



## Concept of *Vyadhikshamatwa* (immunity) in ayurveda and its enhancement through *Rasayana* (Rejuvenation therapy) in prophylactic strategies against COVID-19 pandemic

Sunny C Patil<sup>1\*</sup>, Shubhangi B Kamble<sup>2</sup>, AS Baghel<sup>3</sup>

<sup>1</sup> M.D, PhD Scholar, Department of Basic Principles, Institute of Teaching and Research in Ayurveda (ITRA), Jamnagar, Gujarat, India

<sup>2</sup> Ph.D, Associate Professor, Department of Basic Principles, Institute of Teaching and Research in Ayurveda (ITRA), Jamnagar, Gujarat, India

<sup>3</sup> Ph.D, Professor and Head of Department, Department of Basic Principles, Institute of Teaching and Research in Ayurveda (ITRA), Jamnagar, Gujarat, India

### Abstract

The world now is suffering from a unique and unprecedented situation of corona virus disease outbreak also known as COVID-19 which is caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). This pandemic has challenged health care systems across the globe. Due to lack of definite potential treatment modality against SARS-CoV-2, there remains only one better option to counteract the on-going pandemic that is to evolve our immune system. The coronavirus pandemic has turned the world's attention to the immune system. Our immune systems will need to adapt unaided to COVID-19, until a potential cure is available. The immune system plays a critical role in our response against infectious diseases. Ayurveda has a lot to offer in this area of battle against COVID-19. Even though cure of an illness matters much more but prevention is always better than cure. Ayurveda with its unique concept of *Vyadhikshamatwa* (immunity) and simple natural ways of its enhancement through use of *Rasayana dravyas* (rejuvenating herbal medicines) can play a crucial role in prevention of infectious diseases like COVID-19. The basic principle and practice of *Rasayana* (rejuvenation) is based upon the theory of immunomodulation. It boosts up the immunity and helps to keep the body and mind at the best of its health. *Rasayana dravyas* have been the first line of defense for *Janapadodhwansajanya vyadhis* (pandemics) in Ayurveda.

**Keywords:** ayurveda, COVID-19, immunity, *rasayana*, rejuvenation, *Vyadhikshamatwa*

### Introduction

The world is going through the COVID-19 pandemic, also known as the corona virus pandemic. It is an on-going global pandemic of corona virus disease which is caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). This virus was first identified in December 2019 in Wuhan, China. The World Health Organization declared a Public Health Emergency of International Concern regarding COVID-19 on 30<sup>th</sup> January, 2020 and later declared it as a pandemic on 11<sup>th</sup> March, 2020. As of now more than 153 million cases of corona virus disease have been confirmed, with more than 3.21 million deaths attributed to COVID-19. This statistics makes COVID-19 one of the deadliest pandemics in the history of world [1]. After analyzing the course of disease it is found that, most of the people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, immune-compromised people and those with underlying medical problems like cardiovascular diseases, diabetes, chronic respiratory diseases and cancers are more likely to develop serious illness that causes severe acute respiratory syndrome which has high mortality [2]. Health care systems across the world have become vulnerable and defenseless due to the unprecedented situation of current COVID-19 pandemic. The corona virus pandemic has again brought the concept of immunity- the immune system which

fights naturally against various disease causing viruses, bacteria, fungi, protozoa, parasites etc. onto main platform for global discussion.

Just like many other viruses SARS-CoV-2 virus also lacks effective preventive vaccines and effective antiviral medications. Studies carried out till date have explored that these viruses can form drug-resistant mutants, which will decrease the efficacy of treatment being administered [3]. As per current global statistics, high mortality rate is seen among immune-compromised and those with some underlying pathology. This fact indicates that factors that improve immunity can prevent serious manifestations arising due to COVID-19 infection [4]. World needs effective preventative approaches along with curative measures being employed worldwide in this battle against COVID-19. Ayurveda through its principles for healthy life has a lot to offer in this on-going fight against COVID-19. Preventive measures applied through principles of Ayurveda will not only bridge the gaps that exist in modern medicine, but will complement modern medicine in the combat against COVID-19. This will offer a much needed effective and novel way to manage the current pandemic of COVID-19. Considering these aspects, an attempt has been made to explore the concept of *Vyadhikshamatwa* (immunity) in Ayurveda and its enhancement through *Rasayana* (rejuvenation therapy) in prophylactic strategies against COVID-19 pandemic.

