WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 11, Issue 9, 594-604. Review Article ISSN 2277– 7105

UNDERSTANDING THE INVOLVEMENT OF RASAVAHA SROTODUSHTI IN COVID-19

Dr. Meenu Kumar[1*], Dr. Diksha[2] and Dr. Aditaya Nath Tewari[3]

[1]*PG Scholar, Department of Roga Nidan Evam Vikriti Vigyan, Ch. Brahm Prakash Ayurved Charak Sansthan, Khera Dabar, Najafgarh, New Delhi-110073.

[2]PG Scholar, Department of Roga Nidan Evam Vikriti Vigyan, Ch. Brahm Prakash Ayurved Charak Sansthan, Khera Dabar, Najafgarh, New Delhi-110073.

[3]Associate Professor, Department of Roga Nidan Evam Vikriti Vigyan, Ch. Brahm Prakash Ayurved Charak Sansthan, Khera Dabar, Najafgarh, New Delhi-110073.

Article Received on
11 May 2022,

Revised on 01 June 2022,
Accepted on 22 June 2022

DOI: 10.20959/wjpr20229-24713

***Corresponding Author**
Dr. Meenu Kumar
PG Scholar, Department of Roga Nidan Evam Vikriti Vigyan, Ch. Brahm Prakash Ayurved Charak Sansthan, Khera Dabar, Najafgarh, New Delhi-110073.

ABSTRACT

COVID-19 is an ongoing global health crisis which was declared pandemic on 11 March 2020 by WHO. It is a newly discovered disease which has primarily caused massive harm to mankind. It is very important to evaluate this disease in terms of *ayurvedic* principles in order to effectively develop *ayurvedic* treatment modalities. In *Ayurveda*, it can be classified as *aupasargika roga* (contagious diseases) /*janapadodhvansa janya vyadhi* (epidemic disease) /*bhutabhisangaja jwara (aagantuja jwara)*. While analysing the symptoms of COVID-19, predominance of *rasavaha srotodushti* is seen in its initial phase of infection. *Pranavaha srotas* is subsequently vitiated in COVID-19 since both *rasavaha* and *pranavaha srotas* has common roots. Afterwards, it leads to vitiation of rest of *srotas* following the infection. In addition to describing this disease as per *ayurvedic* principles, we will try to explore the involvement of *rasavaha srotodushti* in COVID-19 through correlating symptoms prevalent in COVID-19 with *rasavaha srotodushti lakshan* along with brief understanding of involvement of *pranavaha srotas*. In this article, other *samprapti ghtaka* of COVID-19 will also be discussed which will be helpful in establishment of a proper treatment regime for COVID-19.

KEYWORDS: COVID-19 symptoms, Coronavirus, *Ayurveda, Srotas, Rasavaha srotodushti lakshan, Dhatu.*

INTRODUCTION

Coronavirus disease is one of the most contagious disease of modern era causing global health crisis infecting about 50 crore people around the world with 4 crore people in India in a short span of 2 years. This disease is life-threatening and has led to approximately 62 lakh deaths worldwide with 5 lakh deaths in India till May, 2022.[1] COVID-19 is caused by SARS-CoV-2 virus[2] which is very notorious in nature. It is constantly changing its organizational setup and due to mutations, a number of variants has been reported worldwide namely Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), Delta (B.1.617.2), Mu (B.1.621), Omicron (BA.2).[3] Alpha variant was responsible for initial wave of COVID-19 whereas delta variant caused second wave in our country. The virus again mutated into omicron variant which was responsible for third wave in most of the countries. Researchers are warning that more variants may emerge with time due to constant mutations. Some studies suggest that there was relative lower hospitalisation and mortality risks for omicron cases while comparing with delta variant cases.[4] The Omicron variant was considered more contagious than previous variants as reported by UNICEF and WHO.[5]

According to *ayurveda*, human body is constituted by *dosha, dhatu & mala.*[6] Their equilibrium in the body is responsible for state of health and their imbalance leads to disease.[7] These *dosha, dhatu and mala* circulates throughout the body through various *srotas.*[8,9] Symptoms of the disease manifested depends on abnormality in various components of the body including *srotas*. The *srotodushti lakshan* play important role in manifestation of disease and without treating these *lakshan*, the movement of the *dosha, dhatu and mala* may not be normalized. Most of the symptoms of COVID-19 are seen similar to *rasavaha* and *pranavaha srotodushti lakshan*. COVID-19 may also be incorporated in *ayurvedic* nomenclature as an *aupasargika roga* on basis of its transmission *(sankramanti naran-naram)*[10], *janapadodhvansa janya vyadhi* or *bhutabhisangaja jwara.*

