

Prevention and Management of Coronavirus Disease-COVID-2019: Review

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ABSTRACT

The recent pandemic spread of coronavirus disease 2019 (COVID-19) caused by a type of virus called coronavirus 2 (SARSCoV2), has led to a worldwide public health crisis. It was first reported on December 31, 2019 when China informed WHO about the sequence of cases of pneumonia like disease of an unknown cause in City of Wuhan. Afterwards the disease quickly spread to other nearby regions and cities of China, and consequently to the remaining parts of the world very soon. In January, 2020 WHO declared it as a pandemic. The virus has been named SARS-CoV-2 and the disease is now called COVID-19. The outbreak has so far killed 3,114,480 people across the globe and infected 147,139,459 (as on April 25, 2021). The virus has spread to 192 countries. In India, 16,960,172 confirmed cases and 192,311 deaths have been reported (as per MoHFW). To check the spread of the coronavirus pandemic, or Covid-19 world-wide lock down was declared. Though there is no confirmed treatment for Corona, but antiviral, steroids and other symptomatic treatments are saving lives. Vaccination programme has been also launched worldwide for the prevention of the disease. Major concerns are rise of number of variants due to frequent mutations in viral genome which resists the vaccination as well. Clinically, individuals with pre-existing conditions of heart disease, diabetes, cerebrovascular diseases and the elderly (above Age 55) are most vulnerable to the infection. Evidences support the benefits of yoga in prevention and management of chronic non communicable diseases including Covid-19.

Key-words: COVID2019, Pandemic, Immune function, Treatment, Vaccination, Yoga

INTRODUCTION

The recent emergence of coronavirus disease 2019 or COVID-19 is a viral infectious disease spread by coronavirus 2-a severe acute respiratory syndrome (SARS-CoV-2) [1-3]. The initial reports of the epidemic disease were collected from Wuhan, Hubei region of China, followed by its spread worldwide [3,4]. Later, on January 30, 2020, WHO declared it pandemic as a Public Health Emergency as it has spread across 18 countries across the globe with four countries reporting human-to-human transmission [5].

Earlier studies have reported the zoonotic origin of SARS-CoV-2 with person-to-person transmissibility [4,6,7]. Although, identical genomes of SARS-CoV-2 to bat CoV, was a reason to believe bat as the natural host [8]. CoVs is a large family of single-stranded RNA viruses having broad distribution in several mammals (Camel, bat etc), and birds including humans. The viruses were so named because of their crown-like appearance. (coronam means crown in latin), the envelope having club-shaped spikes.

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Review literatures- In the past coming out of three highly pathogenic, novel coronavirus CoV-SARSSARS-CoV-1, another one called Middle East respiratory syndrome MERS-CoV and now the SARS-CoV-2, which was identified in December 2019 have emerged [8,9]. SARS-CoV-2 the current pandemic, cause a respiratory viral infection [4]. In severe cases, leading to bacterial

coinfection culminating into severe acute respiratory illness and occasionally into acute respiratory distress syndrome (ARDS) [5,6]. Coronaviruses are large, spherical viruses with specific surface projections. The average size is 80 to 120 nm, which is highly variable. The total molecular mass is an average of 40,000 kDa [10-12].

Their envelope consists of several protein molecules, which are embedded in it [13]. The viral envelope is made up of a lipid bilayer in which spike protein (S), envelope (E) and membrane (M) are anchored. These proteins are structural proteins that are merged with the lipid bilayer which maintain the shape and size of the viral envelope [14,15]. S proteins are essential for interaction with the cells of the host, which are recognized by the host cell receptor [8]. Coronaviruses primarily infect human lung cells through a receptor for an enzyme Angiotensin Converting Enzyme 2 (ACE2).

In the first step to viral infection, the viral spike protein recognizes and binds to the ACE2 receptor [16]. The virus then enters into the lung cells and release viral RNA into the cytoplasm. The viral RNA molecules recruit the cellular machinery to prepare thousands of copies of the viral RNA and also direct cells to synthesize thousands of nucleocapsid, membrane envelope, and spike proteins. These finally assemble into new virus particles, which later bud out from the cell surface. The newly released viral particles propagate the infection [17]. Symptoms of COVID-19 include fever, cough, fatigue, breathing difficulties, loss of smell and taste. Symptoms may begin 01 to 14 days after viral exposure. Though, a one-third of people infected do not develop observable symptoms at all.