## Materials and Methods

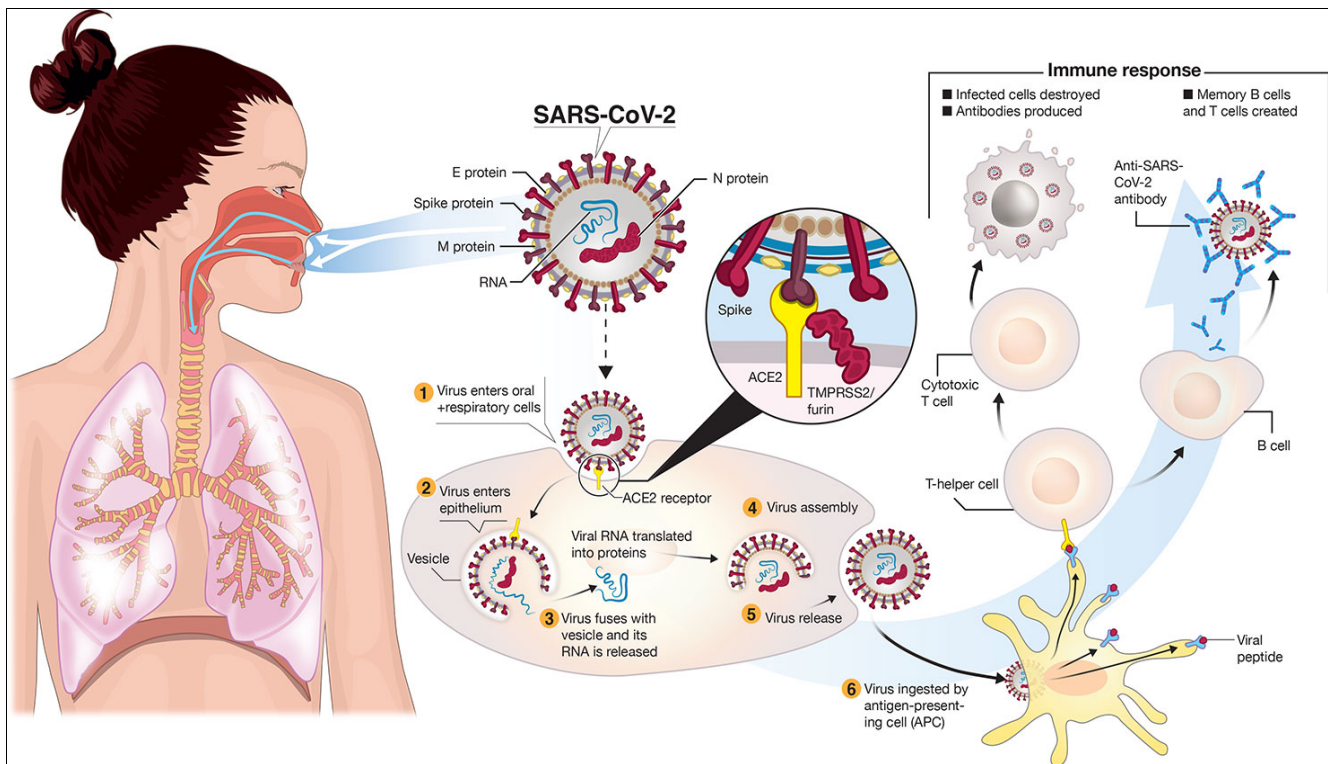
The present review has been done based on the concept of immunity, different aspects of infectious diseases and their prevention as per Ayurveda with special reference to COVID-19 and recent global updates regarding prevention of COVID-19. For this, relevant materials and information have been compiled, screened, reorganized and critically analyzed from Ayurveda texts like Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya and also from the websites of World Health Organization (WHO), Ministry of AYUSH and important news updates related to COVID-19. Various published research articles related to Ayurveda, COVID-19, *Rasayana* and immunomodulatory activities of herbal drugs have also been reviewed for the present work.