Importance of *Srotas*: In *ayurvedic* texts 13 types[11]/11 pairs[12] of *srotas* has been described by *acharyas* along with *srotomula*, vitiating factors and symptoms of vitiation of these *srotas*. *Rasavaha srotas* are the channels carrying *rasa dhatu* formed after digestion of *ahar*. Vital function of *rasa dhatu* is *preenan.*[13] *Rasa dhatu* provide *poshan* to *rakta dhatu* and thus succeeding *dhatus* are formed.[14]

When *rasavaha srotodushti* occurs, *rasa* cannot be circulated properly in body. Wherever the *srotodushti* occurs, *rasa* carried by *vyana vayu*[15] starts accumulating at that place and becomes vitiated. Disease occurs according to region where this vitiated *rasa* accumulates. The *rasavaha srotodushti* ultimately leads to other *srotodushti* and vitiation of their corresponding *dhatus* if not treated well in time.[16]

Hridaya, dasha dhamani[17] and *rasavahini dhamani*[18] are *srotomula (prabhav sthana*[19]) of *rasavaha srotas* and *srotomula* of *pranavaha srotas* is *hridaya, mahasrota*[20] and *rasavahini dhamani*.[21] *Hridaya* and *rasavahini dhamani* are common roots for both *rasavaha* and *pranavaha srotas*. Thus, *rasavaha srotodushti* (vitiation of channels of circulation) may easily cause *dushti* of *pranavaha srotas* as they have close association between them. *Acharya Sushruta* described similar *rasavaha srotovidh* and *pranavaha srotovidh lakshan* may be due to their close relationship.[22] As site of *ojas* is *hridaya* it gets vitiated as well along with *rasa* and *rakta* residing in *hridaya*.

According to *Acharya Charaka, rasavaha srotodushti lakshan* are same as *rasapradoshaja vikar*[23] i.e., *ashraddha, aruchi, aasyavairasya, arasagyata, hrilasa, gaurav, tandra, angamarda, jwara, tama, pandu, strotasaam rodha, klaibya, saada, krishangata, nashoagneya*, and *ayathakalam vali-palita*.[24]

REVIEW OF LITERATURE

The literature relating to symptoms of COVID-19 has been collected from internet and discussed in context of *srotodushti lakshan* described in *ayurvedic* texts. Summarized data is as under.

Table I: Studies with reported prevalence (%) of COVID-19 symptoms conducted in various countries.

S. No.	Symptoms of COVID-19	Meta-analysis of 148 studies from 9 countries[25] (%)	Report of the WHO-China Joint Mission[26] (%)	Study in Bangladesh[27] (%)	Study on European patients[28] (%)	Study in China[29] (%)
1	Fever	78	87.9	93.6	45.4	88.7
2	Fatigue	31	38.1	88.8	63.3	38.1
3	Myalgia/Bodyache/ Myalgia & arthralgia*	17	14.8*	62.6	62.5	14.9*
4	Arthralgia	11	-	-	36.5	-
5	Rigors/Chills	18	11.4	-	-	11.5
6	Rash	-	-	10	-	0.2

7	Any cough	57	-	70.8	63.2	67.8
8	Dry cough	58	67.7	-	-	-
9	Productive cough/Sputum production/Phlegm or sticky mucus	25	33.4	-	15.6	33.7
10	Dyspnoea/Shortness of breath	23	18.6	44	49.1	18.7
11	Chest pain	7	-	-	27.2	-
12	Haemoptysis	2	0.9	-	-	0.9
13	Wheeze	17		-	-	
14	Sore throat	12	13.9	63.6	52.9	13.9
15	Rhinorrhoea	8	-	21.6	60.1	-
16	Vertigo/Dizziness	11	-	-	-	-
17	Nasal congestion	5	4.8	-	67.8	4.8
18	Hyposmia/Loss of smell	25	-	49.7	70.2	-
19	Hypogeusia/Loss of taste	4	-	64	54.2	-
20	Otalgia	4	-	-	25.2	-
21	Diarrhea	10	3.7	30.8	38.1	3.8
22	Nausea/Nausea & vomiting[#]	6	5[#]	-	19.2[#]	5[#]
23	Vomiting	4	-	19.6	-	-
24	Abdominal pain	4	-	-	19.1	-
25	Headache	13	13.6	35.1	70.3	13.6
26	Confusion	11	-	20.5	-	-
27	Conjunctivitis/ Conjunctival congestion^	2	0.8^	-	-	0.8^
28	Ophthalmalgia	4	-	-	-	-
29	Photophobia	3	-	-	-	-
30	Digestive problem	-	-	14.8	-	-
31	Lack of appetite	-	-	39.4	45.7	-
32	Blistering	-	-	2.3	-	-
33	Loss of speech/Dysphonia[+]	-	-	13.2	28.4[+]	-
34	Hair loss	-	-	50.6	-	-
35	Post nasal drip	-	-	-	47.9	-
36	Dysphagia	-	-	-	19.3	-

