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COVID 19:
Impact and Response
Volume VI



Editors

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PREFACE

The new respiratory pandemic disease i.e. COVID-19 has caused disruptions in the lives and customs of people with significant impact on the economies of nations. The outbreak of the disease is a global health emergency and of international interest. This global health challenge leads to the infection, morbidity and mortality of many people.

In the weeks since the World Health Organization manifest the corona virus (COVID – 19) episode a worldwide unstipulated wellbeing crisis, the COVID-19 pandemic has influenced 212 nations and forfeit increasingly than 400,000 lives. Still today there is no successful remedy to lockup the spreading of this infection. The pandemic is developing prior disparities, uncovering vulnerabilities in social, political and financial frameworks which are thusly intensifying the effects of the pandemic.

Governments of various nations adopted restrictive measures involving both within the countries and at international borders as effective response to the corona virus pandemic. These measures includes confinements of workers and order to work from home, banning of social and religious gatherings, closure of market places, closure of workplaces including airports, building or creation of testing and isolation centers, quarantining/isolation of suspected persons, self-imposed isolations, and the use of face masks whether surgical or cloth type in situations where there is a cogent reason to defy the restriction.

Academic communities were not left out as institutions of learning were requested to close in many countries since it is very easy to spread the virus among students and youths in tertiary institutions where socialization is an essential part of their lives.

To address the various issues related with the COVID – 19 we have published the present book. The interdisciplinary approach of the book will make the book useful and informative to the students, teachers, researchers, scientists and policy makers in India and abroad.

We thank all contributors, publishers and all our well-wishers for their blessings, without which this book would not have come into existence.

- **Editors**

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ARE THE CHILDREN LESS AFFECTED TO COVID-19?

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Abstract:

Coronavirus disease 2019 (COVID-19) has become a global public health issue since its discovery at the end of 2019. The lower airway is the primary site of infection for coronavirus 2 in severe acute respiratory syndrome (SARS-CoV-2). In COVID-19 individuals, pneumonia is virtually always present. According to current reports, COVID-19 appears to be rare in children. Investigating the underlying reasons might help us better understand COVID-19 pathogenesis. The reasons behind children's greater immunity to a variety of infectious illnesses remain unclear. It's been suggested that immature mice's resistance to poliovirus-induced paralysis is linked to maturational changes in the axonal transport system. Other possibilities include children having a stronger innate immune response, better respiratory tracts because they are exposed to less cigarette smoke and pollutants than adults, and fewer underlying disorders. Adults' immune responses may be stronger, which might explain why they have a negative immunological response when they have acute respiratory syndrome.

Keywords: Children, COVID-19, Respiratory Syndrome, Pathogenesis, Innate Immune Response

Introduction:

COVID-19 can make children of all ages sick. However, most infected children do not develop as sick as adults, and some may exhibit no symptoms at all. Cough, fever, tachypnea, sore throat, diarrhoea, myalgia, tiredness, rhinorrhoea, vomiting, nasal congestion, stomach pain, conjunctivitis, rash, loss of taste, and anosmia are some of the symptoms that a symptomatic youngster may experience. According to research, children aged 10 to 14 are less likely than those aged 20 and up to become infected with the virus that causes COVID-19. Children's hospitalisation rates are also significantly lower than those of adults. According to studies from the Centers for Disease Control and Prevention, children who are hospitalised need to be treated in the intensive care unit just as often as adults (CDC). COVID-19 also puts children with

underlying diseases like obesity, diabetes, or asthma at an increased risk of serious illness. COVID-19 puts children at risk of significant illness if they have congenital cardiac disease, genetic disorders, or illnesses that impair the brain system or metabolism. During the first month of life, the maternal antibody protects the kid from germs that the mother may have acquired from past pathogen exposure. While epidemics have diminished as a result of improved water sanitation and hygiene, and vaccines have been created to prevent potentially fatal infections, all germs are novel to the child. Repeated infections in the first years of life help to build a reservoir of T and B memory cells that aid to prevent common pathogens from reinfecting or causing disease. The immune system of children is thus educated and capable of reacting to novelty, a mechanism that may be decreased in adults and rendered ineffective in persons over the age of 70.

Protective factors in children:

- **Adaptive vs innate immune system**

In addition to the virus's direct cytotoxic effects, immune-mediated mechanisms play an important role in COVID-19 pathogenesis. The immune systems of children and adults differ significantly, which could explain the various presentations of COVID-19. Children have a stronger innate immune response, with more NK cells, the first line of defence against SARS-CoV-2. T cells are part of the body's adaptive immune system, which develops the ability to detect infections over time. Because children's T cells are mostly untrained, Farber believes they may have a stronger potential to respond to novel infections. However, other research shows that the situation is not that straightforward: a study⁸ of patients with COVID-19 revealed that adults had a greater T-cell response to the viral spike protein than children and young people, with 65 children and young people under the age of 24 compared to 60 adults. However, according to Farber, the study looked at memory T-cell responses, which are far less developed in children. Another crucial component is 'trained immunity,' which includes the epigenetic reprogramming of innate immune cells (including NK cells) in response to certain situations, such as infections and vaccines, resulting in memory. Following a pathogen challenge, these trained cells respond faster and more forcefully, improving protection. This hypothesis, however, does not explain why the system does not protect children against other respiratory illnesses. Children have a higher proportion of lymphocytes and absolute numbers of T and B cells than adults, however ageing is associated with a decrease in thymic activity and a decrease in naïve T cells. SARS-CoV-2 infected adults have lower lymphocyte counts, thus it's plausible that having more

lymphocytes protects children from SARS-CoV-2, especially since they have a broad repertoire of naive T cells.

- **Recurrent and concomitant infections are more common.**

SARS-CoV-2 infected children are frequently co-infected with other viruses that might disrupt SARS-CoV-2 reproduction. Repeated viral infections may cause hyperactivation of the innate immune system as well as epigenetic alterations in the immune system, making SARS-CoV-2 clearance simpler.

- **Cross-reactive coronavirus antibodies and T cells**

According to several studies, children who have been exposed to corona viruses recently and repeatedly develop cross-reactive antibodies that may protect them from the COVID-19 virus. While it has been suggested that children may be protected against SARS-CoV-2 due to pre-existing cross-reactive antibodies against more common and recent HCoV infections, preliminary data show that while HCoV antibodies cross-react with the SARS-CoV-2 and SARS-CoV spike proteins, they rarely neutralise because they do not bind to SARS-CoV-2 receptors. There was no difference in antibody levels against HCoVs between children infected with SARS-CoV-2 and those who were not infected, which supports this theory. People, particularly older adults, have larger amounts of both neutralising and non-neutralizing antibodies than children. SARS-CoV-2 cross-reactive T cells, which are seen in larger numbers in the elderly and may be detrimental, are the same. It's probable that IgA on mucosal surfaces is required to protect against SARS-CoV-2. However, no studies have examined IgA levels or SARS-CoV-2 avidity in children and adults to yet.

- **Microbiota**

Variations in the oropharyngeal, nasopharyngeal, lung, and/or gastrointestinal flora might further explain why COVID-19 symptoms in children are less severe. The microbiota has a significant role in the control of immunity, inflammation, and mucosal homeostasis, as well as pathogen defence. As a result, the microbiome can influence SARS-CoV-2 infection susceptibility and severity. Children are more densely colonised by viruses and bacteria than adults, especially in the nasopharynx, where microbial interactions and competition may limit SARS-CoV-2 development. The connection between viral load and COVID-19 severity provides some support for this concept. Although one small research found no significant abnormalities in nasopharyngeal microbiota between SARS-CoV-2 infected patients and healthy controls, other investigations found substantial differences in oropharyngeal, lung, and gastrointestinal microbiome. However, a variety of variables, such as age, hospitalisation, antibiotic use, and

nutrition, might influence microbiota results. As a result, the role of variances in microbiota to differences in COVID-19 severity, if any, is unknown, and determining the cause will be challenging.

- **Higher levels of melatonin**

Melatonin has anti-inflammatory and anti-oxidant properties via a number of pathways. For example, this hormone promotes the proliferation and maturation of NK cells, T and B lymphocytes, granulocytes, and monocytes in both bone marrow and other organs, as well as macrophage antigen presentation. Melatonin also lowers nuclear factor kappa-B and IL-6 levels in the blood. TNF-alpha, and CRP. Melatonin protects against ARDS and haemorrhagic shock during viral infections. Melatonin inhibits calmodulin, which increases ACE2 expression and cell surface retention. Melatonin can also block CD147, a cellular receptor implicated in SARS-CoV-2 chemotaxis and lung inflammation management. According to recent research, melatonin also inhibits the main protease of SARS-CoV-2. As a result, it's been proposed that melatonin be used as a preventive or therapeutic drug in COVID-19. Melatonin is being tested in a randomised experiment to see if it is useful in preventing SARS-CoV-2 infection among health professionals. Bats, which are the major source of coronaviruses and have little or no symptoms, have greater melatonin levels than humans. As a result, the significance of variances in microbiota to differences in COVID-19 severity, if any, is unknown, and determining cause against effect will be challenging.

- **Off-target effects of vaccines**

Many live vaccines have immunomodulatory effects that aren't specific (targeted) to the disease they're designed to guard against. This includes decreased all-cause mortality in high-mortality areas and protection against viral infections in the case of BCG and measles-containing vaccines (MCV). The mechanisms that underpin vaccination immunomodulatory effects are the subject of current study. BCG vaccination alters innate and T cell immunity via reprogramming immune cells' epigenomes and altering cytokine responses. The age-related difference in COVID-19 incidence is thought to be attributable to children having BCG and other live immunizations more recently than adults. COVID-19 severity variations have been linked to MCV and oral polio vaccines, similar to BCG. Fewer studies have delved into the mechanisms that cause MCV's immunomodulatory effects, but they have shown a correlation between MCV and a reduction in circulating leukocytes and lymphocytes, as well as a decrease in CD4 cells and an increase in CD8 cells. An RCT is being conducted to examine if the measles-mumps-rubella vaccination can lower the prevalence of COVID-19.

- **Intensity of exposure to SARS-CoV-2**

Because viral load influences COVID-19 severity, a lower viral exposure intensity might be another factor contributing to a milder illness. Children may have been exposed to SARS-CoV-2 in a less severe way than adults who have worked in an office, gone shopping, travelled, or worked in a hospital. Because they are commonly infected by an adult, children get infected with the second or third generation SARS-CoV-2. Following generations of SARS-CoV and MERS-CoV viruses have been found, with lesser pathogenicity than the first-generation viruses. However, in the case of SARS-CoV-2, this has yet to be established.

- **Comorbid conditions**

Adults with COVID-19 have an elevated risk of death due to co-morbidities such as coronary artery disease, cerebrovascular disease, and obesity. Upregulation of ACE-2 among smokers can result in poor respiratory infection outcomes, and the same can be said for senior smokers. Children are in a fortunate position because most of these morbidities are uncommon in children. Secondhand smoking may be a danger factor for youngsters.

- **A better capacity of tissue repair**

On the one side, disease defence entails resisting the triggering factor, and on the other, the ability to mitigate the illness's symptoms, such as direct cell toxicity and/or immunopathology. A range of variables help tissue preservation and healing, including efferocytosis (noninflammatory cell death) and the following switch of monocytes/macrophages to the so-called M2 repair pathway. Resolvins, a kind of lipid, are hypothesised to play a role in this process. It might be argued that such pathways have a larger innate capacity in childhood ("M2/M1 balance") and/or that comorbidity decreases them later in life.

- **Effects of Lung Development**

The ability of people's lungs to regenerate decreases as they age. Influenza virus infection induced more extensive alveolar damage and delayed regeneration of alveolar type II cells and pro-Surfactant Protein C-positive bronchiolar epithelial cells in older mice in a study of young and elderly mice. Overall, children's powerful regeneration capacities may explain their lower COVID-19 incidence and early recovery compared to older patients. It would be interesting to see if SARS-affinity CoV-2's for different sections of the respiratory epithelium varies with age, and if upper respiratory tract infections are only found in children. Aerosol particles lodge more in the tracheobronchial tree than alveoli in newborns due to their increased upper airway resistance. This might result in more bronchiolitis-like symptoms and less pneumonia in children infected with SARS-CoV-2.

- **Other factors**

Children are also the primary reservoir for the common cold-causing coronaviruses. According to Munro, some studies have hypothesised that antibodies to these coronaviruses may provide some protection against SARS-CoV-2. Meanwhile, data suggests that youngsters receive a lower dosage of the virus than adults because their nostrils have fewer ACE2 receptors¹¹, which the virus utilises to gain entrance to cells. According to experts, this might possibly explain why COVID-19 is less common in children than in adults.

