktakshayanut</i> <i>Raktapittajit</i> <i>dhatuvridhikara</i>	<i>Shukrasodhana</i> <i>Mutrasodhana</i>		<i>Raktajit</i>
Mala	<i>Bhedana</i> <i>Mutra vibandhanut</i> <i>Samgrahi</i>			
Agni		<i>Vahnikrit</i>		
Ama	<i>Deepana</i> <i>Pachana</i>	<i>Dipana</i> <i>AmaPachana</i>	<i>Dipana</i> <i>Pachana</i>	<i>Amadosha hara</i>
Srotas				<i>Srotosodhana</i>
Indriya			<i>Ruchya</i>	<i>Chakshushya</i>
Budhi	<i>Medhya</i>	<i>Medhya</i> <i>Smritivardhini</i>		
Sthanam	<i>keshya</i>	<i>Kanthya</i>		<i>Dustavrina sho-</i> <i>dhana</i>
Avayavam	<i>hridya</i>	<i>Kanthasya rogajit</i>		<i>Karna- Ashya Roga-</i> <i>nut</i>
Sarva Sareeram		<i>Ayushya</i> <i>jivani</i>		

Therapeutic indication of drugs in Pathyakusthumbaradi Kwatha(8)

With reference to the therapeutic indication of each drug mentioned in the yoga, it is evident that the drugs are beneficial in *pranavaha sroto vikaras* like *swasa, kasa, pinasa, shirashula* etc and also in *krimi roga and jantu roga* which can be correlated to mod-

ern day microorganisms. This wide range therapeutic applicability of the drugs in the formulation makes the whole formulation more perfect in fighting infectious diseases pertaining to the respiratory system and also to improve the post infective health state as the drugs are *rasayana* and *balya* in nature.

Table 4 : Therapeutic indication of drugs in Pathyakusthumbaradii kwatha

Type of Disease	<i>Haritaki</i>	<i>Dhanyaka</i>	<i>Musta</i>	<i>Sunthi</i>	<i>kathrina</i>	<i>Parpata</i>

Nija-vikaras (Endogenous diseases)	Kasa Swasa Hridroga Siroroga Visama-jwara Kamala Yakrit roga	Swasa Kasa Aruchi Chardi Daha jwara trishna ama	Trishna Atisara Arochaka Soola Daha Jwara Atisara	Hikka Swasa' Kasa Hridroga Pamdu Slipada Chardi Visuchika	Jwara Raktapitta Hridroga Kandu Sula Kasa Visuchika Ajirna	Kasa Prameha Trishna Aruchi Jwara Daha Raktapitta Arsa
Agantuja-vikaras (Exogenous diseases)	Krimi	Krimi	Krimi		Krimi Balagraha	

Type of Disease	<i>Kasmari</i>	<i>vacha</i>	<i>Bharngi</i>	<i>Devadaru</i>
Nija-vikaras (Endogenous diseases)	Vishada Jwara Raktadosha Kshata Kshaya	Vibandha Adhmana Sula Apasmara Unmada Hridroga	Kasa Swasa Hikka Sopha Pinasa Jwara	Kasa Hikka Swasa Pinasa Jwara Sotha
Agantuja-vikaras (Exogenous diseases)	Krimi	Bhuta Jantu krimi		Krimi

Pharmacological evaluation of drugs based on various proven antimicrobial activity.

The therapeutic usage of a drug depends on various factors including the patient to which the drug is being administered to. But when it comes to the case of pharmacological potential of a formulation in a particular disease condition, the pharmacological activity

exhibited by each ingredient drug of the formulation helps to understand the possible cumulative pharmacological outcome of the whole formulation. Deep understanding of the pharmacological activities exhibited by each ingredient drugs helps in understanding the level of involvement of their secondary metabolites and pharmacological properties.

Table 5 : Presence of Antimicrobial pharmacological activities conducted of drugs in Pathyakusthumbaradi kwatha

Pharmacological Activity	<i>Pathya</i>	<i>Dhanyaka</i>	<i>Musta</i>	<i>Shunthi</i>	<i>Kathrina</i>	<i>Parpata</i>
Antiviral activity	Yes(9)		Yes(10)	Yes(11)		
Anti-dengue activity				Yes (12)		
Antipyretic		Yes(13)				Yes(27)
Antibacterial activity	Yes(14)		Yes(15).	Yes(16)	Yes(24)	Yes(28)
Anti-tubercular activity		Yes(17)				
Antioxidant activity	Yes (18)	Yes(19)	Yes(20)	Yes(21)	Yes(25)	
Immunomodulator activity		Yes(22)		Yes(23)	Yes(26)	

Pharmacological Activity	Kashmari	Vacha	Bharngi	Devadaru
Antiviral activity	Yes(29)		Yes(30)	
Anti-dengue activity	Yes(31)			
Antipyretic	Yes(32)	Yes(33)		
Antibacterial activity	Yes(34)	Yes(35)	Yes(36)	Yes(37)
Anti-tubercular activity				
Antioxidant activity	Yes (38)	Yes(39)	Yes(40)	Yes(41)
Immunomodulator activity	Yes(42)	Yes(43)	Yes(44)	

Benefits of Pathyakusthumbaradi Kwatha in Infectious diseases caused due to airborne pathogens and its pharmacological understanding.