## Observations and Discussion

The SARS-CoV-2 virus spreads mainly when an infected person is in close contact with another person. Small droplets and aerosols containing the virus can spread from an infected person's nose and mouth as they breathe, cough,

sneeze, sing, or speak. Other people get infected, if the virus gets into their mouth, nose or eyes. People who are infected can transmit the virus to another person up to two days before they themselves show symptoms, as can people who do not experience symptoms. People remain infectious for up to ten days after the onset of symptoms in moderate cases and up to 20 days in severe cases [5, 6].

The virus SARS-CoV-2 possesses a single-stranded RNA genome wrapped in nucleocapsid (N) protein and three major surface proteins- membrane protein (M), envelope protein (E), and spike protein (S). As described earlier, this virus gets transmitted via respiratory droplets of infected case to oral and respiratory mucosal cells. Then it replicates and passes to the lower airways potentially leading to severe pneumonia. The gateway of this virus is via Spike protein to latch onto host cell ACE2 (angiotensin-converting enzyme-2) receptor binding sites on host cells [7]. A simplified depiction of the life cycle of the virus along with potential immune response from body is elicited in figure 1.



**Fig 1:** Transmission and life-cycle of SARS-CoV-2 along with body's potential immune response to it.

After analyzing closely the onset and progression of COVID-19 globally, it can be seen that early transmission of this disease was from animals to humans and then it advanced to be transmitted through human to human contact. Thus COVID-19 can be considered as communicable disease of highly infectious nature. Current evidences suggest that transmission of SARS-CoV-2 occurs primarily between people through direct, indirect or close contact with infected people through infected secretions such as saliva and respiratory secretions. Airborne transmission of the virus can occur in health care settings where specific medical procedures, called aerosol generating procedures, generate very small droplets called aerosols. Some outbreak reports related to indoor crowded spaces have suggested the possibility of aerosol transmission, combined with droplet transmission.

Respiratory droplets from infected individuals can also land on objects, creating fomites (contaminated surfaces). As environmental contamination has been documented by many reports, it is likely that people can also be infected by touching these surfaces and touching their eyes, nose or mouth before cleaning their hands [8].

In ancient ayurvedic texts, the pandemic diseases have been described as *Janapadodhwansa vyadhis* or *Maraka vyadhis* [9, 10]. Explaining the clinical symptomatology of these diseases, Acharya Sushruta has enumerated symptoms like fever, cough, breathing difficulty, headache and vomiting which resemble closely with clinical features of SARS. *Dalhana*, the distinguished commentator of Sushruta Samhita has mentioned that symptoms like anosmia, cough and catarrh will occur after the entry of contaminated air

through the nasal openings which is again similar to typical clinical features of COVID-19 [11]. Thus COVID-19 shows resemblance with the diseases narrated under the concept of *Janapadodhwansa* or *Maraka vyadhis*.

Due to lack of definite potential treatment modality, there remains only one better option to counteract the on-going pandemic that is to evolve the strength of our immune system. The coronavirus pandemic has turned the world's attention to the immune system. Our immune systems will need to adapt unaided to COVID-19, until a potential cure is available. The immune system plays a critical role in our response against infectious diseases. The immune system is the body's multi-level defense network against potentially harmful bacteria, viruses and other organisms.