Conclusion:

These surprising findings show that youngsters may be more resistant to COVID-19 than adults. It's critical to figure out the underlying process that might aid in the treatment of COVID-19 patients. COVID-19 presents a tremendous threat to the entire world. Children have mostly been spared up to this time. Variations in ACE-2 expression, inherent immunity, acquired immunity, and the effects of containment strategies, such as the shutdown of schools and day care centres, are all plausible causes. Furthermore, it is uncertain why children with usual infection risk characteristics, such as immunosuppression, have a low likelihood of getting major COVID-19 disease, whereas previously healthy children seldom do. Although there are various explanations as to why children are less affected by COVID-19, the bulk of them fail to account for the age-related rise in severity and fatality after the age of 60 to 70. Understanding the mechanisms behind age-related variations in COVID-19 severity will provide crucial insights and opportunities for COVID-19 prevention and treatment.

References:

1. Fischer A. Resistance of children to Covid-19. How? *Mucosal Immunol* [Internet]. 2020;13(4):563–5. Available from: <https://doi.org/10.1038/s41385-020-0303-9>
2. Gemmati D, Bramanti B, Serino ML, Secchiero P, Zauli G, Tisato V. COVID-19 and Individual Genetic Susceptibility/Receptivity: Role of ACE1/ACE2 Genes, Immunity, Inflammation and Coagulation. Might the Double X-chromosome in Females Be Protective against SARS-CoV-2 Compared to the Single X-Chromosome in Males? *Int J Mol Sci*. 2020 May;21(10).
3. Lingappan K, Karmouty-Quintana H, Davies J, Akkanti B, Harting MT. Understanding the age divide in COVID-19: why are children overwhelmingly spared? *Am J Physiol Cell Mol Physiol* [Internet]. 2020 Jun 3;319(1):L39–44. Available from: <https://doi.org/10.1152/ajplung.00183.2020>

4. Lee P-I, Hu Y-L, Chen P-Y, Huang Y-C, Hsueh P-R. Are children less susceptible to COVID-19? *J Microbiol Immunol Infect.* 2020 Jun;53(3):371–2.
5. Dhochak N, Singhal T, Kabra SK, Lodha R. Pathophysiology of COVID-19: Why Children Fare Better than Adults? *Indian J Pediatr.* 2020 Jul;87(7):537–46.
6. Steinman JB, Lum FM, Ho PP-K, Kaminski N, Steinman L. Reduced development of COVID-19 in children reveals molecular checkpoints gating pathogenesis illuminating potential therapeutics. *Proc Natl Acad Sci [Internet].* 2020 Oct 6;117(40):24620 LP – 24626. Available from: <http://www.pnas.org/content/117/40/24620.abstract>
7. Zimmermann P, Curtis N. Why is COVID-19 less severe in children? A review of the proposed mechanisms underlying the age-related difference in severity of SARS-CoV-2 infections. *Arch Dis Child [Internet].* 2020 Nov 30;archdischild-2020-320338. Available from: <http://adc.bmj.com/content/early/2020/11/30/archdischild-2020-320338.abstract>
8. Carsetti R, Quintarelli C, Quinti I, Piano Mortari E, Zumla A, Ippolito G, et al. The immune system of children: the key to understanding SARS-CoV-2 susceptibility? *Lancet Child Adolesc Heal.* 2020;4(6):414–6.
9. Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta Paediatr.* 2020 Jun;109(6):1088–95.
10. Kuchar E, Załęski A, Wronowski M, Krankowska D, Podsiadły E, Brodaczewska K, et al. Children were less frequently infected with SARS-CoV-2 than adults during 2020 COVID-19 pandemic in Warsaw, Poland. *Eur J Clin Microbiol Infect Dis Off Publ Eur Soc Clin Microbiol.* 2020 Sep;1–7.
11. Sinaei R, Pezeshki S, Parvaresh S, Sinaei R. Why COVID-19 is less frequent and severe in children: a narrative review. *World J Pediatr.* 2020 Sep;1–11.
12. Tsaouri S, Makis A, Kosmeri C, Siomou E. Risk Factors for Severity in Children with Coronavirus Disease 2019: A Comprehensive Literature Review. *Pediatr Clin North Am.* 2021 Feb;68(1):321–38.
13. Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *International journal of antimicrobial agents.* 2020 Mar 1;55(3):105924.
14. Lee PI, Hsueh PR. Emerging threats from zoonotic coronaviruses—from SARS and MERS to 2019-nCoV. *Journal of microbiology, immunology, and infection.* 2020 Jun;53(3):365.
15. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, Wang B, Xiang H, Cheng Z, Xiong Y, Zhao

- Y. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. *Jama*. 2020 Mar 17;323(11):1061-9.
16. Jin X, Lian JS, Hu JH, Gao J, Zheng L, Zhang YM, Hao SR, Jia HY, Cai H, Zhang XL, Yu GD. Epidemiological, clinical and virological characteristics of 74 cases of coronavirus-infected disease 2019 (COVID-19) with gastrointestinal symptoms. *Gut*. 2020 Jun 1;69(6):1002-9.
 17. Bai Y, Yao L, Wei T, Tian F, Jin DY, Chen L, Wang M. Presumed asymptomatic carrier transmission of COVID-19. *Jama*. 2020 Apr 14;323(14):1406-7.
 18. Ko WC, Rolain JM, Lee NY, Chen PL, Huang CT, Lee PI, Hsueh PR. Arguments in favour of remdesivir for treating SARS-CoV-2 infections. *International journal of antimicrobial agents*. 2020 Apr;55(4):105933.
 19. Kliegman R.M., St Geme J.W., Blum N.J., Shah S.S., Takser R.C., Wilson K.M. Edition 20.Elsevier; Philadelphia, PA: 2020. Nelson textbook of pediatrics.
 20. Jubelt B., Narayan O., Johnson R.T. Pathogenesis of human poliovirus infection in mice. II. Age-dependency of paralysis. *J Neuropathol Exp Neurol*

EMPIRICAL STUDY OF COMPLIANCE RATE OF INFECTION CONTROL MEASURES IN I.C.U OF A MULTI-SPECIALITY HOSPITAL: IMPACT OF EMPLOYEE TRAINING AND EDUCATION

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Abstract:

The purpose of this study was to determine the compliance rate of hand hygiene practices among the clinical staff during patient care in an Intensive Care Unit and to elaborate the impact of Training and Motivation on improving the non-compliance. An empirical study was conducted and data was collected through a hand hygiene monitoring tool to find the results. Findings of this study indicated considerable percentage of non-compliance. After conducting regular training sessions and regular audits, much non-compliance was converted into compliance. Recommendations were given to further improve the compliance rate which included use trained certified independent observers, regular audits and just in time training. Major limitations of this study included unawareness of nurses and doctors for hand hygiene technique and employee attitude.

Keywords: Hand hygiene, Training

Introduction:

Hospital acquired infections are a common source of morbidity and mortality among patients across the globe. Accordingly, hand hygiene (i.e. hand washing with soap and water or use of a waterless, alcohol-based hand rub) has long been considered one of the most important infection control measures for preventing health-care-associated infections. However, the rate of compliance of the hand hygiene procedures is unacceptable, with compliance rates commonly lower than 50%.

Several factors have contribution towards poor hand washing compliance among health care employees, which includes a lack of knowledge about the significance of hand hygiene in lowering the spread of infection and how hands become contaminated, poor understanding of

proper hand hygiene techniques, shortage of staff and lack of access to hand washing facilities and lack of institutional commitment to proper hand hygiene.

Identifying a global need to promote hand hygiene in health care facilities, the World Health Organization (WHO) launched the Guidelines on Hand Hygiene in Health Care (Advanced Draft) in October 2005. These guidelines signify the importance of multidimensional ways as the most effective approach to promote hand hygiene. Identified methods include education and motivation of the staff, adopting alcohol-based hand rub as the main method for hand hygiene, usage of performance guidelines, and strongest commitment towards improving hand hygiene.

Objective:

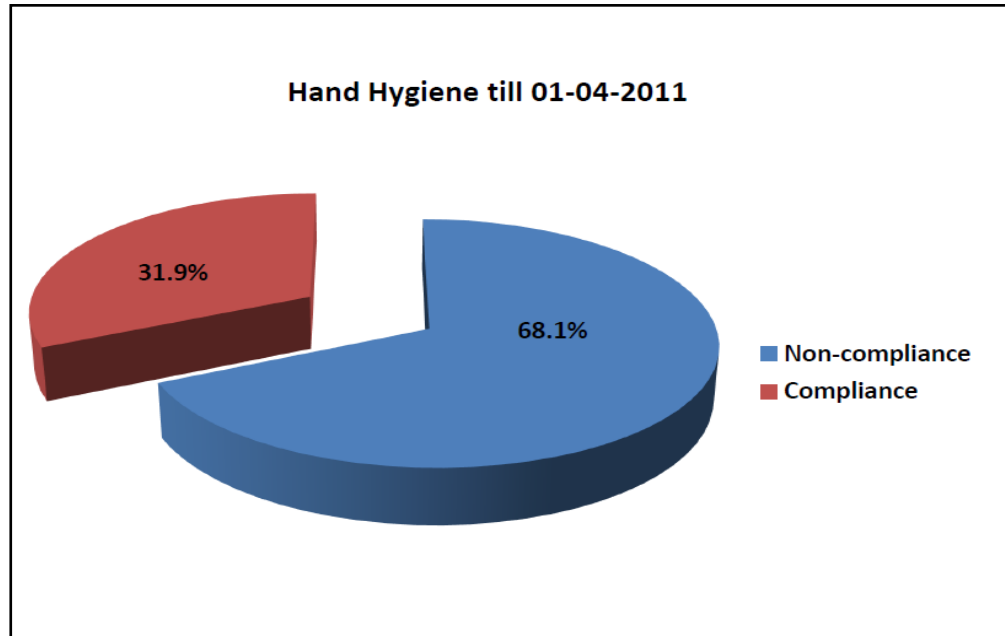
- To know the status of compliance rate of Hand washing practices in I.C.U.
- To train and motivate the clinical staff through training and orientation sessions.
- To increase the awareness for hand hygiene that is the basic tool for infection control.
- To identify various constraints and to give recommendations

Methodology:

Series of internal audits were conducted to find out the status of hand hygiene practices and improve the compliance rate so as to reduce the incidence of infection in I.C.U. For this, a hand hygiene monitoring tool was framed and regular audits were conducted for 1 month.

HAND HYGIENE MONITORING TOOL		
UNIT/DEPARTMENT	H.D.U	H.D.U
Healthcare worker type	DOCTOR	NURSE
HAND WASHING		
Before patient contact		
Before contact with environment		
After patient contact		
After contact with environment		
USAGE		
Hand wash		
Alcohol hand antiseptic		

Till 30th April 2011, we regularly observed doctors and nurses as for their hand hygiene practices in I.C.U. After the analysis of collected data, considerable percentage of non-compliance came into light.

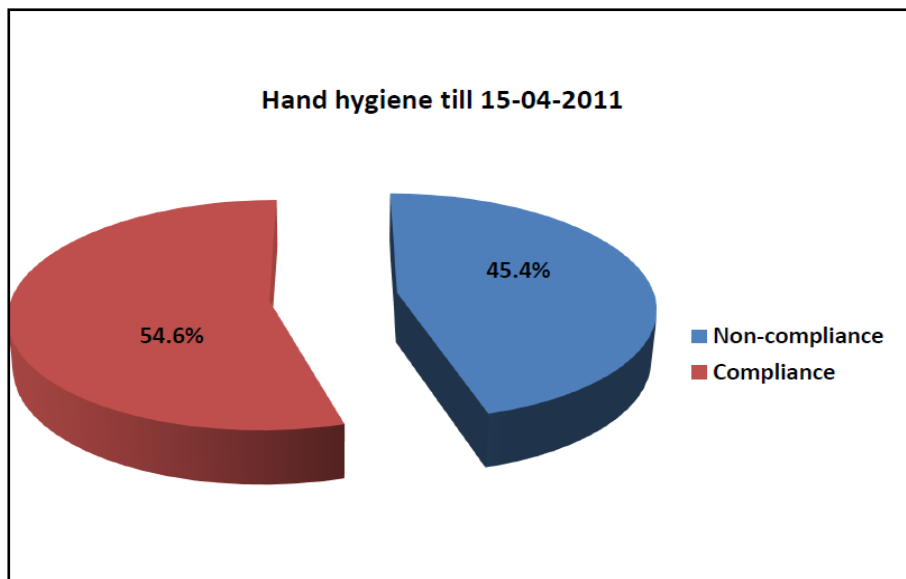


Interventions for improvement:

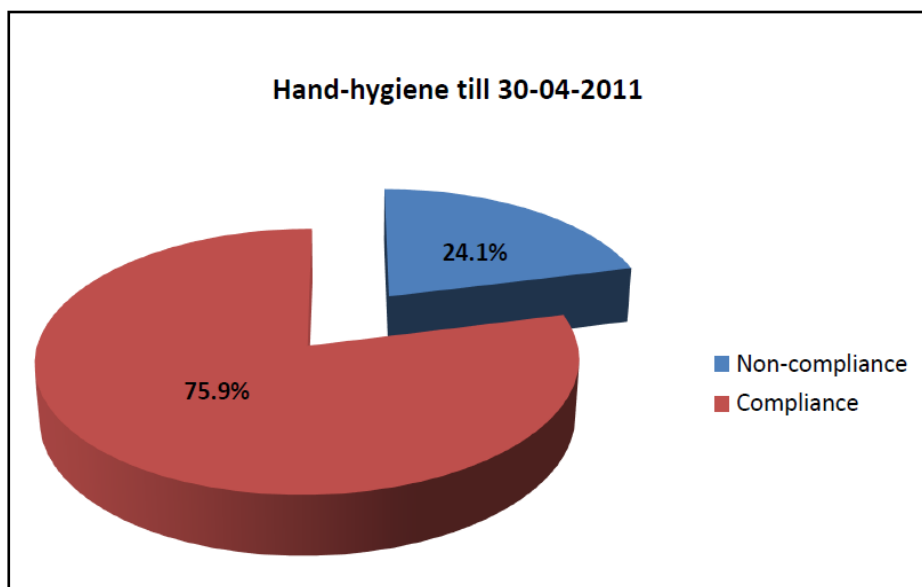
Few recommendations were made for the management of non-compliances:

- Conducting live demonstrations of correct techniques for using an alcohol-based hand rub and hand washing during training sessions for nurses and doctors.
- Providing videotape presentations of correct hand washing and hand rubbing technique.
- Regular monitoring of the hand hygiene methods used by the clinical staff, and giving them feedback regarding their performance.
- Frequent meeting between quality team and discussion of the issues.
- Clearly state expectations about when to sanitize hands to all staff members.
- Provide them with all required resources whose non-availability was a major constraint in achieving the target.
- Reminders in the workplace.
- Provision of hand rubs and agents.