Infectious diseases are of different types based on the organism responsible for the diseased state. Depending upon the mode through which the disease pathogens gets transmitted to the human body, the symptoms that appear during the onset, the system affected everything differs. Airborne pathogens are those that basically transmit into the human body through respiratory route via direct contact, inhalation, water droplets, saliva etc. A typical example of an airborne pathogen and the infection caused due to it is the Coronavirus (Covid 19) which belongs to SARS-coronavirus 2 pathogen classified under HG3 organism(45).

In diseases like Covid-19 which is mainly caused by an infectious airborne pathogen that targets the respiratory system, the clinical spectrum explains the severity of the condition which can range from asymptomatic to severe. Most commonly symptoms like cough, fever, increased formation and retention of sputum within the lungs and respiratory tract, fatigue, headache, hemoptysis, dyspnea, diarrhea, lymphopenia etc. Deterioration of health and improper medical interference can even lead to pneumonia, cardiac arrest even death.(46)

During the pathogenesis phase, the infection is characterized by increase in number of Leucocytes, plasma inflammatory cytokines. In case of Covid-19 infection also, increased level of cytokines, chemokines were seen in the blood report of the infected patient(47). Severe cases of infection can even be char-

acterized by release of large amount of pro-inflammatory cytokines called as cytokine storm” leading to uncontrolled systemic inflammatory response. This ultimately impairs the immune system of the body, which further increases the amount of virus within the body due to easy multiplication increasing the total virus load(48).

Infectious airborne pathogens that affect the respiratory system initially manifests with fever, which is afterwards associated with symptoms like cough, Increased sputum production, dyspnea, low oxygen saturation levels, fatigue etc. According to ayurveda classics, diseases caused by exogeneous factors are included under “*ägantuja vikara*”. *Jwara* brought about in the body associated with microorganism infection has been included under *Abhishanga jwara* whose main reason for manifestation itself is the vitiation of *tridosha*(49). After the infection enters within the body, it localizes in the respiratory system or the *Pranavaha srotas* bringing forth various symptoms like *swasa, kasa, pinasa, asphota* etc, which further enters into the blood stream vitiating the blood and produces symptoms like Blood clots, decreased oxygen saturation, hemoptysis etc. Considering the symptoms and pathogenesis of infectious respiratory diseases caused by airborne pathogens, it is evident that the disease mainly includes the vitiation of all three *doshas*.

The formulation *Pathyakusthumbaradi kwatha* according to the text *Astanga hridaya* is mentioned in the chapter exclusively dedicated for *Jwara* or fever under the context of medicinal formulations applicable. Going through the verse of the formulation, it is mainly indicated in *jwara* which is *vatakaphaja* in

nature, along with it, acharya has exclusively indicated the usage of the formulation in other conditions like *swasa*, *kasa*, *asthiva*, *kantha roga*, *aasya sosha*, and *vedana* (pain) in regions of *kukshi*, *hrit* and *parshwa* which infact are the main symptoms itself in case of an infectious respiratory disease. On the onset of any infection or disease in general, they are basically characterized by loss of appetite and irregular bowel movements. In the case of the formulations looking at the pharmacological activity it is clear that all the drugs are basically *dipana* and *pachana* in nature, some of them even being *amahara* in nature removing the undigested stagnated food within the stomach.

On analysis of the therapeutic indication of each drugs, it is evident that the drugs are indicated and are highly beneficial in disorders of the respiratory tract. When it comes to the pharmacological properties or the *rasa panchaka* of the drug, all the drugs are *katu*, *tikta* and *Kashaya rasa* in nature, which helps to prevent the formation of sputum or phlegm within the lungs and prevent dyspnea(50). Many of the ingredient drugs also possess *raktadoshahara*, *Raktashodhana* and *raktapittahara* property which exclusively denotes the dominant action of the drugs in *raktavaha srotas* as well. Main action of the formulation itself is in disorders afflicting the *pranavaha srotas*. Acharya has advised at the end of the verse to consume the medicine along with *Hingu* and *madhu*, and looking at their properties, are also *dipana-pachana*, *Lekhana* and *kaphahara* in nature respectively. The pharmacological activity with special emphasis on antimicrobial, antioxidant and immunomodulatory activity of each ingredient drugs of the formulation was analysed. On analysis of the pharmacological activity of these drugs with reference to the above mentioned activities, all of these drugs have excellent proved action on virus, bacteria. Majority of the drugs are antipyretic in nature. 6 out of 10 drugs are having immunomodulator action which helps in terms of both post infection and preventive measures. All of the drugs except *parpata* have proven antioxidant property which emphasizes the effectiveness of

the drugs in case of infection, building of immunity by the elimination of free radicals.

Considering the above proved and demonstrated facts it is evident that the formulation can be a very useful and reliable medication in diseases of *pranavaha*, *annavaha*, *Raktavaha* and *rasavaha srotas*. It can be inferred the curative effect of the formulation in infectious respiratory diseases caused by air borne pathogens. Along with the formulation being a curative medicine, it can also be considered and advised as a preventive and prophylactic measure also for people who are at risk or exposed to the pathogens,

CONCLUSION

Air borne pathogen caused infectious respiratory diseases are increasing day by day due to the decreased air quality, exotic food and lifestyle, low immune status, drug resilience and vaccine resilience. Mutation of these pathogens are what bothers the medical professionals to find a cure that could prevent the mutation to happen as well as protect the body from the ill effects of the virus. As per the concern of ayurveda, all the classical literatures offer us innumerable formulations that can prove to be helpful in all the above said cases. One such formulation was considered and analyzed here for its potential to prove as an effective medicine that could very well be a preventive, curative, prophylactic as well as post infection medication.

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