### Immunity Ayurveda View

In Ayurveda, *Vyadhikshamatwa* is illustrated as the power of resistance capable enough to check the progress, occurrence or recurrence of diseases. Synonyms for *Vyadhikshamatwa* which appears in Ayurveda scriptures are *Ojas*, *Bala* and *Prakrita Shleshma*. The term '*Vyadhikshamatwa*' is composed of two words viz. *Vyadhi* and *Kshamatwa*. The meaning of the term '*Vyadhi*' is to harm, to injure, to damage or to hurt. The term '*Kshamatwa*' means to suppress or to keep quite or to resist. So, the term '*Vyadhikshamatwa*' means the power of resistance to the diseases. Concept of *Vyadhikshamatwa* was first defined by *Acharya Chakrapani*, the distinguished commentator of *Charaka Samhita*, in a very scientific manner in terms of *Vyadhibalavirodhitwam*- capacity of the body to fight against the manifested diseases (natural immunity) and *Vyadhiutpadpratibandhkatwam*- capacity of the body to not allow manifestation of diseases or pathogenesis [12]. Thus *Vyadhikshamatwa* denotes the resistance power of the body or defense of body against occurrence of any diseases. *Ojas* is the fine essence of all the *Dhatus* (body components) and the superfine essence of *Shukradhatu*

which is responsible for biological strength, vitality and immunity in the body that makes a person physically active [13, 14]. *Acharya Charaka* has described *Ojas* as one of the *Pranayatanas* (sites of vitality) which means if *Ojas* is destroyed, the human life will also perish [15]. *Ojas* in the body is situated in heart and is white, yellowish and reddish in colour or it may be of colour of ghee, tastes like honey and smells like fried paddy [16]. Ayurveda scholars recognized *Ojas* as the active and potent principle of the body that is responsible for the strength, vigour, and vitality of an individual. In Ayurveda literature *Bala* and *Prakrita shleshma* are used as synonyms for *Ojas*. *Charaka* has narrated that the *Shleshma* in its *Prakrita avastha* (normal state) promotes strength, lubrication, virility, immunity, resistance and stability in the form of *Ojas*. [17]. The term '*Bala*' signifies the physical and mental strength of the body. *Bala* has been classified into three types as- *Sahaja bala*, *Kalaja bala* and *Yuktikrita bala*. *Sahaja bala* is the strength an individual possesses naturally by birth. *Kalaja bala* is the strength acquired due to favourable conditions like youth, season etc. and *Yuktikrita bala* is the strength acquired by the intake of specific diet such as flesh, ghee etc [18, 19].

*Ojas* in Ayurveda is considered as the resistance to decay and degeneration of the body and immunity against diseases. It is considered as quintessence of all the *Dhatus* and represents the *Bala* (strength) of all *Dhatus*. The concept of immunology as described by ancient Ayurveda scholars is stated as *Vyadhikshamatwa* or *Ojabala* of an individual. The *Sahaja bala* may be clinically correlated with natural immunity whereas *Kalaja* and *Yuktikrita bala* with acquired immunity. There are clear descriptions available in ancient texts about the three broad categories of immune disorders, namely *Oja-vyapat*, *Oja-vistramsa* and *Oja-kshaya*. The symptomatology of *Ojo vikriti* (immune disorders) described in classical texts of Ayurveda is depicted in Table 1.

**Table 1:** Symptomatology of *Ojo vikriti* (immune disorders) described in Ayurveda [20].

Sr. No.	<i>Oja visrams</i>	<i>Oja vyapat</i>	<i>Oja kshaya</i>
1	<i>Sandhi vishlesha</i> (Feeling of looseness and displacement in joints or synapses)	<i>Stabdha-guru gatrata</i> (Feeling of stiffness and rigidity in body)	<i>Murchcha</i> (Fainting or unconsciousness)
2	<i>Gatra sadanam</i> (Fatigue)	<i>Vata shoph</i> a (Unstable swelling due to vitiation of Vata dosha)	<i>Mamsa kshaya</i> (Emaciation and muscle wasting)
3	<i>Dosha chyavanam</i> (Migration of vitiated dosha to other sites)	<i>Varna bheda</i> (Abnormal change in normal complexion)	<i>Moha</i> (Confusion)
4	<i>Kriya sannirodha</i> (Impairment and blockage of all functions in body and mind)	<i>Glani</i> (Lassitude)	<i>Pralapa</i> (Delirium)
5	-	<i>Tandra</i> (Drowsiness)	<i>Marana</i> (Death)
6	-	<i>Nidra</i> (Excess sleepiness)	-