After regular audits, we again measured the compliance of the hand hygiene practices till 15th April 2011-



Again after conducting training sessions and regular audits, we observed following compliance rate till 30th April 2011.

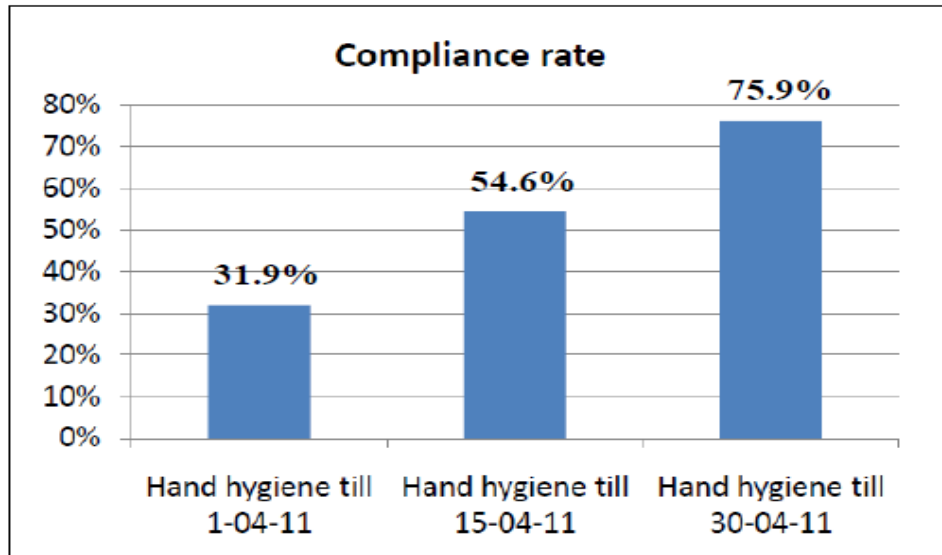


Limitations of the study:

- Major limitation was unawareness of nurses and doctors for hand hygiene technique which is the most basic infection control measure.
- Lack of proper authorization.
- Employee attitude.
- Intradepartmental bonding missing.
- Lack of resources.

Result:

As a result of teaching hand hygiene practices, 75.9% of the doctors and nurses in I.C.U adhered to Hand hygiene



Conclusion and Recommendations:

Conclusion:

After analyzing the results for I.C.U for a period of one month, it was observed that the compliance rate of hand washing facilities has been increased through regular training sessions and series of internal audits. Much non-compliance was converted into compliance due to indigenous efforts.

Recommendations:

The following recommendations were given to improve hand hygiene further:

- Use trained certified independent observers to monitor appropriateness of hand hygiene.
- Proper communication of the expectations from the staff regarding the hand sanitization of all staff members.
- Provide Just-in-time training.
- Intervene to remind staff to wash hands.
- Regular checks by quality team.
- Scrutinize and question the data.

References:

1. www.IHI.org
2. www.expresshealthcare.com
3. www.qcin.org
4. www.indmedica.com
5. NABH reference guide book

THERAPEUTIC ROLE OF GILOY AND TULSI AGAINST COVID-19

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Abstract:

On 31st December 2019 in Wuhan, city of China, a new strain of coronavirus is reported *i.e.* SARS-CoV-2. The illness of this new strain is referred to as “Covid-19”, which in its pandemic form has lockdown the world in social, economic and mainly serious health setbacks. As we all know that there is neither any an effective drug nor vaccines which can treat and prevent Covid-19 completely. Many traditional medicinal plants *e.g.* *Ocimum sanctum* (Tulsi), *Azadirachta indica* (Neem), *Withaniasomnifera* (Ashwagandha) and *Tinospora cordifolia* (Giloy) *etc.* possess antiviral, antimicrobial, antiinflammatory properties. Many molecular docking studies have been done during the last two years with compounds of these traditional plants and their interaction with this virus. So in the present review article firstly covid-19 and its structure will be discussed briefly followed by the different compounds of tulsi and giloy which have the potential to interact with different structural component of virus, to kill the virus and they may be proved to be perfect cure to treat covid-19.

Keywords: Covid, docking, giloy, SARS-CoV, tulsi

Introduction:

Till date, approximately 50 million people (World Health Organization) have lost their lives in the world and 4 million (Ministry of Health and Family Welfare) in India from coronavirus disease 2019 (COVID-19). This COVID-19 pandemic is started from the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), first case was reported in

Wuhan, China in December, 2019 and this is still continuing to kill thousands of people all around the globe.

COVID-19:

The COVID-19 has caused unexpected pandemic, severe panic among people worldwide. The emergency committee of WHO declared an outbreak in China on 30th January, 2020. The affected individuals show a wide array of symptoms, *e.g.*, the most common symptoms are cough, fever and shortness of breath (Ledford, 2020; Machhi *et al.*, 2020). The easiest targets of this COVID-19 are the persons with weak immune system, including children, old age persons and patients with pre-existing clinical history *e.g.*, cancer, diabetes, respiratory disorders etc (Felsenstein *et al.*, 2020). Severity of symptoms increases with age as well as pre-existing conditions, *e.g.*, obesity, asthma, hypertension or diabetes. Pia 2020 found that severely ill patients of COVID-19 suffer from cytokine storm, multi-organ failure and lung injury. The underlying mechanism is not properly understood, COVID-19 is proved to be more lethal to men as compared to women (Mukherjee and Pahan, 2021). As discussed above this COVID-19 is responsible for high mortality and considering this mortality rate the whole world is trying hard to discover its effective therapeutic solution either by repurposing existing antiviral drugs or by developing a new antiviral drug. There are some antiviral medicines which are commercially available *e.g.*, lopinavir, remdisavir, ritonavir, ribavir which show some potential against SARS-CoV-2 alone as well as in combination with chloroquine, interferon-alpha and hydroxychloroquine (Khan *et al.*, 2020). The development of safe and effective vaccines against this SARS-CoV-2 is the most promising remedy for controlling COVID-19 and at the same time researchers are doing a lot of efforts in this direction and as per WHO many vaccines had already entered the clinical trials as of September, 2020 (https://www.who.int/medicines/ebola-treatment/ebola_vaccine_clinicaltrials/en/). 1.17 billion Vaccine doses have been administered to the Indian population but still an effective antiviral and anti-inflammatory agent is needed to treat this viral pandemic. As we know that in the present scenario there is lack of any proven vaccines/medicines for COVID-19 cure, immune booster and potential antiviral herbal medicines, formulations and extracts can be good remedies that can be proved helpful in lowering down the global mortality rate due of COVID-19.

Structure of SARS-CoV-2:

Corona viruses (CoVs) are spherical in shape having diameter of 80-120 nm and are beta strains of Coronaviridae family and Nidovirales order (Figure 2). These are single stranded RNA viruses (positive sense) which are broadly distributed in different mammalian species including

humans. Owing to zoonotic origins and genetic similarity, bats are natural hosts of SARS-CoV-2 (Ye *et al.*, 2020). Most of the coronavirus infections are associated with mild clinical symptoms in human, however, beta-coronavirus is responsible for serious epidemics and SARS-CoV emerged in November 2002 in China MERS-CoV (Middle East Respiratory Syndrome coronavirus) originated in 2012 in Saudi Arabia (Lu *et al.*, 2019). It leads to maladies of the vital organs like enteric, hepatic, respiratory and neurological systems if not treated (Zumla *et al.*, 2016; Chan *et al.*, 2012) and has arisen as a universal infecting human with 3-4% mortality rate (Zhu *et al.*, 2020).

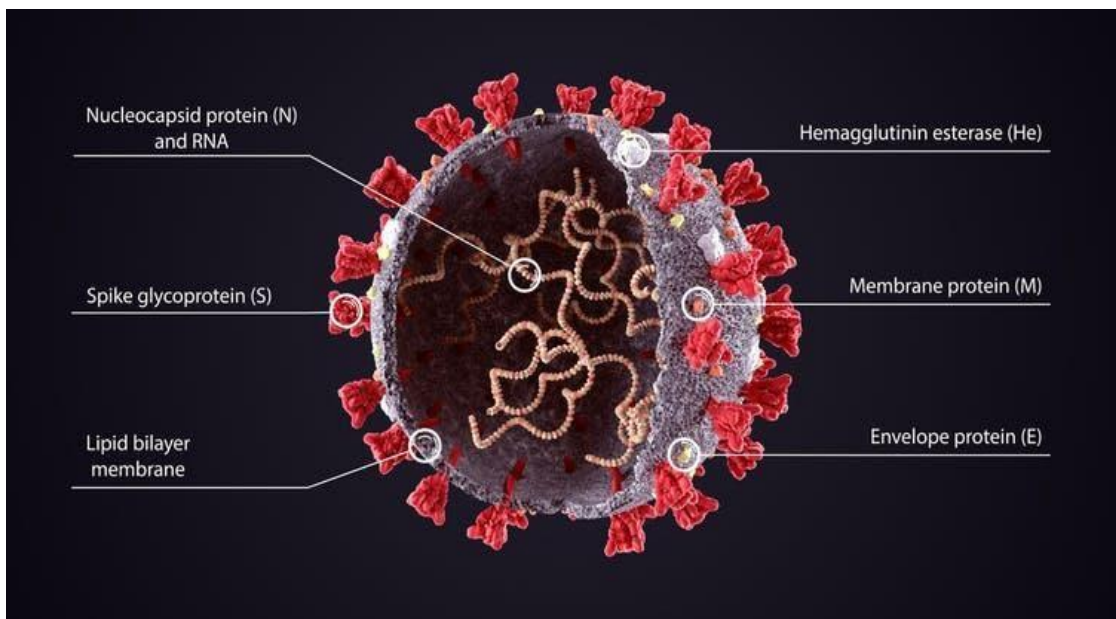


Figure 1: Structure of COVID-19

Coronaviruses are the large genome size RNA viruses ranging 13 to 16 kbp in length. There are mainly four key structural proteins viz. a) spike (S) glycoprotein, b) nucleocapsid (N) phosphoprotein, c) membrane (M) glycoprotein, and d) envelope (E) glycoprotein (Figure 1), these all proteins are encoded by this large genome of viruses. A special type of protein *i.e.*, hemagglutinin-esterase (HE) is also present in the envelope of this SARS-CoV-2 virus. All the proteins present in this virus are vital for the development of complete virion structure (Walls *et al.*, 2020; Wang *et al.*, 2017). The entry of this virus into the host cells is mediated by a homotrimer formed by S glycoprotein that protrudes from the virus surface (Tortorici and Veeslera, 2019). This S glycoprotein is constituted of two subunits-S1 and S2 subunits, S1 which is associated with binding of the virus with host cell angiotensin-converting enzyme 2 (ACE2) receptors and S2 assists the fusion of virus with cellular membrane (Walls *et al.*, 2020). Strong binding to ACE2 of the host cell explains the fast-human transmission of SARS-CoV-2 similar

to that of SARS-CoV. The first line of action is to hinder the approach of the virus towards the host ACE2 receptors by blocking the function of spike proteins, which coils help to trim down the figure of new cases.

SARS-CoV-2 is found to be transmitted from human to human through small respiratory droplets *e.g.*, sneezing, coughing or while executing close proximity interactions among people (Stadnytskyi *et al.*, 2020). These droplets then can be inhaled or can contaminate different surfaces which will act as a secondary source of infection and when other people touch these surfaces and then touch their nose, mouth or eyes.