Mild to moderate symptoms were observed in 81% of cases (up to mild pneumonia), while 14% reported severe symptoms (dyspnoea, hypoxia, and almost 50% lung involvement), while 5% reported critical symptoms (respiratory failure, shock, or multiorgan dysfunction) [18]. Older people (55 Yrs and above) [19], and those having comorbidities like diabetes, hypertension, cardiac problems, asthma etc are at a higher risk of developing severe symptoms. It is observed that few people continuously experienced a variety of effects for months even after recovery. Effects of the disease seen after a long time called Long COVID syndrome can happen even if the illness is mild or asymptomatic.

These include tiredness or fatigue, difficulty in thinking, concentrating on a task, headache, loss of smell or taste,

dizziness on standing, palpitation, chest pain, breathing difficulty, cough, joint or muscle pain, depression or anxiety, delirium, sleeplessness, headache etc. Fortunately, these symptoms are getting better with time. One has to sincerely follow the post covid rehabilitation for at least 1-3 months, which include good quality sleep, eating sufficient healthy food, drink plenty of water, being physically active, stay socially connected, do relaxing activities and breathing exercises to overcome such effects. Diabetes and hypertension have been observed to be one of the most typical comorbidities in COVID-19 patients.

Compromised immune function reduced neutrophil action, reduced T-cell response, and abnormalities of humoral immunity were observed in these patients [20].

The hyperglycemic environment in covid patients could enhance the virulence of pathogen; reduce the formation of interleukins against infection, reduce phagocytic activity and polymorphonuclear leukocytes. Hypertension is another comorbidity of COVID-19 infection [21]. Hypertension is typically treated with drug inhibitors that target the renin-angiotensin system (RAS) [22]. These drugs are mainly the angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs). RAS inhibitors have been assuming to affect the activity of ACE2 and the expression of ACE2 mRNA in tissues, ACE2 has been observed to be the cellular receptor of COVID-19 [23]. Long-term use of ACEIs might suppress the adaptive immune response, which is a key defence against viral infection [22].

As of April 05, 2021, there is a drastic escalation in the number of cases of COVID-19 not only in India but across the world [24]. These latest updates imply that the pandemic has reached a new stage with rapid spread suggesting the need of working the measures for self-protection in the direction of the prevention and further spread of the infection to others. Covid-19 spread via close contact or contact with surfaces touched by infected persons. Most patients identified are asymptomatic or symptomatic were healthy adults aged 25–70 years. Though few suspected cases have been also reported among children less than 15 years.

Though transmission of COVID-19 occurs mainly by close contact with a positive infected person recently the possibility of airborne transmission has not been ruled out, as smaller infected droplets and particles can remain in the air for minutes to hours within enclosed spaces

that do not have adequate ventilation. Effective prevention or treatment of COVID-19 is a top priority toward curtailing the number of cases of infected patients. The treatments that are practised for COVID-19 include Hydroxychloroquine, Remdesivir, Lopinavir-Ritonavir combination with or without interferon, Dexamethasone and convalescent plasma therapy [25-27]. Implementation of several infection control procedures such as social distancing, quarantine, isolation, continuous hand washing when touching any surface and frequent use of sanitiser along with wearing a mask are undertaken [28]. But the actual challenge is to establish preventive intervention strategies such as Vaccination [29,30].