Most of the above-mentioned symptoms has been described in *rasapradoshaja vikar* (disease due to *rasadushti/rasavaha srotodushti*). Similarity of symptoms of COVID-19 and *rasapradoshaja vikar/rasavaha srotodushti lakshan* is discussed below.

1. ***Ashraddha* (Disinclination for food) and *Aruchi* (Anorexia):** Both these terms bear similar meaning i.e., lack of appetite. This symptom was seen in patients of COVID-19 with prevalence of 39.4% and 45.7% as depicted above.

2. ***Aasyavairasya* (Tastelessness of mouth/inability in perceive taste) and *Arasagyata* (Ageusia/hypogeusia/loss of taste):** The prevalence of loss of taste in patients of COVID-19 was found to be 4%, 64% and 54.2% in above studies.
3. ***Hrilasa* (Nausea):** Nausea was found in 6% patients of COVID-19 in a meta- analysis research. In some studies, nausea was accompanied by vomiting with prevalence of 5%, 19.2% and 5%
4. ***Gaurav* (Heaviness):** Feeling of heaviness is one way that a person may describe as chest pain or discomfort. Prevalence of chest pain in COVID-19 patients was found to be 7% and 27.2%
5. ***Tandra* (Drowsiness/lassitude) and *Tama* (Black out/fainting):** In the meta- analysis research, vertigo / dizziness was reported as 11%. Dizziness is sometimes followed by fainting.
6. ***Angamarda* (Generalized body ache):** Patients of COVID-19 suffered from bodyache depicted as 17%, 62.6% and 62.5% with some studies indicating presence of both myalgia & arthralgia in 14.8% and 14.9% of the patients.
7. ***Jwara* (Fever):** Fever was one of the most prevalent symptoms found as 78%, 87.9%, 93.6%, 45.4% and 88.7% in patients of COVID-19.
8. ***Pandu* (Pallor):** One study reported that anemia is a common and persistent finding in COVID-19 during hospitalization outside of the ICU.[30]
9. ***Strotasaam rodha* (Obstruction to *srotas*):** Obstruction to *srotas* (channels of circulation) in terms of COVID-19 may refer to simple nasal congestion or it can be obstruction of minute srotas such as alveolar edema causing disruption in gaseous exchange and thus dyspnoea. Fluid accumulation in alveoli also causes production of cough. Nasal congestion was found to be prevalent as 5%, 4.8%, 67.8% and 4.8%. Dyspnoea was found to be prevalent as 23%, 18.6%, 44%, 49.1% and 18.7%. Prevalence of any type of cough in COVID-19 was reported as 57%, 70.8%, 63.2% and 67.8% with dry cough seen as 58% and 67.7% and productive cough seen as 25%, 33.4%, 15.6% and 33.7%.
10. ***Klaibya* (Impotence):** Impairment of spermatogenesis along with elevated immune response in testis and epididymis was reported in one study.[31] Other study suggested COVID-19 may affect prevalence and severity of erectile dysfunction either directly or indirectly.[32]
11. ***Saada* (Exhaustion/tiredness to body):** Prevalence of fatigue was found to be 31%, 38.1%, 88.8%, 63.3% and 38.1% in above studies.