The present article fascinating the potential macromolecular target of SARS-CoV-2 for COVID-19 management using active phytoconstituents of Indian traditional medicine *e.g.*, tulsi and giloy. During the last two decades, both the viral infections are reported to result in >10,000 cumulative cases with high death rates *i.e.*, 10% for SARS-CoV and 37% for MERS-CoV (Wu *et al.*, 2020). In December 2019, a series of serious pneumonia cases appeared due to a mysterious source of infection in Wuhan (Wu *et al.*, 2020). According to, https://www.who.int/medicines/ebola-treatment/ebola_vaccine_clinicaltrials/en/, it was realized that upon genetic sequence analysis this contagious and serious infection is due to a novel coronavirus species, it was originated from bats, which was later named as 2019 novel coronavirus (2019-nCoV). According to Cheng and Shan, 2019; SARS-CoV-2 is the seventh member of the coronavirus family and it is >70% resembling SARS-CoV genetically. COVID-19, an infectious disease caused by SARS-CoV-2 virus, is a serious infection of the respiratory tract which affects both the upper respiratory tract including throat, nose and sinuses and lower respiratory tract, *i.e.*, windpipe and lungs, of a person. As of 18th May 2020, there are more than 4.7 million confirmed cases of COVID-19 with more than 315,000 confirmed deaths across the world affecting 213 countries and territories.

In Indian Traditional healthcare system, viral infections can be treated via using several plant extracts (Sohail *et al.*, 2011). Tulsi (*Ocimum sanctum*) (Goothy *et al.*, 2020; Ghoke *et al.*, 2018), giloy (*Tinospora cordifolia*) (Shree *et al.*, 2020) and neem (*Azadirachta indica*) (Tiwari *et al.*, 2010; Badam *et al.*, 1999) are the plants widely used to treat viral infections in humans as well as animals due to their immunomodulator, immunostimulant and antimicrobial properties and also strengthen the body against infections. A lot of *in silico* pharmacology has been done to screen various active compounds of these medicinal plants.

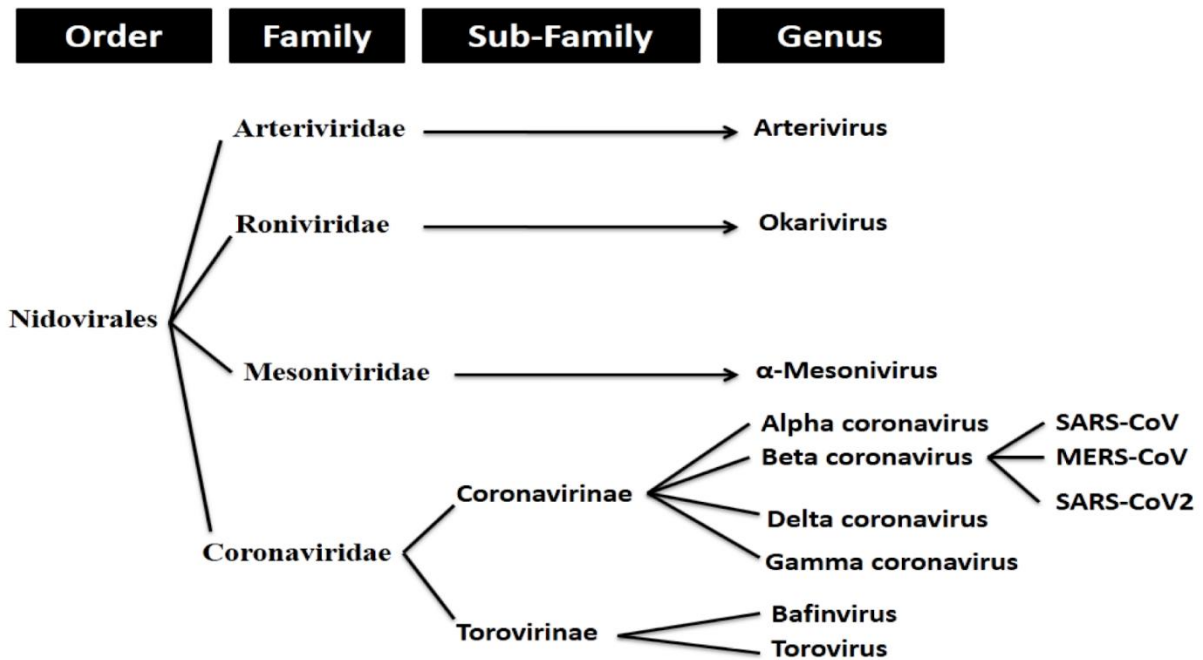


Figure 2: Classification of order Nidovirales upto genus

The active bio-compounds of these traditional medicinal plants can be utilized or infused into nanofiber-based respiratory masks to develop an efficient viral inactivation system. Three layered masks can be developed by impregnating the active bio-compounds for viral deactivation (Das *et al.*, 2020).

A. *Ocimum sanctum*:

Commonly known as Tulsi which is a sanctified herb possessing medicinal properties. These therapeutic properties consist of antimicrobial, cardioprotective, anti-inflammatory, adaptogenic (Jamshidiand Cohen, 2017), antibacterial, antifungal, antiviral activity (Vasudevan *et al.*, 1999), it also possesses antifertility, antiemetic, diaphoretic and hepatoprotective actions (Prakash and Gupta, 2005). Tulsi have the ability to enhance both humoral and cellular immunity hence it strengthens the immune response (Mukharjee *et al.*, 2005). Prakash and Gupta in 2005 concluded that the main phytoconstituents of tulsi are Eugenol and Ursolic acid, Maurya and Sharma, 2020 reported in their study that these constituents shows interaction with SARS CoV-2 Mpro (Main protease) and other proteins including (S, E, N) of COVID-19. Varshney *et al.*, 2020 reported that Tulsinol A, B, C, D, E, F, G and Dihydrodieuginol of *O. sanctum* could be used as potential inhibitors for Papain-like Protease and SARS Coronavirus Mpro (Figure 3. B, C).

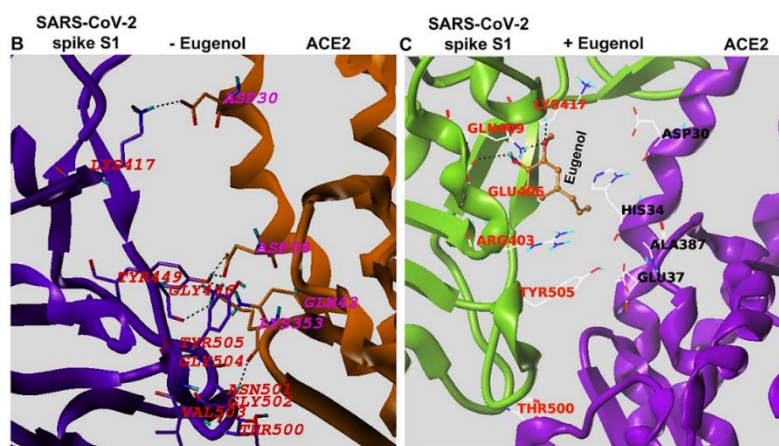


Figure 3 B) A rigid-body in silico docked pose of human ACE2 (dark yellow epoxy color) and SARSCoV-2 spike S1 (dark magenta) in the absence of eugenol. C) A rigid-body in silico docked pose of human ACE2 (magenta) and SARS-CoV-2 spike S1 (green) in the presence of eugenol (dark yellow structure)

The pure form or an extract of tulsi can be effective inhibitors of SARS-CoV-2 by binding to the RNA polymerase, its protease and also to the spike glycoprotein and these variations in the binding regions of the natural compounds against SARS-CoV-2 RNA polymerase and spike surface glycoprotein suggests that these compounds will be equally efficacious in preventing both viral attachment and its replication (Choy *et al.*, 2020 and Beck *et al.*, 2020). SARS-CoV-2 is reported to have high predilection in the pharyngeal epithelial cells and the deliverability of tulsi extract to the pharyngeal regions is feasible by suitable oral formulations, they will be useful in the medical management of SARS-CoV-2 infections. The superior binding efficacy of tulsi and neem compounds compared to both Lopinavir/Ritonavir and Remdesivir merits their clinical translation (Stower, 2020).

B. *Tinospora cordifolia*:

Also called as Giloy or Guduchi, is a medicinal plant which possesses remedial purpose for thousands of years in traditional medicine. Panchabhai *et al.*, 2008 concluded that its extracts have steroids, alkaloids, glycosides and polysaccharides which show antioxidant, antihepatotoxic, cytotoxic and immunomodulatory effects (Sharma *et al.*, 2012). Its active phytoconstituents are Cardifolioside A, Tinocordioside, Syringin and Magnoflorine and these compounds have immunomodulatory effect (Sharma *et al.*, 2011). Among 28 active phytochemicals from *T. cordifolia* (Giloy), only one compound namely Tinocordioside (CID_177384) showed highest binding affinity as compared to built-in ligand N3 for SARS-

CoV-2 Mpro as per YASARA scoring. Tinocordiside have binding energy of 8.10 kcal/mol. Tinocordiside is found to be a new reorganized cadinane sesquiterpene glycoside from *T. cordifolia* (Giloy) (Ghosal and Vishwakarma, 1997). Different 2D–3D interactions formed by Tinocordiside includes conventional and carbon hydrogen bonding with the residues Gly 143, Leu 141 and Met 165, alkyl and p-alkyl interaction were formed with Cys 145, His 41 and Leu 27. Many vander Waals interactions were formed by remaining residues (Figure 3. A) (Shree et al., 2020).

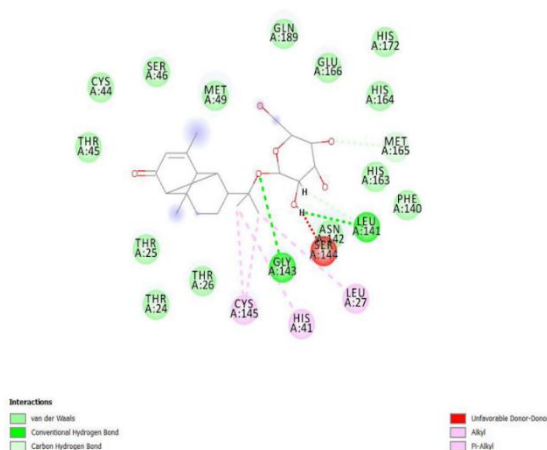


Figure 3 (A) 2 D interaction diagram of Tinocordiside with SARS-CoV-2 Mpro

Conclusion:

Researchers are requisite to find an effective drug more rapidly against this COVID-19 which is causing millions of deaths. As we all know that SARS CoV-2 is a new virus hence more studies are required for searching drugs against the viral system without much side effects to human populations. Ayurvedic formulations can play a significant role, for developing therapeutic moieties because they not only provide healthy environment to body but also boost the immune system that would be non-toxic and safe for the human. Various studies have revealed that people with strong immunity have higher recovery rate against this COVID-19. Since Ayurvedic products cannot completely cure the COVID-19 but it could be minimizing the risk of viral infection and reduces the mortality rate via increasing immunity. From long time, we are aware of the beneficial properties of Ayurvedic and medicinal plant product utilizing to cure infectious and other diseases. Since these botanical plants having low cost, minimum toxicity and almost found everywhere in country, it has potential to enhance immunity to fight against COVID-19 and other infectious disease and play an important role to becomes fit and healthy India and world.