Vaccination is one of the most radical countermeasures to combat an infectious epidemic, as it is a safe and most effective way to prevent such disease and save lives. Vaccines reduce the risks of disease by working with the body's natural defence to build protection. The government of India launched a mass vaccination programme in March 2021. Covishield (Serum Institute) and Covaxin (Bharat Biotech) have been used for this purpose. Data for Covishield showed that out of total vaccinated 11.6 cr. 10, 03, 02,745 received 1st dose and 1, 57, 32,754 received 2nd dose. Total positive found after 1st dose was 17.145 (0.2%), while after 2nd dose 5014(0.03%). Similarly, for Covaxin, the total vaccinated were 1.1 Cr. 93, 56436 received 1st dose and 17, 37,178 received 2nd dose. Out of which positive found after 1st dose are 4208 (0.04%) and after 2nd dose 695 (0.04%). In India, a comparison of these vaccination programmes clearly shows that the proportion of covid infections in the vaccinated is insignificant. According to Chairperson, Bharat Biotech, Dr. Krishna Ella injectable for Covid 19 only gives protection to the lower lung but not the upper lung from infection. The chances of getting infected even after two doses are not completely ruled out. Though the vaccine will protect from infection from getting serious and won't be life-threatening.

However, implementation of antiviral treatment and prophylaxis has several requirements, such as infrastructure, hospital beds, ventilators, the stockpile of drugs, safety of the treatment and cost-effectiveness.

Yoga for the control of Coronavirus Disease 2019- Yoga and meditation are ancient mind-body techniques and are defined as balance at both mind and body levels achieved through practising yoga exercises [31]. The

evidence available suggests that yoga/meditation facilitates coordination among the nervous, endocrine, and immune systems [32]. Asana (Sanskrit), Pranayama (in Sanskrit) or breathing regulatory practices and meditation comprise the integrative system of yoga techniques. The asanas and pranayama practices promote physical as well as mental well-being.

Some of these have a calming effect on the body, some are stimulatory to the circulatory and nervous and systems, while some develop concentration and coordination. Clinically, these yoga techniques have been observed to be beneficial for the management of post-traumatic stress, chronic stress, depression or anxiety [33,34] and also effective in many non-communicable diseases such as asthma [35], hypertension [36], heart disease [37] and diabetes [38,39]. It has been reported that the abdominal pressure created during exhalation in Kapalabhati improves the efficiency of β -cells of the pancreas [38].

Evidence for the positive effects of yoga on communicable diseases including influenza, tuberculosis [40,41] and human immunodeficiency virus (HIV) infection, wherein condition of the immune system is a key factor that determines the success of the disease [42]. Impaired immunity is characterized by lymphopenia and elevated CRP levels which are essential clinical features of COVID-19 [43]. Lung pneumocytes invaded by SARS-CoV-2 collapse the air sacs [44]. An immune response is induced as neutrophils and macrophages rush to the site, initiating inflammation that leads to pneumonia [45].

Pneumonia and acute respiratory distress syndrome are responsible for death in severe cases, in which impairing the gaseous exchange occurs due to deposition in alveoli and small blood vessels around alveoli [46]. Hence, one of the treatment strategies for COVID-19 could be managing the immune response. Fear, anxiety and depression are psychological stress factors observed in COVID-19 patients [47]. These factors may alter the immune functions in quarantine or hospital admitted patients or healthcare workers. Modulation of HPA axis through the practice of meditation and yoga could help alleviate stress and strengthen the antiviral immune responses.

An arbitrarily controlled investigation in young healthy non stressed students revealed a significant rise in interferon-gamma (IFN- γ) levels (a key regulator of cell-mediated immunity, with antiviral, immune-regulatory

activities) after yoga exercise^[48]. According to its ability to increase and regulate the IFN- α level, yoga practices could enhance innate immune activities during the incubation and non-severe stages of Covid -19 to eliminate the virus. It was observed that the count of transcendental meditation (TM) practitioners, CD3+CD4-CD8+ lymphocytes ($P<0.05$), B-lymphocytes ($P<0.01$), and natural killer (NK) cells ($P<0.01$) was more as compared to the control group.

A significant correlation between the increase in NK and the activation of frontal alpha wave and activity during yoga exercises has been also reported^[49,50]. NK cells serve as the first line of defence against invading viruses, being a part of innate lymphocytes, which limit their spread and subsequent tissue damage. Tooley et al. reported significantly higher plasma melatonin levels in mediators practising TM-Sidhi^[51]. Melatonin is known to regulate cellular as well as humoral immunity and stimulates the production of immune cells. Post yoga increase IgA antibody in pregnant women which helps the protective potential of yoga against infecting pathogens^[52]. These studies indicate that the practice of yoga might strengthen cell-mediated or mucosal immunity and could be used as a preventive measure against virus or other pathogen-mediated infections.