12. ***Krishangata* (Emaciated or thin body):** A very high incidence of weight loss and risk of malnutrition was found among COVID-19 survivors. As reported in a study, 29% of total COVID-19 patients had lost >5% of initial body weight independent of their hospitalization status.[33]
13. ***Nashoagneya* (Loss of agni):** Loss of *agni* or diminished *agni* which is the most common cause of *srotodushti* leads to indigestion and produces *aama* (partial digested food). Production of *aama* can cause various symptoms like digestive problem, diarrhea, vomiting, abdominal pain etc. Prevalence of these symptoms in patients of COVID-19 were found as - Digestive problem (14.8%), diarrhea (10%, 3.7%, 30.8%, 38.1% and 3.8%), vomiting (4% and 19.6%) and abdominal pain (4% and 19.1%).
14. ***Ayathakalam vali* (Premature appearance of wrinkles) and *Ayathakalam palita* (Premature appearance of gray hairs):** A study reported that 97.2% of patients with COVID-19 had some degree of depression. In the study, all patients (100%) had severe (0.9%) and very severe (99.1%) anxiety. 97.1% of patients had some degree of stress and it was reported that the 84.9% of patients had severe and very severe stress.[34] Such high levels of stress can cause premature appearance of wrinkles and premature graying of hairs.

DISCUSSION

In *Ayurveda*, diseases which are widely spread in an area or a community occurring due to *vikrit vayu*, *vikrit jala*, *vikrit desha* and *vikrit kala* are described as *janapadodhvansa*[35] and contagious diseases are described as *aupasargika roga*. Modes of transmission of *aupasargika roga* are physical contact (Intercourse/close contact), direct physical touch (contact during a gathering), exhalation, eating, sleeping, sitting nearby and using clothes, ornaments of diseased person.[36] Thus, COVID-19 disease falls under category of *janapadodhvansa* (*vikrit vayu* – air containing respiratory droplets of coronavirus from an infected person) and an *aupasargika roga* on basis of similar transmission routes of COVID-19. Coronavirus can be viewed as *bhuta* causing *bhutabhisangaja jwara* (COVID-19) which leads to *tridosha prakopa* based on description by *Acharya Charaka*.[37]

From above findings, it is evident that many symptoms of *rasavaha srotodushti* are present in acute stage of COVID-19. Some of the studies did not directly report presence of few symptoms as most of the studies were done in acute phase of the disease. These symptoms may be found in longer duration subjected to persistence of *dosha-dushya sammurchana*. It

can be suggested that COVID-19 primarily causes vitiation of *rasavaha srotas*, rest of the *srotas* get vitiated subsequently and lakshan of *pranavaha srotodushti* are predominantly found in later stage of the disease.

CONCLUSION

By taking all facts in consideration, COVID-19 can be classified as *janapadodhvansa janya vyadhi* or *aupasargika roga* or *bhutabhisangaja jwara* which is responsible for *tridosha prakopa* in COVID-19. Moreover, it can be concluded that there is predominance of *rasavaha srotodushti lakshan* in COVID-19 in its initial phase of infection. Since both *rasavaha* and *pranavaha srotas* has common roots, *pranavaha srotas* is subsequently vitiated in COVID-19. Afterwards, it seems to lead vitiation of other *srotas* as symptoms of other *srotodushti* are also found following the infection. As *chikitsa* is defined as *samprapti-vighattan*, the knowledge of involved components in *samprapti* of COVID-19 - *dosha (tridosha), dushya (rasa, rakta, ojas), srotas (rasavaha srotas, pranavaha srotas), srotodushti (sanga, ati-pravritti), adhisthana (nasa, urasa)* is helpful in development of treatment modality for COVID-19 infection.

REFERENCES

1. https://covid19.who.int/table. (Retrieved on 09/05/2022).
2. https://www.who.int/health-topics/coronavirus#tab=tab_1. (Retrieved on 09/05/2022).
3. https://www.webmd.com/lung/coronavirus-strains#1. (Retrieved on 09/05/2022).
4. Nyberg T, Ferguson NM, Nash SG, et al. Comparative analysis of the risks of hospitalisation and death associated with SARS-CoV-2 omicron (B.1.1.529) and delta (B.1.617.2) variants in England: a cohort study. Lancet, 2022; 399(10332): 1303-1312. doi:10.1016/S0140-6736(22)00462-7, retrieved on 09/05/2022.
5. https://www.unicef.org/coronavirus/what-we-know-about-omicron-variant. (Retrieved on 09/05/2022)
6. Shastri Kaviraja Ambikadutta, Sushruta Samhita, Sutra Sthana Vol.1, Doshdhatumalkshyavridhivigyaniya-adhyaya Ch. 15/3, Ayurveda Tattva Sandipika, Hindi Commentary, Chaukhambha Sanskrit Sansthan Varanasi; Reprint, 2017; p 73.
7. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Sutra Sthana Vol.1, Vatakalakaliya-adhyaya Ch. 12/13, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 252.

8. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Vimana Sthana Vol.1, Srotovimana-adhyaya Ch. 5/6, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 710.
9. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Vimana Sthana Vol.1, Srotovimana-adhyaya Ch. 5/3, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 709.
10. Shastri Kaviraja Ambikadutta, Sushruta Samhita, Nidan Sthana Vol.1, Kushtanidan-adhyaya Ch. 5/33, Ayurveda Tattva Sandipika, Hindi Commentary, Chaukhambha Sanskrit Sansthan Varanasi; Reprint, 2017; p 325.
11. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Vimana Sthana Vol.1, Srotovimana-adhyaya Ch. 5/29, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 714.
12. Shastri Kaviraja Ambikadutta, Sushruta Samhita, Sharir Sthana Vol.1, Dhamanivyakaran-adhyaya Ch. 9/12, Ayurveda Tattva Sandipika, Hindi Commentary, Chaukhambha Sanskrit Sansthan Varanasi; Reprint, 2017; p 96.
13. Gupta Kaviraj Atrideva, Astanga hridayam, Sutra Sthana, Doshadivigyaniya-adhyaya Ch. 11/4, Vidyotini Hindi Commentary, Chaukhambha Prakashan Varanasi; Reprint, 2009; p 114.
14. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Chikitsa Sthana Vol.2, Grahanidosha-adhyaya Ch. 15/16, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 456.
15. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Chikitsa Sthana Vol.2, Grahanidosha-adhyaya Ch. 15/36, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 458.
16. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Vimana Sthana Vol.1, Srotovimana-adhyaya Ch. 5/9, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 712.
17. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Vimana Sthana Vol.1, Srotovimana-adhyaya Ch. 5/8, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 711.
18. Shastri Kaviraja Ambikadutta, Sushruta Samhita, Sharir Sthana Vol.1, Dhamanivyakaran-adhyaya Ch. 9/12, Ayurveda Tattva Sandipika, Hindi Commentary, Chaukhambha Sanskrit Sansthan Varanasi; Reprint, 2017; p 96.

19. Acharya Yadavji Trikamji, Charaka Samhita, Vimana Sthana, Srotovimana-adhyaya Ch. 5/8, Ayurved-dipika Commentary, Chaukhambha Publications New Delhi; Reprint, 2018; p 251.
20. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Vimana Sthana Vol.1, Srotovimana-adhyaya Ch. 5/7, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 710.
21. Shastri Kaviraja Ambikadutta, Sushruta Samhita, Sharir Sthana Vol.1, Dhamanivyakaran-adhyaya Ch. 9/12, Ayurveda Tattva Sandipika, Hindi Commentary, Chaukhambha Sanskrit Sansthan Varanasi; Reprint, 2017; p 96.
22. Shastri Kaviraja Ambikadutta, Sushruta Samhita, Sharir Sthana Vol.1, Dhamanivyakaran-adhyaya Ch. 9/12, Ayurveda Tattva Sandipika, Hindi Commentary, Chaukhambha Sanskrit Sansthan Varanasi; Reprint, 2017; p 96.
23. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Vimana Sthana Vol.1, Srotovimana-adhyaya Ch. 5/8, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 711.
24. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Sutra Sthana Vol.1, Vividhaashitpitiya-adhyaya Ch. 28/9-11, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 571.
25. Grant MC, Geoghegan L, Arbyn M, Mohammed Z, McGuinness L, Clarke EL, et al. (2020) The prevalence of symptoms in 24,410 adults infected by the novel coronavirus (SARS-CoV-2; COVID-19): A systematic review and meta-analysis of 148 studies from 9 countries. PLoS ONE 15(6): e0234765. https://doi.org/10.1371/ journal.pone.0234765, retrieved on 09/05/2022.
26. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Available from: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf. retrieved on 09/05/2022.
27. Amin MT, Hasan M and Bhuiya NMMA (2021) Prevalence of Covid-19 Associated Symptoms, Their Onset and Duration, and Variations Among Different Groups of Patients in Bangladesh. Front. Public Health 9:738352. doi: 10.3389/fpubh.2021.738352, retrieved on 09/05/2022.
28. Lechien JR, Chiesa-Estomba CM, Place S, Van Laethem Y, Cabaraux P, Mat Q, Huet K, Plzak J, Horoi M, Hans S, Rosaria Barillari M, Cammaroto G, Fakhry N, Martiny D, Ayad T, Jouffe L, Hopkins C, Saussez S; COVID-19 Task Force of YO-IFOS. Clinical and epidemiological characteristics of 1420 European patients with mild-to-moderate

coronavirus disease 2019. J Intern Med, 2020 Sep; 288(3): 335-344. doi: 10.1111/joim.13089. Epub 2020 Jun 17. PMID: 32352202; PMCID: PMC7267446, retrieved on 09/05/2022.