References:

1. Badam, L., Joshi, S.P. and Bedekar, S.S. (1999): 'In vitro' antiviral activity of neem (*Azadirachta indica*. A. Juss) leaf extract against group B coxsackieviruses. *The Journal of communicable diseases*, 31(2): 79-90.
2. Beck, B.R., Shin, B., Choi, Y., Park, S. and Kang, K. (2020): Predicting commercially available antiviral drugs that may act on the novel coronavirus (SARS-CoV-2) through a drug-target interaction deep learning model. *Computational and structural biotechnology journal*, 18: 784-790. <https://doi.org/10.1016/j.csbj.2020.03.025>
3. Chan, J.F., Li, K.S., To, K.K., Cheng, V.C., Chen, H. and Yuen, K.Y. (2012). Is the discovery of the novel human betacoronavirus 2c EMC/2012 (HCoV-EMC) the beginning of another SARS-like pandemic?. *Journal of Infection*, 65(6): 477-489. <https://doi.org/10.1016/j.jinf.2012.10.002>
4. Cheng, Z.J. and Shan, J. (2020): 2019 Novel coronavirus: where we are and what we know. *Infection*, 48(2): 155-163. <https://doi.org/10.1007/s15010-020-01401-y>
5. Choy, K.T., Wong, A.Y.L., Kaewpreedee, P., Sia, S.F., Chen, D., Hui, K.P.Y., Chu, D.K.W., Chan, M.C.W., Cheung, P.P.H., Huang, X. and Peiris, M. (2020): Remdesivir, lopinavir, emetine, and homoharringtonine inhibit SARS-CoV-2 replication in vitro. *Antiviral research*, 178: 104786. <https://doi.org/10.1016/j.antiviral.2020.104786>
6. Das, M., Banerji, A., Cheemalapati, V.N. and Hazra, J. (2020). Antiviral Activity Of Indian Medicinal Plants: Prventive Measures For COVID-19. *Journal of Global Biosciences*, 9(5): 7307-7319. www.mutagens.co.in/jgb/vol.09/05/090503.pdf
7. Felsenstein, S., Herbert, J.A., McNamara, P.S. and Hedrich, C.M. (2020): COVID-19: Immunology and treatment options. *Clinical immunology*, 215: 108448. <https://doi.org/10.1016/j.clim.2020.108448>
8. Ghoke, S.S., Sood, R., Kumar, N., Pateriya, A.K., Bhatia, S., Mishra, A., Dixit, R., Singh, V.K., Desai, D.N., Kulkarni, D.D. and Dimri, U. (2018): Evaluation of antiviral activity of *Ocimum sanctum* and *Acacia arabica* leaves extracts against H9N2 virus using embryonated chicken egg model. *BMC complementary and alternative medicine*, 18(1): 1-10. <https://doi.org/10.1186/s12906-018-2238-1>
9. Ghosal, S. and Vishwakarma, R.A. (1997): Tinocordiside, a new rearranged cadinane sesquiterpene glycoside from *Tinospora cordifolia*. *Journal of Natural Products*, 60(8): 839-841.
10. Goothy, S.S.K., Goothy, S., Choudhary, A., Potey, G.G., Chakraborty, H., Kumar, A.H., and Mahadik, V.K. (2020): Ayurveda's holistic lifestyle approach for the management of

- Coronavirus disease (COVID-19): possible role of tulsi. *Int. J. Res. Pharm. Sci.*, 1(11): 16-18.
11. [https://www.who.int/medicines/ebola-treatment/ ebola_vaccine_clinicaltrials/en/](https://www.who.int/medicines/ebola-treatment/ebola_vaccine_clinicaltrials/en/)
 12. Jamshidi, N. and Cohen, M. M. (2017): The clinical efficacy and safety of Tulsi in humans: a systematic review of the literature. *Evidence-Based Complementary and Alternative Medicine*, 2017. <https://doi.org/10.1155/2017/9217567>
 13. Khan, Z., Karataş, Y., Ceylan, A.F. and Rahman, H. (2021): COVID-19 and therapeutic drugs repurposing in hand: the need for collaborative efforts. *Le PharmacienHospitalier et Clinicien*, 56(1): 3-11. <https://doi.org/10.1016/j.phclin.2020.06.003>
 14. Ledford, H. (2020): How does COVID-19 kill? Uncertainty is hampering doctors' ability to choose treatments. *Nature*, 580(7803): 311-313.
 15. Lu, R., Zhao, X., Li, J., Niu, P., Yang, B., Wu, H., Wang, W., Song, H., Huang, B., Zhu, N. and Tan, W. (2020): Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *The lancet*, 395(10224): 565-574. [https://doi.org/10.1016/S0140-6736\(20\)30251-8](https://doi.org/10.1016/S0140-6736(20)30251-8)
 16. Machhi, J., Herskovitz, J., Senan, A.M., Dutta, D., Nath, B., Oleynikov, M.D., Blomberg, W.R., Meigs, D.D., Hasan, M., Patel, M., Kline, P., Chang, R.C., Chang, L., Gendelman, H.E., and Kevadiya, B.D. (2020): The natural history, pathobiology, and clinical manifestations of SARS-CoV-2 infections. *Journal of Neuroimmune Pharmacology*, 1-28. <https://doi.org/10.1007/s11481-020-09944-5>
 17. Maurya, D.K. and Sharma, D. (2020): Evaluation of traditional ayurvedic Kadha for prevention and management of the novel Coronavirus (SARS-CoV-2) using in silico approach. *Journal of Biomolecular Structure and Dynamics*, 1-16. <https://doi.org/10.1080/07391102.2020.1852119>
 18. Mukherjee, R., Dash, P.K. and Ram, G.C. (2005): Immunotherapeutic potential of *Ocimum sanctum* (L) in bovine subclinical mastitis. *Research in veterinary science*, 79(1): 37-43. <https://doi.org/10.1016/j.rvsc.2004.11.001>
 19. Mukherjee, S. and Pahan, K. (2021): Is COVID-19 Gender-sensitive?. *Journal of Neuroimmune Pharmacology*, 16: 38-47. <https://doi.org/10.1007/s11481-020-09974-z>
 20. Panchabhai, T.S., Kulkarni, U.P. and Rege, N.N. (2008): Validation of therapeutic claims of *Tinospora cordifolia*: a review. *Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*, 22(4): 425-441. <https://doi.org/10.1002/ptr.2347>

21. Pia, L. (2020): Spatial resolution of SARS-CoV-2 lung infection. *Nature Reviews Immunology*, 20(10): 591-591. <https://doi.org/10.1101/2020.07.30.20165241>
22. Prakash, P.A.G.N. and Gupta, N. (2005): Therapeutic uses of *Ocimum sanctum* Linn (Tulsi) with a note on eugenol and its pharmacological actions: a short review. *Indian journal of physiology and pharmacology*, 49(2): 125.
23. Sharma, P., Parmar, J., Verma, P. and Goyal, P. K. (2011): Radiation-induced testicular injury and its amelioration by *Tinospora cordifolia* (an Indian medicinal plant) extract. *Evidence-Based Complementary and Alternative Medicine*, 2011. <https://doi.org/10.1155/2011/643847>
24. Sharma, U., Bala, M., Kumar, N., Singh, B., Munshi, R.K. and Bhalerao, S. (2012): Immunomodulatory active compounds from *Tinospora cordifolia*. *Journal of ethnopharmacology*, 141(3): 918-926. <https://doi.org/10.1016/j.jep.2012.03.027>
25. Shree, P., Mishra, P., Selvaraj, C., Singh, S.K., Chaube, R., Garg, N. and Tripathi, Y.B. (2020): Targeting COVID-19 (SARS-CoV-2) main protease through active phytochemicals of ayurvedic medicinal plants—*Withaniasomnifera* (Ashwagandha), *Tinospora cordifolia* (Giloy) and *Ocimum sanctum* (Tulsi)—a molecular docking study. *Journal of Biomolecular Structure and Dynamics*, 1-14. <https://doi.org/10.1080/07391102.2020.1810778>
26. Sohail, M.N., Rasul, F., Karim, A., Kanwal, U. and Attitalla, I. H. (2011): Plant as a source of natural antiviral agents. *Asian Journal of Animal and Veterinary Advances*, 6(12): 1125-1152.
27. Stadnytskyi, V., Bax, C.E., Bax, A. and Anfinrud, P. (2020): The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission. *Proceedings of the National Academy of Sciences*, 117(22): 11875-11877. <https://doi.org/10.1073/pnas.2006874117>
28. Stower, H. (2020): Virological assessment of SARS-CoV-2. *Nature medicine*, 26(4): 465-465. <https://doi.org/10.1038/s41586-020-2196-x>
29. Tiwari, V., Darmani, N.A., Yue, B.Y. and Shukla, D. (2010): In vitro antiviral activity of neem (*Azadirachta indica* L.) bark extract against herpes simplex virus type-1 infection. *Phytotherapy Research*, 24(8): 1132-1140. <https://doi.org/10.1002/ptr.3085>
30. Tortorici, M.A. and Veesler, D. (2019): Structural insights into coronavirus entry. *Advances in virus research*, 105: 93-116. <https://doi.org/10.1016/bs.aivir.2019.08.002>

31. Varshney, K.K., Varshney, M. and Nath, B. (2020): Molecular Modeling of isolated phytochemicals from *Ocimum sanctum* towards exploring potential inhibitors of SARS coronavirus main protease and papain-like protease to treat COVID-19. Available at SSRN 3554371.
32. Vasudevan, P., Kashyap, S., & Sharma, S. (1999): Bioactive botanicals from basil (*Ocimum sp.*).<http://nopr.niscair.res.in/handle/123456789/17820>
33. Walls, A.C., Park, Y.J., Tortorici, M.A., Wall, A., McGuire, A.T. and Velesler, D. (2020): Structure, function, and antigenicity of the SARS-CoV-2 spike glycoprotein. *Cell*, 181(2): 281-292.<https://doi.org/10.1016/j.cell.2020.02.058>
34. Wang, C., Zheng, X., Gai, W., Zhao, Y., Wang, H., Wang, H., Feng, N., Chi, H., Qiu, B., Li, N. and Xia, X. (2017): MERS-CoV virus-like particles produced in insect cells induce specific humoral and cellular immunity in rhesus macaques. *Oncotarget*, 8(8): 12686.[10.18632/oncotarget.8475](https://doi.org/10.18632/oncotarget.8475)
35. Wu, D., Wu, T., Liu, Q. and Yang, Z. (2020): The SARS-CoV-2 outbreak: what we know. *International Journal of Infectious Diseases*, 94: 44-48. <https://doi.org/10.1016/j.ijid.2020.03.004>
36. Wu, F., Zhao, S., Yu, B., Chen, Y.M., Wang, W., Song, Z.G., Hu, Y., Tao, Z.W., Pei, Y.Y. and Zhang, Y.Z. (2020): A new coronavirus associated with human respiratory disease in China. *Nature*, 579(7798): 265-269. <https://doi.org/10.1038/s41586-020-2008-3>
37. Ye, Z.W., Yuan, S., Yuen, K.S., Fung, S.Y., Chan, C.P. and Jin, D.Y. (2020): Zoonotic origins of human coronaviruses. *International journal of biological sciences*, 16(10): 1686. [10.7150/ijbs.45472](https://doi.org/10.7150/ijbs.45472)
38. Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., Zhao, X., Huang, B., Shi, W., Lu, R. and Tan, W. (2020): A novel coronavirus from patients with pneumonia in China, 2019. *New England journal of medicine*.
39. Zumla, A., Chan, J.F., Azhar, E.I., Hui, D.S. and Yuen, K.Y. (2016): Coronaviruses—drug discovery and therapeutic options. *Nature reviews Drug discovery*, 15(5): 327-347. <https://doi.org/10.1038/nrd.2015.37>

IMPACT OF COVID-19 ON THE ANIMAL WORLD- A COMPREHENSIVE REVIEW

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Abstract:

Covid-19 pandemic, the major cause of global concern nowadays, is caused by an RNA virus belonging to the family Coronaviridae. The deadly disease originated from Wuhan city of China in December 2019 through animal source (anthropozoonosis) and is responsible for the severe acute respiratory syndrome (SARS) in humans. Soon it spread in animals also (Tigers, Lions, Cats, Dogs) through close contact with the infected humans (zooanthropozoonosis). Although the infection is maintained in both man and lower vertebrates and can be transmitted in either direction (amphixenoses), till now there is no evidence that a companion animal can directly transmit the disease to humans. The aim of this review is to focus on the miserable effect of this pandemic on the world of animals and also to throw some light on the facts and myths regarding the transmission of the virus between the human and animal population.

Keywords: Animals; Covid-19; Impact; Transmission; Zoonosis

Introduction:

December 2019 marked the beginning of a highly infectious and contagious viral disease caused by the novel corona virus (CoV) that very soon resulted in a deadly pandemic and was named as Corona Virus Disease (COVID-19) by the World Health Organization (WHO). CoV belongs to a family of RNA (ribonucleic acid) viruses characterised by the presence of a crown (corona) of spike proteins around its lipid envelope. The pathogen causing covid-19 in humans was designated as SARS-CoV-2 by the International Committee on Taxonomy of Viruses (ICTV) as it resulted in severe acute respiratory syndrome in humans (Lai *et al.*, 2020; Yuen *et al.*, 2020). Due to its transboundary spread COVID-19 was declared as public health emergency of international concern by the WHO on January 30, 2020, and later as pandemic situation (Du Toit, 2020; Habibzadeh and Stoneman, 2020; Liu *et al.*, 2020a, 2020b; Wood, 2020; WHO, 2020). The virus is also referred to as “the COVID-19 virus” and is known to have four genera: α , β , γ and δ all of which act as etiologic agents of enteric, respiratory, or systemic diseases in

animals. The SARS-CoV-2 belongs to the genus Betacoronavirus and subgenus Sarbecovirus. The alpha and betacoronavirus infect mammals and have bat origin, while as the gamma and deltacoronavirus infect birds, fishes and mammals and have swine origin (Hu *et al.*, 2017; Cui *et al.*, 2019). Other members of the coronavirus family cause common cold in humans while as two deadly strains caused the 2003 Severe Acute Respiratory Syndrome (SARS) epidemic in China and the outbreak of Middle East Respiratory Syndrome (MERS) in Saudi Arabia in 2012, both of which were zoonotic (Wei *et al.*, 2020). It was reported that SARS-CoV was transmitted from civets to humans and MERS-CoV from dromedary camels to humans. The COVID-19 pandemic not only resulted in a huge health loss worldwide (nearly 4.71 million confirmed cases) along with death toll of nearly 0.31 million by May 17, 2020 (WHO 2020) but also affected adversely the global economy especially in developing nations (Ayittey *et al.*, 2020). COVID-19 is primarily a respiratory disease and the SARS-CoV-2 virus uses the ACE2 receptor, found on human cells (type II pneumocytes in the lungs) and other animal species for attachment (Astuti and Ysrafl. 2020; Hofmann *et al.*, 2020). Laboratory diagnosis of SARS-CoV-2 in animals is similar to diagnosis of the virus among humans and samples from the nasal turbinate, soft palate, and tonsils are preferred (Shi *et al.* 2020). The gold standard test to diagnose SARS-CoV-2 in animals is real-time reverse-transcription polymerase chain reaction (RT-PCR) as in humans (Richard *et al.* 2020 and Zhong *et al.* 2020). Other molecular tests used for the detection of SARS-CoV-2 in animals include viral isolation in cell culture, viral genome sequencing, and reverse transcription loop-mediated isothermal amplification (RT-LAMP) (OIE, 2020). Other diagnostic tests include rapid immunochromatographic tests, serological immune assays like enzyme-linked immunosorbent assay (ELISA) (OIE, 2020 and Younes *et al.*, 2020). Most of the coronavirus (2019-nCoV)-infected people in Wuhan developed acute respiratory problems, hence the virus was named novel coronavirus-infected pneumonia (NCIP) (Zhou *et al.*, 2020 and Huang *et al.*, 2020). Only supportive therapy and preventive measures are helpful in both human and animal population as there is no specific treatment for this deadly disease.