There is evidence, which uniformly supports that yoga practice could down-regulate pro-inflammatory markers such as interleukin-1 (IL-1) beta, as well as in IL-6 and tumour necrosis factor (TNF)- α Cytokine storm represented by elevated cytokine levels (IL-6, IL-10, and TNF- α), lymphopenia (in CD4+ and CD8+ T-cells), and decreased IFN- γ Expression in CD4+ T-cells has been reported in severe COVID-19^[53]. These studies support the usefulness of yoga exercises as a complementary mediation for people in danger or already infected with COVID-19. Reports also suggest that the duration of the yoga exercise intervention also significantly influence the inflammatory markers.

Pranayama, a yoga that includes respiratory exercise should be included in daily routine was found beneficial in all age groups including the older ones. Regular practice enhances the strength of inspiratory as well as expiratory muscles^[54]. Joshi *et al.*^[55] reported beneficial effects of a 6-week course of pranayama on ventilatory lung functions. The breathing yoga called Kapalabhati includes powerful strokes of exhalations where contraction of diaphragmatic and abdominal muscles

follow passive inhalations, not only train and tone abdominal and diaphragm muscles but also helps in removal of secretions from the bronchial tree, thus cleansing up respiratory passages and the alveoli^[56].

There have been several reports of clinical trials that suggest an overall effect of yoga practices toward improved pulmonary function in patients, who suffered from chronic obstructive pulmonary disease (COPD), an important cause of morbidity and mortality^[57,58]. A meta-analysis done showed significant clinical benefits of yoga in COPD patients^[52]. A recent study has reported beneficial effects of meditation on adjustment to the hypoxic high altitude conditions that require synergistic functioning of the cardiac, respiratory and haematological system and increases in the partial pressure of oxygen, (PO₂) a marker of bio-availability of oxygen at the cellular levels^[59]. The present situation thus requires prompt response toward COVID-19 to identify planning's to overcome the stress and infection associated with it.

This planning must not only be limited to therapeutic and preventive measures but also aim at enhancing immunity and mental condition in infected and cured covid patients. This can certainly be obtained by yogic breathing techniques. This emphasizes the importance of yogic breathing exercises under different names anulom vilom, kapalbhati, sudarshn Kriya and Simha Kriya or Isha kriya, the simple yet effective breathing techniques^[60].

CONCLUSIONS

The COVID-19 outbreak is an unprecedented pandemic that demands urgent efforts in the development of effective preventive measures and treatment strategies. In past one year there is a rise in the number of deaths due to rapid transmission and various mutated strains of SARS-CoV-2, though with low mortality rates. Several therapeutic aspects of Yoga exercises on the immune and respiratory functions have been reported. Yoga like meditation or pranayama or similar practices emphasizes their important role in COVID-19 management. Extensive work, both universities and related institutions have shown that systematic tailor-made asana practices, dedicated pranayamas, meditation could provide a broad-spectrum immune build up in the body so that viral infection could be reduced or prevented. As the upper respiratory tract is the main port of entry for the SARS-CoV-2 virus, yoga practices utilizing deep exhalation and inhalation relaxation could be very

beneficial.

Therefore, yoga techniques such as asanas, pranayama meditation, Isha kriya (long duration breathing technique), Simha kriya (short duration breathing technique and detoxification kiyas must be included in the daily routine.