### Rasayana: Enhancer for Immunity

In view of the immune status of an individual being an important factor for conservation of health and prevention of disease, Ayurveda deliberates extensively on positive health measures such as life-style management, healthy dietetics and rejuvenation therapy with the help of a range of micro-medicinal nutrients called *Rasayana*. *Rasayana* (literal meaning- rejuvenation that which nourishes the channels) is the specialized treatment modality of Ayurveda which is enlisted among the eight Ayurvedic specialties. It deals with the study of medicines and measures which can act as *Vayasthapana* (slowing the ageing process), *Ayu-karam* (increasing life span), *Medha-karam* (improving

intellectual functioning), *Bala-karam* (improving strength) and can treat the disease as well. The word *Rasayana* itself includes *Rasa* (nourishing fluid) denoting all the body tissues and *Ayana* meaning the road, path, movement. Thus the word *Rasayana* indicates the way to attain optimum quality of body tissues [21].

A *Rasayana* remedy promotes nutritional status of an individual through qualitative changes in bodily cells and tissue leading in turn to improved bodily functions, promotion of health and prevention of diseases as well as longevity. These *Rasayanas* are considered to be the therapeutic means of obtaining the best quality of *Dhatus* through micro-nutrition dynamics. It is believed that a

Rasayana acts at the level of *Dhatus* (body components), *Agni* (digestive fire) and *Srotasas* (structural and functional channels in the body). *Rasayana* remedies described in Ayurveda texts are known to sustain micro-nutrition and promote immune strength besides retarding the aging

process [22]. The facts which have emerged from modern researches relating to natural resistance or immunity do not contradict the existing ayurvedic conceptual scheme of natural resistance. Probable mode of action of *Rasayana* therapy is depicted in figure 2.

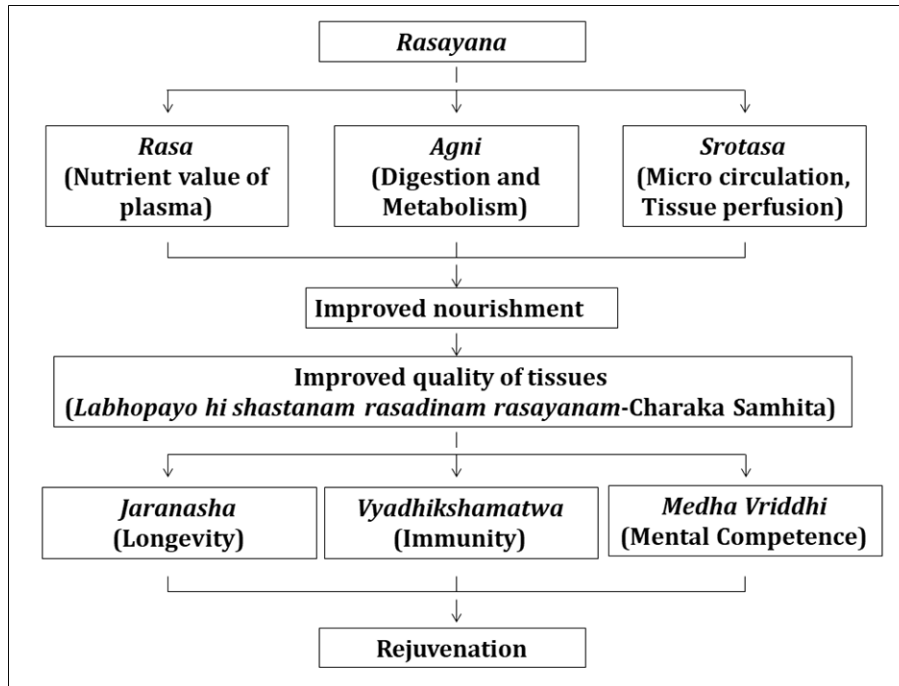


Fig 2: Mode of action of *Rasayana* therapy

Also in contemporary medical terms, *Rasayana* activity of herbs can be related to their immunomodulatory actions. Immune stimulants are substances, which bring about a heightened resistance through the stimulation of non-specific defensive processes, which are largely independent of antigens. In Ayurveda, immunity is largely related with status of *Oja*, *Kapha* and quality of *Rasa dhatu*. Therefore a *Rasayana* drug which can improve the *Rasa*, *Kapha* and *Oja* quality can be stated as immunomodulator. Various efforts are being made to prove immunomodulatory activity of ayurvedic *Rasayana* herbs [21].