Origin and transmission of the disease:

On January 25, 2020 pneumonia of unknown origin was reported in the people of Wuhan city of China (Gao, 2020; Lu *et al.*, 2020). The virus likely originated from animals, transmitted to humans and then maintained a human-to-human transmission, as per the evidence of several infected people's exposure to seafood in the wet animal market of Wuhan City (Ji *et al.*, 2020; Rothan *et al.*, 2020). Current evidence suggests that horseshoe bats (*Rhinolophus*

genus) are the initial reservoirs of the virus (Temmam *et al.*, 2020) and pangolins (*Manis javanica*) are the most likely intermediate hosts responsible for SARS-CoV-2 human transmission (Lam *et al.*, 2020). CoVs circulate in mammals and birds (Abdel-Moneim 2020). The main route of transmission remains the respiratory droplets and/or aerosols (limited to short distances, <2m) and COVID-19 patients are currently the primary source of infection (Jahan *et al.*, 2020). Infection can also spread through fomites in the immediate environment and consecutive touching of mouth, nose, and/or eyes by contaminated hands (Ong *et al.*, 2020). SARS-CoV-2 virus has a zoonotic link (transmission between human and animal). CoVs could affect various mammal species and birds including companion animals and show a lot of mutations as a result of which it can transmit the infection among other animals, humans, and make them zoonotic pathogens (Seah, 2020). Consumption of wild animal meat by the Chinese people due to their believed medicinal value as well as the health promoting effects is responsible for transmission of the infection from animals to humans in China (Harypursat and Chen, 2020). Besides being transmitted by the respiratory route, SARS-CoV-2 is also a food-borne infection (Jalava, 2020).

Covid-19 outbreak in wild and pet animals:

Among the animals several dogs, cats and a tiger have tested positive to COVID-19 virus following close contact with infected humans. Findings suggest that cats and ferrets are most susceptible to the infection, dogs are less susceptible, and pigs, chickens, and ducks appear to be resistant. Besides humans, Corona viruses (CoVs) infect domestic as well as wild animal species with infections mostly sub-clinical in nature (Ji *et al.*, 2020; Li *et al.*, 2020; Salata *et al.*, 2020). The clinical form varies from enteritis in cattle, horses and swine, upper respiratory tract disease in cattle, dogs, felines, and poultry, and common cold to highly fatal respiratory infections in humans (Dhama *et al.*, 2020a, 2020b). Samples collected from a four-year-old tiger, named Nadia, at the Bronx Zoo in New York City, suffering from dry cough and wheezing tested positive for SARS-CoV-2 (James, 2020). In the USA, the first reported case of transmission in animals involved big cats from the Bronx Zoo, five tigers and three lions. The first animal to show any symptoms was a tiger on March 27, but on April 3, three other tigers and all three lions showed respiratory symptoms and one animal lacked appetite. Two different SARS-CoV-2 genotypes were identified in lions and tigers (McAloose *et al.*, 2020). Assumption was made that an asymptomatic zoo employee was the source of infection for these captive wild felines. Till now, SARS-CoV-2 infection has been detected in two pet dogs (Pomeranian and German Shepherd) from Hong Kong (Almendros, 2020). Both these dogs were living in close contact

with SARS-CoV-2 positive owners (American Veterinary Medical Association, 2020). Two cats, one from Belgium and another from Hong Kong, that were living in close contact with SARS-CoV-2 positive owners were also tested positive for SARS-CoV-2 (American Veterinary Medical Association, 2020). The potential of human to animal transmission was confirmed by the genetic sequence similarities of the SARS-CoV-2 from the owner and the pets (Almendros, 2019). Natural and experimental COVID-19 infections have been reported in American mink, dogs, cats, raccoon dogs and big cats, rabbits, cattle, pigs, golden Syrian hamsters, marmosets and macaques (World Health Organization. 2020). Respiratory and gastroenteric signs were reported in many cases. Symptoms in cats were mild and included signs of an upper-respiratory infection with sneezing as the main symptom reported, along with general signs like loss of appetite, apathy, weakness, and sometimes an ocular discharge. In two cases only, outside the USA, cats had suffered severe respiratory symptoms with bilateral pneumonia and breathing difficulties, which led to the euthanasia of the suffering animals. Corona viruses have a broad animal host range but only few of them get a severe infection (Cui *et al.*, 2019; Andersen *et al.*, 2020). Preliminary findings from studies until now suggest that poultry and pigs, are not susceptible to SARS-CoV-2 infection. Bovine coronaviruses (BoCoVs) have zoonotic potential affecting several domestic and wild ruminants, in which calf diarrhoea in neonates, bloody diarrhoea in adult cattle and respiratory form of shipping fever in all age groups of cattle are universal implications (Zhang *et al.*, 1994; Suzuki *et al.*, 2020). Feline CoVs affect the respiratory tract, CNS, and GIT producing enteritis and infectious peritonitis (Tekes and Thiel 2016). Canine enteric coronavirus (Alpha corona virus) and canine respiratory coronavirus (Beta corona virus) genera affect the enteric and respiratory tract, respectively (Erles and Brownlie, 2008; Licitra *et al.*, 2014). Laboratory findings confirm that SARSCoV-2 is also 96% identical to the bat CoV at the genomic level, hence bats might be the primary source of zoonotic spillover (Tang *et al.*, 2006; Rodriguez-Morales *et al.*, 2020; Zhou *et al.*, 2020). General symptoms of CoV-2 infection in animals include fatigue, cough, and breathing problems while as serious cases result in pneumonia, renal failure, and even death.

Spread of infection from animals to humans:

Until now spread of COVID-19 is a result of human-to-human transmission and there is no evidence that companion animals (dog, cat or any pet) can play a significant role in spreading the disease as per the WHO reports. However, thorough research is still warranted to know the real transmission between pets and humans. Altogether, pets living with COVID-19 infected

people are at risk of contracting the disease and can spread the virus to other naive pets, there is currently no evidence on the potential role of pets on SARS-CoV-2 transmission to humans. However, these pets express the same cell Angiotensin-converting Enzyme 2 (ACE2) receptor (Schoeman and Fielding, 2019) hence they might have the potential to transmit the virus to humans making it necessary to follow all precautionary measures. Similarly, most of the domestic and wild animals are susceptible to SARS-CoV-2 and get the infection from the Covid-19 infected persons but there is no strong evidence to prove the reverse transmission of the disease. However, a new case of COVID-19 from the Netherlands was detected in an employee who worked in a mink farm and was supported by the viral sequence similarities between the infected human and the virus found from a mink on the same farm. This suggested that animal-to-animal and animal-to-human transmission is possible in addition to human-to-human transmission (Schoeman and Fielding, 2019). It was studied that infected animals had a viral mutation that could be transmitted to humans, consequently in 2020 Denmark culled 17 million mink (Reuters, 2021). Animal to human transmission of the virus might occur through the consumption of CoV-infected animals as the food, as such it was recommended that the utilization and consumption of live animals and birds as the food by humans should be banned (Shereen *et al.*, 2020). Significant risk factors for the emergence of zoonotic diseases, particularly in China include repeated human-animal interactions either in the market or in the animal industry without using proper environmental biosecurity measures (Daszak, 2020).

Precautionary measures for veterinarians and pet owners:

The WHO (world health organisation), OIE (world organisation for animal health) and CDC (centres for disease control and prevention) recommend many precautions that are to be taken into consideration by the people in direct contact with the animals (like veterinarians, pet owners and zoo keepers) which include wearing of mask, washing hands with soap for at least 20 sec. before or after touching the animal, use of sanitizers, maintaining distance of at least 2m from the animal, avoiding sneezing or coughing in the direction of the animal and avoiding direct contact with the animal like kissing, hugging, patting etc. Precautions for preventing infection of pets/companion animals include keeping our pets indoors, avoid the pets from interacting with other animals and humans outside of our household and do not let our pets out in the people crowded places to prevent outside infection (FDA, 2020). Russian researchers from Federal Service for Veterinary and Phytosanitary Surveillance developed world's first COVID-19 vaccine (Carnivac-Cov/Karnivak-Kov) for animals to combat the risk of animal-to-human transmission and the rise of mutant variants resulting in SARS-CoV-2 immunity which lasts for

at least six months (WION Web Team2021). Carnivac-Cov is an inactivated vaccine developed through chemical means (heat or radiation) making the virus replication-deficient, however, it can be recognized by the host immune system to elicit humoral and T cell-mediated immune responses to the viral antigens (Sinelschikova, 2021). World must follow a one-health approach in the prevention and control strategy against this disease to protect both humans and animals from being infected.

Conclusion:

In addition to huge mortalities among the human population, Covid-19 pandemic has also affected the animal health. There is no known effective treatment for COVID-19 so far, although many vaccines and antiviral drugs are being used, hence, effective preventive and control measures have to be taken to prevent further spread of the disease which includes strict adherence to proper SOPs (standard operating procedures) and vaccination of people as well as companion animals. Although SARS-CoV-2 is zoonotic, still there is no clear evidence that pets/companion animals play a significant role in spreading the virus to humans. Hence unnecessary panic should not be spread among the pet owners and animal welfare should not be affected at all. Also unwanted and inhumane abandonment of companion animals should be avoided. Rather concept of one health must be followed and all precautions taken to combat the spread of this deadly disease amongst both the human and animal populations as soon as possible.

References:

1. Abdel-Moneim AS, Abdelwhab EM. 2020. Evidence for SARS-CoV-2 infection of animal hosts. *Pathogens (Basel, Switzerland)*.9(7):529.
2. Almendros A. 2019. Can pets transmit Covid-19 infection? *Open Vet J*.
3. Almendros A. 2020. Can companion animals become infected with Covid-19? *Vet Rec*. 186(12):388–389.
4. American Veterinary Medical Association. 2020. SARS-CoV-2 in animals, including pets. [Accessed 2020 April 11].
5. Andersen KG, Rambaut A, Lipkin WI, Holmes EC, Garry RF. 2020. The proximal origin of SARS-CoV-2. *Nat Med*. 26(4):450–452.

6. Astuti I, Ysrafl. 2020. Severe Acute Respiratory Syndrome Coronavirus 2 (SARSCoV-2): an overview of viral structure and host response. *Diabetes Metab Syndr.*14(4):407–12.
7. Ayittey FK, Ayittey MK, Chiwero NB, Kamasah JS, Dzuvor C. 2020. Economic impacts of Wuhan 2019-nCoV on China and the world. *J Med Virol.* 92(5):473–475.
8. Cui J, Li F, Shi ZL. 2019. Origin and evolution of pathogenic coronaviruses. *Nat Rev Microbiol.* 17(3):181–192.
9. Daszak P, Olival K, Li H. 2020. A strategy to prevent future epidemics similar to the 2019-nCoV outbreak. *Biosaf Health.* 2(1):6–8.
10. Dhama K, Patel SK, Pathak M, Yatoo MI, Tiwari R, Malik YS, Singh R, Sah R, Rabaan AA, Bonilla-Aldana DK. 2020b. An update on SARS-COV-2/COVID-19 with particular reference on its clinical pathology, pathogenesis, immunopathology and mitigation strategies – a review.
11. Dhama K, Sharun K, Tiwari R, Sircar S, Bhat S, Malik YS, Singh KP, Chaicumpa W, Bonilla-Aldana DK, Rodriguez-Morales AJ. 2020a. Coronavirus disease 2019 –COVID-19.
12. Du Toit A. 2020. Outbreak of a novel coronavirus. *Nat Rev Microbiol.* 18(3):123.
13. Erles K, Brownlie J. 2008. Canine respiratory coronavirus: an emerging pathogen in the canine infectious respiratory disease complex. *Vet Clin North Am Small Anim Pract.* 38(4):815–825.
14. Food and Drug Administration [FDA]. 2020. Helpful questions and answers about coronavirus (COVID-19) and your pets. [cited 2020 September].
15. Gao ZC. 2020. Efficient management of novel coronavirus pneumonia by efficient prevention and control in scientific manner. *Zhonghua Jie He He Hu Xi Za Zhi.* 43(0): E001.
16. Habibzadeh P, Stoneman EK. 2020. The novel coronavirus: a bird’s eye view. *Int J Occup Environ Med.* 11(2):65–71.
17. Harypursat V, Chen YK. 2020. Six weeks into the 2019 coronavirus disease (COVID-19) outbreak- it is time to consider strategies to impede the emergence of new zoonotic infections. *Chin Med J (Engl).* 133(9): 1118–1120.
18. Hofmann M, Kleine-Weber H, Schroeder S, Krüger N, Herrler T, Erichsen S. 2020. SARS-CoV-2 cell entry depends on ACE2 and TMPRSS2 and is blocked by a clinically proven protease inhibitor. *Cell.* 181(2):271– 808.