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REFERENCES

- [1] World Health Organization. Coronavirus Disease (COVID-19) Outbreak. World Health Organization. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>, 2020.
- [2] Wang D, Hu B, Hu C, Zhu F, Liu X, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel corona virus infected pneumonia in Wuhan. China. *JAMA*, 2020; 323(11): 1061-69.
- [3] Zhu N, Zhang D, Wang W, Li X, Yang B, et al. A Novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med.*, 2020; 382: 727-33.
- [4] Adhikari SP, Meng S, Wu YJ, Mao YP, Ye RX, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: A scoping review. *Infect Dis Poverty*, 2020; 9: 29. doi: 10.1186/s40249-020-00646-x.
- [5] Cascella M, Rajnik M, Cuomo A, Dulebohn S, Napoli R. Features, evaluation and treatment coronavirus (COVID-19). In: StatPearls. Treasure Island (FL): Stat Pearls Publishing; 2020. <https://www.ncbi.nlm.nih.gov/books/NBK554776/>.
- [6] Guo YR, Cao QD, Hong ZS, Tan YY, Chen SD, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak-An update on the status. *Mil Med Res.*, 2020; 7: 11. doi: 10.1186/s40779-020-00240-0.
- [7] Chan JF, Yuan S, Kok KH, To KK, Chu H, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: A study of a family cluster. *Lancet*, 2020; 395: 514-23.
- [8] Weiss SR, Leibowitz JL. Coronavirus pathogenesis. *Adv Virus Res.*, 2011; 81: 85-164.
- [9] Raoult D, Zumla A, Locatelli F, Ippolito G, Kroemer G. Coronavirus infections: Epidemiological, clinical and immunological features and hypotheses. *Cell Stress*, 2020; 4(4): 66–75. doi: 10.15698/cst2020.04.216.
- [10] Chan JF, Yuan S, Kok KH, To KK, Chu H, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: A study of a family cluster. *Lancet*, 2020; 395: 514-23.
- [11] Matthews CE, Ockene IS, Freedson PS, Rosal MC, Merriam PA, et al. Moderate to vigorous physical activity and risk of upper-respiratory tract infection. *Med Sci Sports Exerc.*, 2002; 34: 1242-48.
- [12] Lai MM, Cavanagh D. The molecular biology of coronaviruses. *Adv Virus Res.*, 1997; 48: 1–100.
- [13] Lalchhandma K. The chronicles of coronaviruses: the electron microscope, the doughnut, and the spike. *Sci vision*, 2020; 20: 78-92.
- [14] Neuman BW, Adair BD, Yoshioka C, Quispe JD, Orca G, et al. Supramolecular architecture of severe acute respiratory syndrome coronavirus revealed by electron cryomicroscopy. *J Virol.*, 2006; 80: 7918–28.
- [15] Neuman BW, Kiss G, Kunding AH, Bhella D, Baksh MF, et al. A structural analysis of M protein in coronavirus assembly and morphology. *J Struct Biol.*, 2011; 174(1): 11–22.
- [16] Naskalska A, Dabrowska A, Szczepanski A, Milewska A, Jasik KP, et al. Membrane Protein of Human Coronavirus NL63 Is Responsible for Interaction with the Adhesion Receptor. *J Vir.*, 2019; 93: doi: 10.1128/JVI.00355-19.
- [17] Fehr AR, Perlman S. "Coronaviruses: an overview of their replication and pathogenesis". In Maier HJ, Bickerton E, Britton P (eds.). *Coronaviruses*. Methods Mol Biol., 2015; pp. 1–23.