All such conditions promote nutritional status of an individual with improved quality of cells and tissues in the body, longevity, immunity and superior health both physical and mental. In this entire process *Ojas* is the basic matrix and all *Rasayanas* are supposed to be *Oja-vardhaka* remedies. *Rasayana tantra* was developed as one of the eight branches of *Ashtangayurveda* which is comparable to nutrition science, immunology and geriatrics all interlinked together. Thus ayurvedic immunology is a continuum of vital nutrition [22].

All the descriptions cited above indicate that *Ojas* can be compared with immune system in the body because functions of *Ojas* and that of immune system are similar in a way that both protect the body from diseases and also

maintain strength of the body. *Rasayana dravyas* have been used as the first line of defense for *Janapadodhwansajanya vyadhis* (pandemics) [23]. Stressful life, unhealthy nutrition and continuous exposure to several toxins in the present era lead to compromised immune system. Therefore immunomodulation should be of central importance in medical field to combat several infective, chronic, autoimmune & inflammatory diseases [24]. The SARS-CoV-2 virus is an evolved pathogen from corona virus group capable of mutating itself hence enough strong immunity is needed to prevent or survive from COVID-19 pandemic. Ayurveda can provide ways for evolving physiological responses to build immunity. The preventive measures of Ayurveda such as medicated water, gargles, oil pulling and nasal oil administration can be practiced as home-based care and that may offer a ‘physiological mask’, thereby reducing the risk of catching the SARS-CoV-2 infection.

The local interventions form a protective biofilm on the most common site of infection- oral and oro-pharyngeal mucosa, and may reduce the risk of infection. Health promoting immunomodulator (*Rasayana*) botanicals like *Withania somnifera*, *Tinospora cordifolia*, *Piper longum*, *Embllica officinalis* and many such herbs as depicted in table 2 can improve host defense and could be an effective prophylaxis approach against COVID-19.

Table 2: Herbs with proven immune-modulatory activity

S.N.	Name of herb	Part used	S.N.	Name of herb	Part used
1.	<i>Withania somnifera</i> [25]	Root	6	<i>Aloe vera</i> [30]	Root
2.	<i>Tinospora cordifolia</i> [26]	Stem	7	<i>Curcuma longa</i> [31]	Bulb
3	<i>Piper longum</i> [27]	Fruit	8	<i>Eclipta alba</i> [32]	Whole plant
4	<i>Embllica officinalis</i> [28]	Fruit	9	<i>Centella asiatica</i> [32]	Whole plant
5	<i>Asparagus racemosus</i> [29]	Leaf	10	<i>Azadirachta indica</i> [33]	Leaf

The care of the most vulnerable group of COVID-19 patients such as those with co-morbidities, immune-compromised and older people is another therapeutic challenge where conventional medicine has limitations. Therapeutic approaches like *Rasayana* therapy, gargles, oil pulling, massage can offer effective means of nourishing the tissues, thereby preventing the worsening of the disease and also reducing the stress. Ayurveda has several potential drug candidates which can be used as an add-on therapy with the empirical modern medicine therapy in the management of COVID-19<sup>[34]</sup>. This is an opportune time to take this bold step and explore the tremendous potential that these ayurvedic drugs could potentially offer. The rapidly growing burden on healthcare services across the nation solicits for collaboration and interaction among clinicians of modern medicine and AYUSH systems. India has a unique opportunity to bring modern medicine and AYUSH with all its richness, tradition and experience with the single aim of stopping this on-going COVID-19 pandemic. Although the challenges of disease are surfacing in newer forms, they can be tackled with an optimistic approach and hard work.