29. Guan, Wei-jie, et al. "Clinical characteristics of coronavirus disease 2019 in China." New England journal of medicine 382.18 (2020): 1708-1720, https://www.nejm.org/doi/full/10.1056/neJMoa2002032, retrieved on 09/05/2022.
30. Bergamaschi, G., Borrelli de Andreis, F., Aronico, N., Lenti, M. V., Barteselli, C., Merli, S., Pellegrino, I., Coppola, L., Cremonte, E. M., Croce, G., Mordà, F., Lapia, F., Ferrari, S., Ballesio, A., Parodi, A., Calabretta, F., Ferrari, M. G., Fumoso, F., Gentile, A., Melazzini, F., … Internal Medicine Covid-19 Collaborators (2021). Anemia in patients with Covid-19: pathogenesis and clinical significance. *Clinical and experimental medicine*, *21*(2): 239–246. https://doi.org/10.1007/s10238-020-00679-4, retrieved on 09/05/2022.
31. Li H, Xiao X, Zhang J, Zafar MI, Wu C, Long Y, Lu W, Pan F, Meng T, Zhao K, Zhou L, Shen S, Liu L, Liu Q, Xiong C. Impaired spermatogenesis in COVID-19 patients. EClinical Medicine, 2020 Nov; 28: 100604. doi: 10.1016/j.eclinm.2020.100604. Epub 2020 Oct 23. PMID: 33134901; PMCID: PMC7584442, retrieved on 09/05/2022.
32. Hsieh TC, Edwards NC, Bhattacharyya SK, Nitschelm KD, Burnett AL. The Epidemic of COVID-19-Related Erectile Dysfunction: A Scoping Review and Health Care Perspective. Sex Med Rev, 2022 Apr; 10(2): 286-310. doi: 10.1016/j.sxmr.2021.09.002. Epub 2021 Sep 20. PMID: 34732316; PMCID: PMC8450276, retrieved on 09/05/2022.
33. Di Filippo L, De Lorenzo R, D'Amico M, Sofia V, Roveri L, Mele R, Saibene A, Rovere-Querini P, Conte C. COVID-19 is associated with clinically significant weight loss and risk of malnutrition, independent of hospitalisation: A post-hoc analysis of a prospective cohort study. Clin Nutr, 2021 Apr; 40(4): 2420-2426. doi: 10.1016/j.clnu.2020.10.043. Epub 2020 Oct 29. PMID: 33160700; PMCID: PMC7598735, retrieved on 09/05/2022.
34. Zandifar A, Badrfam R, Yazdani S, Arzaghi SM, Rahimi F, Ghasemi S, Khamisabadi S, Mohammadian Khonsari N, Qorbani M. Prevalence and severity of depression, anxiety, stress and perceived stress in hospitalized patients with COVID-19. J Diabetes Metab Disord, 2020 Oct 29; 19(2): 1431-1438. doi: 10.1007/s40200-020-00667-1. PMID: 33145259; PMCID: PMC7594988, retrieved on 09/05/2022.
35. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Vimana Sthana Vol.1, Janapadodhvansaniya-adhyaya Ch. 3/6, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 693.

36. Shastri Kaviraja Ambikadutta, Sushruta Samhita, Nidan Sthana Vol.1, Kushtanidan-adhyaya Ch. 5/32, Ayurveda Tattva Sandipika, Hindi Commentary, Chaukhambha Sanskrit Sansthan Varanasi; Reprint, 2017; p 325.
37. Shastri Kashinath & Chaturvedi Gorakhnath, Charaka Samhita, Chikitsa Sthana Vol.2, Jwarachikitsa-adhyaya Ch. 3/116, Vidyotini Hindi Commentary, Chaukhambha Bharati Academy Varanasi; Reprint, 2015; p 125.