- [18] Everything you need to know about SARS. Available at: <http://www.medical.newstudy.com/article/7543>.
- [19] Coronavirus. Know About Coronavirus Mutants and Variants that Could Have Contributed to India's Second Wave. [Last access at 23 April, 2021]. Available at: <https://weather.com/en-IN/india/coronavirus/news/2021-04-23-triple-mutant-variant-cause-concern-in-india>.
- [20] Casqueiro J, Casqueiro J, Alves C. Infections in patients with diabetes mellitus: A review of pathogenesis. *Indian J Endocrinol.*, 2012; 16(S1): S27-36.
- [21] Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med.*, 2020; 382: 1708-20.
- [22] Fang L, Karakiulakis G, Roth M. Antihypertensive drugs and risk of COVID-19? – Authors' reply. *Lancet Respir Med.*, 2020; 8: e32-e33.
- [23] Li G, Hu R, Zhang X. Antihypertensive treatment with ACEI/ARB of patients with COVID-19 complicated by hypertension. *Hypertens Res.*, 2020; pp. 1-3.
- [24] World Health Organization. Coronavirus Disease (COVID-2019) Situation Reports. Situation Report-55. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200315-sitrep-55-covid-19.pdf?sfvrsn=33daa5cb_6 (2020).
- [25] Annitori S, Cossu M, Aidolfo AL, Rechi R, Bonazzati C, et al. Compassionate Remdesivir treatment of severe covid -19 pneumonia in intensive care unit (ICU) and non ICU patients. Clinical outcome and difference in post-treatment hospitalization status. *Pharma Res.*, 2020; 158: 104899. doi: 10.1016/JPharma.Res.2020.104899.
- [26] Huang IFN, Lung KC, Tso EY, Liu R, Chung JWH, et al. Triple combination of interferon beta 1b, lopanivir, ritopavir and ribavirin in the treatment of patients admitted to hospital with covid-19: A open, label, randomized, phase-2 trial. *The Lancet*, 2020; 395: 1695-704.
- [27] Okur M, Al-Kofahi M, Austin D. Hydroxychloroquine and Azithromycin as potential treatments for Covid-19; Clinical status impacts the outcome. *J Pharmacokinetic Pharmacodynam.*, 2020; 47: 187-88.
- [28] Bedford J, Enria D, Giesecke J, Heymann DL, Ihekweazu C, et al. COVID-19: Towards controlling of a pandemic. *Lancet*, 2020; 395: 1015-18.
- [29] Abbasi J Covid-19 and mRNA vaccines -first large test for new approach. *JAMA*, 2020; 324: 1125-27.
- [30] Ball P. The lightning fast b quest for Covid vaccines and what it means for other diseases. *Nature*, 2021; 589: 16-18.
- [31] Nagarathna R, Nagendra HR, Mazumdar V. A perspective on Yoga as a preventive strategy for corona virus disease. *Int J Yoga*, 2020; 13: 89-98.
- [32] Gard T, Noggle JJ, Park CL, Vago DR, Wilson A. Potential self-regulatory mechanisms of yoga for psychological health. *Front Hum Neurosci.*, 2014; 8: 770. doi: 10.3389/fnhum.2014.00770.
- [33] Cramer H, Lauche R, Anheyer D, Pilkington K, de Manincor M, Dobos G, et al. Yoga for anxiety: A systematic review and meta-analysis of randomized controlled trials. *Depress Anxiety*, 2018; 35: 830-43.
- [34] Telles S, Singh N, Joshi M. Risk of posttraumatic stress disorder and depression in survivors of the floods in Bihar, India. *Indian J Med Sci.*, 2009; 63: 330-34.
- [35] Cramer H, Posadzki P, Dobos G, Langhorst J Yoga for asthma: A systematic review and meta-analysis. *Ann Allergy. Asthma Immunol.*, 2014; 112: 503-10.
- [36] Hagins M, States R, Selfe T, Innes K. Effectiveness of yoga for hypertension: Systematic review and meta-analysis. *Evid Compl Alt Med.*, 2013; 649836. doi: 10.1155/2013/649836.
- [37] Pullen PR, Seffens WS, Thompson WR. Yoga for Heart Failure: A Review and Future Research. *Int. J Yoga*, 2018; 11: 91-98.
- [38] Raveendran AV, Deshpandae A, Joshi SR. Therapeutic role of yoga in type 2 diabetes. *Endocrinol Metab.*, 2018; 33: 307-17.
- [39] Innes KE, Selfe TK. Yoga for adults with type 2 diabetes: A systematic review of controlled trials. *J Diab Res.*, 2016: 6979370.
- [40] Obasi CN, Brown R, Ewers T, Barlow S, Gassman M, et al. Advantage of meditation over exercise in reducing cold and flu illness is related to improved function and quality of life. *Influenza Other Respir Viruses*, 2013; 7: 938-44.
- [41] Visweswarai NK, Telles S. Randomized trial of yoga as a complementary therapy for pulmonary tuberculosis. *Respiro.*, 2004; 9: 96-101.
- [42] Dunne EM, Balletto BL, Donahue ML, Feulner MM, DeCosta J, et al. The benefits of yoga for people