19. Hu B, Zeng LP, Yang XL, Ge XY, Zhang W, Li B, Xie JZ, Shen XR, Zhang YZ, Wang N, Luo DS. 2017. Discovery of a rich gene pool of bat SARS-related coronaviruses provides new insights into the origin of SARS coronavirus. *PLoS Pathog.* 13(11): e1006698.
20. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y. 2020. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet.* 395:497–506.
21. Jahan Y, Rahman S, Rahman A. 2020. COVID-19: a case report from Bangladesh perspective. *Respir Med Case Rep.*30:101068.
22. Jalava K. 2020. First respiratory transmitted food borne outbreak? *Int J Hyg Environ Health.* 226:113490.
23. James A.2020. A Tiger at Bronx Zoo Tests Positive for COVID-19. ABC News, <https://wpde.com/news/coronavirus/a-tiger-at-bronx-zoo-tests-positive-for-covid-19>.
24. Ji W, Wang W, Zhao X, Zai J, Li X. 2020. Cross-species transmission of the newly identified coronavirus 2019-nCoV. *J Med Virol.*92(4):433–40.
25. Lai CC, Liu YH, Wang CY, Wang YH, Hsueh SC, Yen MY, et al. 2020. Asymptomatic carrier state, acute respiratory disease, and pneumonia due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): facts and myths. *J Microbiol Immunol Infect.*53:404–12.
26. Lam TTY, Shum MHH, Zhu HC, Tong YG, Ni XB, Liao YS, Wei W, Cheung WY, Li WJ, Li LF, Leung GM, Holmes EC, Hu YL, Guan Y. 2020. Identifying SARS-CoV-2 related coronaviruses in Malayan pangolins. *Nature.* <https://doi.org/10.1038/s41586-020-2169-0>.
27. Li X, Song Y, Wong G, Cui J. 2020. Bat origin of a new human coronavirus: there and back again. *Sci China Life Sci.* 63(3):461–462.
28. Licitra BN, Duhamel GE, Whittaker GR. 2014. Canine enteric coronaviruses: emerging viral pathogens with distinct recombinant spike proteins. *Viruses.* 6(8):3363–3376.
29. Liu J, Zheng X, Tong Q, Li W, Wang B, Sutter K, Trilling M, Lu M, Dittmer U, Yang D. 2020a. Overlapping and discrete aspects of the pathology and pathogenesis of the emerging human pathogenic coronaviruses SARS-CoV, MERS-CoV, and 2019-nCoV. *J Med Virol.* 92(5):491–494.
30. Liu Z, Xiao X, Wei X, Li J, Yang J, Tan H, Zhu J, Zhang Q, Wu J, Liu L. 2020b. Composition and divergence of coronavirus spike proteins and host ACE2 receptors predict potential intermediate hosts of SARS-CoV-2. *J Med Virol.* 92(6):595–601.
31. Lu H, Stratton CW, Tang YW. 2020. Outbreak of pneumonia of unknown etiology in Wuhan China: the mystery and the miracle. *J Med Virol.* 92(4):401–402.

32. McAloose D, Laverack M, Wang L, Killian ML, Caserta LC, Yuan F, Mitchell PK, Queen K, Mauldin MR, Cronk BD. 2020. From People to Panthera: Natural SARS-CoV-2 Infection in Tigers and Lions at the Bronx Zoo. *mBio*:11.
33. OIE. 2020. Infection with SARS-COV-2 in animals. Technical fact sheet.
34. Ong SWX, Tan YK, Chia PY, Lee TH, Ng OT, Wong MSY. 2020. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. *JAMA*.323(16):1610–2.
35. Reuters. 2021. Russia Registers World’s First Covid-19 Vaccine for Animals.
36. Richard M, Kok A, de Meulder D, Bestebroer TM, Lamers MM, Okba NM. 2020. SARS-CoV-2 is transmitted via contact and via the air between ferrets. *bioRxiv*. 11:3496.
37. Rodriguez-Morales AJ, Bonilla-Aldana DK, Balbin-Ramon GJ, Rabaan AA, Sah R, Paniz-Mondolfi A, Pagliano P, Esposito S. 2020. History is repeating itself, a probable zoonotic spillover as a cause of an epidemic: the case of 2019 novel Coronavirus. *Infez Med*. 28(1):3–5.
38. Rothan HA, Byrareddy SN. 2020. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *J Autoimmunity*.109:102433.
39. Salata C, Calistri A, Parolin C, Palu G. 2020. Coronaviruses: a paradigm of new emerging zoonotic diseases. *Pathog Dis*. 77(9): ftaa006.
40. Schoeman D, Fielding BC. 2019. Coronavirus envelope protein: current knowledge. *Virology*.16(1):69.
41. Seah I, Agrawal R. 2020. Can the coronavirus disease 2019 (COVID-19) affect the eyes? A review of coronaviruses and ocular implications in humans and animals. *Ocul Immunol Inflamm*. 28(3): 391-5.
42. Shereen MA, Khan S, Kazmi A, Bashir N, Siddique R. 2020. COVID-19 infection: origin, transmission, and characteristics of human coronaviruses. *J Adv Res*. 24: 91-8.
43. Shi J, Wen Z, Zhong G, Yang H, Wang C, Huang B. 2020. Susceptibility of ferrets, cats, dogs, and other domesticated animals to SARS–coronavirus 2. *Science*. 368:1016–20.
44. Sinelschikova Y. 2021. The World’s First Anti-Covid Vaccine for ANIMALS—Made in Russia! (Main Questions). In: *Russ. Beyond*.
45. Suzuki T, Otake Y, Uchimoto S, Hasebe A, Goto Y. 2020. Genomic characterization and phylogenetic classification of bovine Coronaviruses through whole genome sequence analysis. *Viruses*. 12(2):183.

46. Tang XC, Zhang JX, Zhang SY, Wang P, Fan XH, Li LF, Li G, Dong BQ, Liu W, Cheung CL. 2006. Prevalence and genetic diversity of coronaviruses in bats from China. *J Virol.* 80(15):7481–7490.
47. Tekes G, Thiel HJ. 2016. Feline coronaviruses: pathogenesis of feline infectious peritonitis. *Adv Virus Res.* 96: 193–218.
48. Temmam S, Barbarino A, Maso D, Behillil S, Enouf V, Huon C, et al. 2020. Absence of SARS-CoV-2 infection in cats and dogs in close contact with a cluster of COVID-19 patients in a veterinary campus. *bioRxiv.*10:2315.
49. Wei X, Li X, Cui J. 2020. Evolutionary perspectives on novel Coronaviruses identified in pneumonia cases in China. *Natl Sci Rev.* 7(2):239–242.
50. WHO. 2020. Coronavirus disease 2019 (COVID-19) Situation Report – 103.
51. WION Web Team. 2021. Russia Produces First Batch of COVID-19 Vaccine for Animals. In: WION.
52. Wood C. 2020. Infections without borders: a new coronavirus in Wuhan, China. *Br J Nurs.* 29 (3): 166-167.
53. World Health Organization. 2020. Infection with SARS-COV-2 in Animals.2: 1-4.
54. Younes N, Al-Sadeq DW, Al-Jighefee H, Younes S, Al-Jamal O, Daas HI. 2020. Challenges in laboratory diagnosis of the novel coronavirus SARS-CoV-2. *Viruses.* 12(6):582.
55. Yuen KS, Ye ZW, Fung SY, Chan CP, Jin DY. 2020. SARS-CoV-2 and COVID-19: the most important research questions. *Cell Biosci.*10:40.
56. Zhang XM, Herbst W, Kousoulas KG, Storz J. 1994. Biological and genetic characterization of a hemagglutinating coronavirus isolated from a diarrhoeic child. *J Med Virol.* 44(2):152–161.
57. Zhong L, Chuan J, Gong B, Shuai P, Zhou Y, Zhang Y. 2020. Detection of serum IgM and IgG for COVID-19 diagnosis. *Sci China Life Sci.* 63(5):777–80.
58. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, Si HR, Zhu Y, Li B, Huang CL. 2020. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature.* 579(7798):270–273.

IMPACT OF COVID-19 AND PREVENTIVE MEASURES

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Abstract:

Corona virus is a large family of virus causes respiratory illness. It spreads between people through close contact. It takes 5 to 6 days from infected period. The precautions are washing your hands frequently, using alcohol sanitizers, wearing mask and avoiding touching hands or mouth. The lungs are the organs more affected by COVID-19

Keywords: COVID-19, mask, sanitizer etc.

Introduction:

COVID-19 is a disease caused by SARS-COV-2 virus. It is a virus come illness starting from common cold to more severe diseases. It is a novel coronavirus (nCOV), a new stain not previously identified in human. It belongs to Coronavirus family, which also includes the SARS virus (Severe Acute Respiratory Syndrome) and MERS (Middle East Respiratory Syndrome) virus. It has strain that come Common cold and flu. The first known infections from SARS discovered in Wuhan, china. The original source of viral transition to humans remains unclear. The official name COVID-19 and SARS-Cov-2 were issued by WHO on 11 February 2020. Its name was given on the basis of genetic structure. The virus is genetically related to the coronavirus responsible for the SARS outbreak & 2003. It is named for the spiky projections on their surface.

The virus primarily spread between people through close contact and respiratory droplets that are exhaled when talking, breathing or those produced through coughs or sneezes. The Corona Survive on surface from 2 hours to 9 days. The Survival time depends on a number of factors including the type of surface temperature; humidity and specific strain of the virus. Coronaviruses die very quickly when exposed to the UV light in sunlight. Like other enveloped viruses, SARS-COV-2 survives longest when the temperature is room temperature of humidity is low. It has no approved treatment. It is very important to prevent the spread in the society. Its preventive measures include physical or social distancing quarantine ventilation of indoor spaces, Covering Coughs and sneezes hand washing and keeping unwashed hands away from the face. The use of face masks or coverings has been recommended in public settings to minimise the risk of transmission.

The methods used for preventing the spread of COVID-19 include quarantines travel restrictions and closing of Schools workplaces Stadium, theatres or Shopping Centres. Individuals may apply social distancing methods by staying at home, limiting travel, avoiding crowded areas, using notification greetings and physically distancing themselves from others. If you have to be around people, maintain a distance 2 meter or 6 feet from others around you as much as possible. Not just men gatherings but even shopping mall, stadium and movie theatres also avoided social and physical distancing measure aim to slow the spread of disease by stopping chain of transmission of COVID-19 and preventing new ones from appearing. These measures reduce contact with contaminated surfaces while encouraging and sustaining virtual social connection within families and communities.

Stopping the spread start with ourselves by wearing a mask, clean our hand, maintain safe distance and get vaccinated. Protect ourselves and other around us by knowing the facts and taking appropriate precautions. Follow advice provided by local health authority.

To prevent spread of COVID-19

1. Maintain a safe distance from others even if they don't appear sick.
2. Wear mask in public places.
3. Choose open well ventilated spaces over closed ones open window.
4. Clean hands using soaps and water.
5. Get vaccinated.
6. Cover nose and mouth with bent elbow or tissue when coughs or sneeze.
7. Stay home if fell unwell.

If you have fever cough and difficulty in breathing seek medicine attention, reduce ones contact maintain distance.

Properly fitted mask can help prevent the spread of virus from person ill person should stay in separate room provide good ventilation in room of ill person. Ill person should wear mask, quarantine limit of incubation period is 14 days. Isolation is last until individuals is free of symptoms and test negative for virus.