### Conclusion

In this on-going pandemic of COVID-19 when health care systems across the globe are being challenged by the unprecedented situation of SARS-CoV-2 infection, Ayurveda has a lot to offer in this battle against COVID-19. Even though cure of an illness matters much more, but prevention is always better than cure. Ayurveda with its unique concept of *Vyadhikshamatwa* (immunity) and simple natural ways of its enhancement through use of *Rasayana dravyas* (herbal medicines) can play a crucial role in prevention of infectious diseases like COVID-19. The basic principle and practice of *Rasayana* is based upon the immunomodulation. It boosts up the immunity and helps to keep the body and mind at the best of its health. *Rasayana dravyas* have been first line of defense for *Janapadodhwansajanya vyadhis* (pandemics). The immunity enhancing measures of Ayurveda are significantly helpful in strengthening the immune system and thereby offer a natural way for the prevention of pandemic diseases like COVID-19.

### References

1. [https://en.wikipedia.org/wiki/COVID-19\\_pandemic](https://en.wikipedia.org/wiki/COVID-19_pandemic). dated 04-05-2021 time 20:05 IST.
2. [https://www.who.int/health-topics/coronavirus#tab=tab\\_1](https://www.who.int/health-topics/coronavirus#tab=tab_1). dated 04-05-2021 time 20:15 IST.
3. Lin LT, Hsu WC, Lin CC. Antiviral natural products and herbal medicines. *J. Trad. Compliment Med*,2014;4(1):24-35.
4. Abdulmir AS, Hafidh RR. The possible immunological pathways for the variable immunopathogenesis of COVID-19 infections among healthy adults, elderly and children. *Electr. J. Gen. Med*,2020;17(4):1-4.
5. 'Coronavirus disease (COVID-1): How is it transmitted?' World Health Organisation (WHO). Retrieved 6 December 2020.
6. 'Coronavirus Disease 2019 (COVID-19)' U.S. Centers for Disease Control and Prevention (CDC). 11 February 2020. Retrieved 6 December 2020.
7. Colin D Funk, Craig Laferriere, Ali Ardakani, A SARS-CoV-2 and the COVID-19 Pandemic. *Front. Pharmacol*,2020;11:1-17.
8. <https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions> dated 15-04-2021 time 10:15 IST.
9. Acharya YT, editor, Charak Samhita of Agnivesha, Vimana Sthana, Ch. 3, Ver. 5-6, Reprint ed., Varanasi, Chaukhamba Orientalia, 2006:241.
10. Acharya YT, editor, Sushruta Samhita of Sushruta, Sutra Sthana, Ch. 6, Ver. 17-19, 9th ed., Varanasi, Chaukhamba Orientalia, 2007:28.
11. Acharya YT, editor, Dalhana Commentary on Sushruta Samhita of Sushruta, Sutra Sthana, Ch. 6, Ver. 19, 9th ed., Varanasi, Chaukhamba Orientalia, 2007:28.
12. Acharya YT, editor, Chakrapanidatta Commentary on Charaka Samhita of Agnivesha, Sutra Sthana. Ch. 28, Ver. 7, Reprint ed., Varanasi, Chaukhamba Orientalia, 2006:178.
13. Acharya YT, editor, Sushruta Samhita of Sushruta, Sutra Sthana, Ch. 15, Ver. 19, 9th ed., Varanasi, Chaukhamba Orientalia, 2007:71.
14. Paradakara HSS, editor, Ashtanga Hridaya of Vagbhata, Sutra Sthana, Ch. 11, Ver. 37, Reprint ed., Varanasi, Chaukhamba Surbharati Prakashan, 2011:189.
15. Acharya YT, editor, Charak Samhita of Agnivesha, Sutra Sthana, Ch. 29, Ver. 3, Reprint ed., Varanasi, Chaukhamba Orientalia, 2006:181.
16. Acharya YT, editor, Charak Samhita of Agnivesha, Sutra Sthana, Ch. 17, Ver. 75, Reprint ed., Varanasi, Chaukhamba Orientalia, 2006:103.
17. Acharya YT, editor. Charak Samhita of Agnivesha, Sutra Sthana, Ch. 17, Ver. 117, Reprint ed., Varanasi, Chaukhamba Orientalia, 2006:105.
18. Acharya YT, editor. Charak Samhita of Agnivesha, Sutra Sthana, Ch. 11, Ver. 36, Reprint ed., Varanasi, Chaukhamba Orientalia, 2006:74.
19. Dwarikanath C. Introduction to Kayachikitsa. 3rd Edition. Chaukhamba Orientalia, 1996:267.
20. Acharya YT, editor, Dalhana Commentary on Sushruta Samhita of Sushruta, Sutra Sthana, Ch. 15, Ver. 24, 9th ed., Varanasi, Chaukhamba Orientalia, 2007:72.
21. Deole Yogesh. Improve Quality of Life with Ayurvedic Rasayana (Rejuvenation therapy). 1st ed. Lambert Academic Publishing, 2012:9.
22. Singh R. H., Foundations of immunology in Ayurvedic classics. *Indian Journal of History of Science*,2015;50(1):83-94.
23. Acharya YT, editor, Charak Samhita of Agnivesha, Vimana Sthana, Ch. 3, Ver. 14, Reprint ed., Varanasi, Chaukhamba Orientalia, 2006:241.
24. Chauhan VP, Dutt B, Vyas M, Gupta SK, Effect of immune-modulators (RasayanaDravya) in Janapadodhwansa WSR to COVID-19. *Journal of Ayurvedic and Herbal Medicine*,2020;6(1):26-29.
25. Davis L, Kuttan G, Immunomodulatory activity of *Withania somnifera*. *Journal of Ethnopharmacology*, 2000;71(1-2):193-200.
26. Upendra Sharma, Manju Bala, Neeraj Kumar, Bikram Singh, Renuka K Munshi, Supriya Bhalerao. *et al.* Immunomodulatory active compounds from *Tinospora cordifolia*. *Journal of Ethnopharmacology*, 2012;141(3):918-26.