- living with HIV/AIDS: A systematic review and meta-analysis. *Compl Ther Clin Pract.*, 2019; 34: 157-64.
- [43] Shi Y, Wang Y, Shao C, Huang J, Gan J, et al. COVID-19 infection: the perspectives on immune responses. *Cell Death Diff.*, 2020; 27: 1451-54.
- [44] Hari Chandra BP, Ramesh MN, Nagendra HR. Effect of Yoga on Immune Parameters, Cognitive Functions, and Quality of Life among HIV-Positive Children/Adolescents: A Pilot Study. *Int J Yoga*, 2019; 12: 132-38.
- [45] Duan K, Liu B, Li C, Zhang H, YuT, et al. Blocking the virus and reducing inflammatory damage in Covid-19. *PNAS*, 2020; 117: 12529-30.
- [46] Welty-Wolf KE, Carraway MS, Ortel TL, Piantosi CB. Coagulation and inflammation in adult lung injury. *Thromb Haematol.*, 2002; 88: 17-25.
- [47] Xiang YT, Yang Y, Li W, Zhang L, Zhang Q, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psych.*, 2020; 7: 228-29.
- [48] Lim SA, Cheong KJ. Regular yoga practice improves antioxidant status, immune function, and stress hormone releases in young healthy people: A randomized, double-blind, controlled pilot study. *J Altern Compl Med.*, 2015; 21: 530-38.
- [49] Infante JR, Peran F, Rayo JI, Serrano J, Domínguez ML, et al. Levels of immune cells in transcendental meditation practitioners. *Int J Yoga*, 2014; 7: 147-51.
- [50] Kamei T, Toriumi Y, Kimura H, Kimura K. Correlation between alpha rhythms and natural killer cell activity during yogic respiratory exercise. *Stress Health*, 2001; 17: 141-45.
- [51] Tooley GA, Armstrong SM, Norman TR, Sali A. Acute increases in night-time plasma melatonin levels following a period of meditation. *Biol Psych.*, 2000; 53: 69-78.
- [52] Chen PJ, Yang L, Chou CC, Li CC, Chang YC, Liaw JJ. Effects of prenatal yoga on women's stress and immune function across pregnancy: A randomized controlled trial. *Compl Ther Med.*, 2017; 31: 109-17.
- [53] Pedersen SF, Ho YC. SARS-CoV-2: A storm is raging. *J Clin. Invest.*, 2020; 137: 647.
- [54] Madan M, Thombre DP, Balakumar B, Nambinarayanan TK, Thakur S, et al. Effect of yoga training on reaction time, respiratory endurance and muscle strength. *Ind J Physiol Pharmacol.*, 1992; 36: 229-33.
- [55] Joshi LN, Joshi VD, Gokhale LV. Effect of short term 'Pranayam' practice on breathing rate and ventilatory functions of lung. *Indian J Physiol Pharmacol.*, 1992; 36: 105-08.
- [56] Karthik PS, Chandrasekhar M, Ambareesha K, Nikhil C. Effect of pranayama and suryanamaskar on pulmonary functions in medical students. *J Clin Diagn Res.*, 2004; 8: BC04-6.
- [57] Liu XC, Pan L, Hu Q, Dong WP, Yan JH, et al. Effects of yoga training in patients with chronic obstructive pulmonary disease: A systematic review and meta-analysis. *J Thorac Dis.*, 2014; 6: 795-802.
- [58] Donesky-Cuenca D, Nguyen HQ, Paul S, Carrieri-Kohlman V. Yoga therapy decreases dyspnea-related distress and improves functional performance in people with chronic obstructive pulmonary disease: A pilot study. *J Alter Compl Med.*, 2009; 15: 225-34.
- [59] Fulambarker A, Farooki B, Kheir F, Copur AS, Srinivasan L, Schultz S. Effect of yoga in chronic obstructive pulmonary disease. *Am J Ther.*, 2012; 19: 96-100.
- [60] Rain M, Subramaniam B, Avti P, Mahajan P. Can yoga breathing techniques like Simha kriya and Isha kriya regulate Covid-19 related stress? *Front Psychol.*, 15: 2021. doi: 10.3389/fpsyg.2021.635816.

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