27. Sunila ES, Kuttan G. Immunomodulatory and antitumor activity of Piper longum Linn. and piperine. Journal of Ethnopharmacology,2004;90(2-3):339-346.
28. Madhuri S, Pandey G, Verma KS. Antioxidant, Immunomodulatory and Anticancer activities of Emblica officinalis: An Overview. International research Journal of Pharmacy,2011;2(8):38-42.
29. Manish Gautam, Santanu Saha, Sarang Bani, Bhushan K Patwardhan, Immunomodulatory activity of Asparagus racemosus on systemic Th1/Th2 immunity: Implications for immunoadjuvant potential. Journal of Ethnopharmacology,2008;121(2):241-7.
30. Maharajan H Radha, Nampoothiri P Laxmipriya. Evaluation of biological properties and clinical effectiveness of *Aloe vera*: A systematic review. J. Tradit. Complement. Med,2015;5(1):21-26.
31. Chinampudur V Chandrasekaran, Kannan Sundarajan, Jothie R Edwin, Gligar M Gururaja, Deepak Mundkinajeddu, Amit Agarwal, Immune-stimulatory and anti-inflammatory activities of *Curcuma longa* extract and its polysaccharide fraction. Pharmacognosy Research,2013;5(2):71-79.
32. Jayathirtha MG, Mishra SH, Preliminary immunomodulatory activities of methanol extracts of Eclipta alba and Centella asiatica. Phytomedicine,2004;11(4):361-365.
33. Awah M, *In vitro* anti-HIV and immunomodulatory potentials of Azadirachta indica (Meliaceae) leaf extract. African Journal of Pharmacy and Pharmacology,2011;5(11):1353-1359.
34. Girish Tillu, AYUSH for COVID-19 management. Journal of Ayurveda and Integrative Medicine,2020;11(2):95-96.