Reference:

1. <https://www.youtube.com>watch>
2. <https://www.osha.gov.>coronavirus>
3. <https://www.cdc.gov>preveention>
4. <https://www.COVID19.gov.lv>COVID19>
5. <https://www.who.int>diseases>
6. <https://www.ecdc.europa.eu>prevention>

IMPACT OF COVID-19 CRISIS ON HUMAN RESOURCE PRACTICES

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Abstract:

The COVID-19 has shattered all organisations, creating a complex and challenging environment for managers and human resource management (HRM) practitioners who must devise creative solutions to ensure the survival of their businesses and assist their employees in dealing with this unprecedented crisis. This article discusses about the impact of covid-19 on Human Resource Practices. It analyses the major difficulties and opportunities that have evolved as a result of this novel epidemic, and it provides managers and HRM practitioners with insights into possible future organisational directions that may evolve as a result of these opportunities

Keywords: Human Resource Practices, Covid-19 Crisis, Working conditions, people Analytics

Introduction:

COVID-19 is a global health emergency that has shook the entire world, causing widespread dread and confusion. It has had a significant impact on economies, cultures, employees, and businesses. This crisis began in the Chinese city of Wuhan, which had an epidemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in December 2019, which expanded quickly, prompting the World Health Organization to declare it a worldwide pandemic on March 11, 2020. Due to the rapid transmission of the COVID-19 viral infection, several countries have introduced a number of non-pharmaceutical measures, such as social distance, to slow its spread. People have been quarantined; schools, universities, non-essential companies, and non-governmental organisations have been temporarily shuttered; travel has also been restricted; flights have been cancelled; and massive public meetings and social gatherings have been restricted. Companies have begun reopening in an attempt to recover from the economic downturn. Companies have begun reopening in the midst of this ongoing pandemic, under extraordinary conditions and a new functioning, in an attempt to recover from this economic blow. As a result, this pandemic has created a complex and challenging environment for managers and human resource management (HRM) practitioners who needed to come up

with creative solutions to keep their businesses afloat while also assisting their employees in coping with the challenges of this unprecedented situation.

Working conditions

Working conditions are the foundation of paid labour and employment relationships. They involve a wide range of themes and issues, including working time (hours of work, rest intervals, and work schedules), remuneration, and workplace physical and mental demands. Organizational working circumstances have been substantially altered as a result of the COVID-19 issue. Most firms have switched to remote working, requiring their workers to work from home, in order to assure company continuity. These unanticipated and severe organisational shifts provide substantial issues for managers and HRM practitioners. All organisations have been jolted by the COVID-19, which has created a complex and tough environment for all managers and HRM practitioners. Human resources professionals are working around the clock to ensure the continuity of their organisations and to assist employees in adjusting to the new working environment created by the epidemic.

With the adoption of work schedules for different groups of employees, physical presence in workplaces has been maintained with exact protection measures (e. g. , social separation and constantly wearing protection masks.) In this instance, the main difficulty is to guarantee that these protection measures are followed and that work schedules are planned with the employees' needs in mind. Human resources practitioners have faced significant challenges as a result of managing remote working, including ensuring that employees on flexi time have the necessary tools to perform their jobs, as remote working necessitates the availability of technological tools that facilitate communication between employees and managers, such as Zoom, Microsoft remote desktop, team viewer, and Microsoft team, which cannot be afforded by all organisations due to financial constraints. Second, to enable effective communication, supervision, assistance, and performance monitoring for workers who work from home.

Talent management challenges

Significant talent management difficulties have come from the COVID-19 pandemic, including (a) hiring freezes and layoffs; (b) wage freezes, cancelled bonuses, and pay reductions; (c) how work is done (i. e. , teleworking); and (d) increased employee stress and burnout. Furthermore, COVID-19 has revealed that many organisations do not use state-of-the-art performance management systems and instead rely on performance appraisal systems that typically include a once-a-year evaluation and review, little effort to provide ongoing feedback and coaching, little alignment between employee performance and the organization's strategic

goals, a focus on past performance only, and ownership by the human resources function. As a result of the lack of value provided by the traditional performance evaluation and review process, many organisations are deferring or even eliminating performance evaluations. It is critical for firms to retain and develop their performance management processes throughout this health crisis. They should share pertinent information about the company's strategic direction with their employees, collect important business data, and provide feedback, all of which will assist these firms retain their talent and prevent legal action. The frequent evaluation of employees' performance stimulates their learning and sharing, which can help businesses reclaim their market share. Hence companies need to be more concerned regarding total compensation (both financial and non-financial), as well as its fairness, in order to maintain and improve their performance amid crises.

Work from Home

COVID-19, the global pandemic, has rendered a huge percentage of the workforce unable to commute to work in order to prevent the virus from spreading. In a fast-paced metropolis like Hong Kong, this has resulted in both businesses and people seeking alternate work arrangements. Most, if not all, people were forced to work from home as a result of the pandemic (WFH). As a result, most governments have made WFH a policy priority. The policies must be created with the practicality of both employers and employees in mind. This existing position, however, provides unique insight into how effectively working from home works, and it could play a key part in future regulations that reconfigure the current structure of working hours, potentially allowing for more flexibility. WFH was a pipe dream for many people prior to the pandemic. This is primarily due to the fact that home working necessitates a peaceful and focused workspace, which can be problematic for people living in small rooms. Over the years, there has been a widespread assumption in the city that employees must be physically present in the workplace to do their duties. For many, this is their first time working remotely, and it is proving to be successful to a significant part now that the pandemic has forced a trial run for WFH in the city.

People analytics

During these periods of uncertainty and instability, Human Resources has acquired a central and important role in business boardrooms for resolving the COVID-19 issue and establishing working practises in the economy's relaunch. HR and people analytics are a formidable weapon in the hands of CHROs and HR analytics heads in their goal to protect the people while preserving productivity and work morale in these extremely difficult circumstances.

Indeed, although the function of CHROs had been challenged by other C-level jobs previous to the crisis, it is now clear that the pandemic crisis has elevated the role of Chief HR Officers in the C-suite. HR departments have had a short time to put gut feelings aside and make place for bold data-driven decision making and inventive thinking in order to be effective in managing remote talent.

People analytics in managing remote work:

Due to statewide lockdowns, it became necessary for workers to work from home, and HR departments were confronted with the challenge of ensuring that targets were reached while maintaining the highest level of morale in the remote working environment. Many prominent firms, like Twitter, Google, Microsoft, Zillow, Slack, Amazon, and PayPal, have intends to build their work-from-home possibilities, and more are anticipated to fall into line. People analytics teams in the remote working environment are dedicated to assisting employees, assigning resources and focus, analysing impact, and making plans using HR data. At the same time, HR departments use people analytics to track employee welfare and the impact of remote work by capturing data from across the organisation.

Finding and hiring talent

The COVID-19 problem resulted in enormous layoffs across numerous industries, putting us in the midst of the greatest economic downturn since the Great Depression. Despite a decrease in labour demand, locating and employing the right people with the requisite capabilities remains one of HR departments' top priorities. According to McKinsey, the much-needed IT and digital skills are still in short supply, so CHROs should start rethinking their hiring processes and considering tools and platforms that make it easier to connect people to work and gain a better understanding of their skills and how they match up with available jobs. Making wise and planned hires also necessitates having a thorough understanding of the recruitment process and analysing key HR analytics indicators in order to make the best judgments. HR analytics may aid in the recruitment process and provide valuable insights, allowing you to save time and dollars while hiring the appropriate people.

HR executives should consider strategies and tools for tracking data, such as an application tracking system or other HR systems for reporting hiring. Time to hire, cost per hire, reduce time to hire, early turnover, sourcing channel efficacy, visitor to candidate conversion rate, quality of hire, revenue per employee, and so on are some of the indicators HR practitioners should keep watch on.

People Analytics in monitoring and rewarding performance

Reward and performance plans are another part of work that has been impacted by the present COVID-19 situation. Furthermore, according to McKinsey, people who work remotely are much more reliant on performance management to tell them how they're doing.

Strategic people and workforce analytics may assist HR not only improve compensation and rewards, but also positively impact the company's bottom line while offering equitable wages. Furthermore, according to a CEB Analytics report, firms that successfully use HR analytics may improve talent outcomes by nine percentage points, resulting in a 4% increase in gross profit margin and \$12.8 million in savings for every \$1 billion in revenue. In troubled times like these, relying on people analytics to generate rewards and compensation plans, resolve employee pay fears, and handle job candidate salary demands allows business leaders and HR managers to make fact-based and right decisions for both the organisation and their employees.

Prioritising and gaining intelligence

Prioritization is one of the most important, but also difficult, aspects of risk and crisis management. In a time of turmoil, HR has a lot of fires to put out, so defining clear targets for where to invest resources can be difficult. People data aids in the gathering of critical information for decision-making. Having demographic and location data required to identify high-risk employees is an example of gaining intelligence and insights in order to prioritise. Business leaders must comprehend recent pandemic trends and incorporate public health dashboards with people analytics platforms in order to make wise decisions in a short amount of time. Another objective for businesses, as well as a source of intelligence, is having data sets that show how COVID-19 affects daily operations, such as tracking absenteeism or disseminating pulse surveys on how employee sickness affects teamwork. Identifying people who are crucial to the business and without whom the business cannot operate properly is a top concern for companies. Having accurate and available people data, as well as location and demographic data on employees, may assist HR in identifying and locating these persons, assessing their risk scenarios, and formulating contingency plans for who could fill in for them if they are absent.

Conclusion:

The pandemic highlighted that HR deserves and needs a seat at the table after adapting and leading in this catastrophe. The ability of an organization's HR function to adapt and respond may very well determine the company's existence. For numerous years, the concept of the "future of work" has been discussed. That catch appears to have come to fruition now. According to Brian Kropp in HBR, "While 2020 was the most tumultuous year in recent history, we would

be naive to think the disruption is ended. " "Rather, as we get closer to 2022 and beyond, the rate of disruption could pick substantially as the consequences of 2020 play out over the next few years. "This is the time for HR to take what they've learned and apply it to people-centered tactics that reimagine workplace safety, time off, systems and engagement. HR's ability to deal with significant challenges in 2020 shows that they are better prepared than ever to lead their firms into people policies and practises that will alter the workplace.

References:

1. Adams-Prassl, A., Boneva, T., Golin, M., and Rauh, C. (2020). Inequality in the impact of the coronavirus shock: Evidence from real time surveys. *Journal of Public Economics*, 189, 104245.
2. AitkenFox, E., Coffey, J., Dayaram, K., Fitzgerald, S., Gupta, C., McKenna, S., and Wei Tian, A. (2020a). COVID-19 and the changing employee experience. *LSE Business Review*. Retrieved from <https://blogs.lse.ac.uk/businessreview/2020/06/24/covid-19-and-the-changing-employee-experience/>
3. Bartik, A. W., Cullen, Z. B., Glaeser, E. L., Luca, M., and Stanton, C. T. (2020). What jobs are being done at home during the COVID-19 crisis? Evidence from firm-level surveys (No. w27422). National Bureau of Economic Research.
4. Caligiuri, P., DeCieri, H., Minbaeva, D., Verbeke, A., and Zimmermann, A. (2020). International HRM insights for navigating the COVID-19 pandemic: Implications for future research and practice. *Journal of International Business Studies*, 51, 697–713
5. Chapman, E. F., Sisk, F. A., Schatten, J., and Miles, E. W. (2018). Human resource development and human resource management levers for sustained competitive advantage: Combining isomorphism and differentiation. *Journal of Management and Organization*, 24(4), 533–550.
6. Greer, T. W., and Payne, S. C. (2014). Overcoming telework challenges: Outcomes of successful telework strategies. *The Psychologist-Manager Journal*, 17(2), 87. doi: 10.1037/mgr0000014
7. Hecker, S. (2020). Hazard pay for COVID-19? Yes, but it's not a substitute for a living wage and enforceable worker protections. *New Solutions: A Journal of Environmental and Occupational Health Policy*, 30(2), 95–101. doi: 10.1177/1048291120933814

8. Ismail, H., and Gali, N. (2017). Relationships among performance appraisal satisfaction, work–family conflict and job stress. *Journal of Management and Organization*, 23(3), 356–372.
9. Leighton, P., and McKeown, T. (2020). *Work in challenging and uncertain times: The changing employment relationship*. New York: Routledge.
10. Liu, Y., Lee, J. M., and Lee, C. (2020). The challenges and opportunities of a global health crisis: The management and business implications of COVID-19 from an Asian perspective. *Asian Business and Management*, 19, 277–297.
11. Maclean, J. C., Pichler, S., and Ziebarth, N. R. (2020). Mandated sick pay: Coverage, utilization, and welfare effects. National Bureau of Economic Research,(No. w26832). Retrieved from https://www.nber.org/system/files/working_papers/w26832/w26832.pdf.
12. Major, L. E., and Machin, S. (2020). Covid-19 and social mobility. Centre for Economic Performance, London School of Economics and Political Science, (No.004).
13. Molino, M., Ingusci, E., Signore, F., Manuti, A., Giancaspro, M. L., Russo, V., Cortese, C. G. (2020). Wellbeing costs of technology use during Covid-19 remote working: an investigation using the Italian translation of the technostress creators scale. *Sustainability*, 12(15), 5911.
14. Ngoc Su, D., Luc Tra, D., Thi Huynh, H. M., Nguyen, H. H. T., and O'Mahony, B. (2021). Enhancing resilience in the Covid-19 crisis: Lessons from human resource management practices in Vietnam. *Current Issues in Tourism*, 1–17. doi: 10.1080/13683500.2020.1863930

IMMUNITY AGAINST COVID-19: POTENTIAL ROLE OF YOGA AND WELLNESS

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Introduction:

SARS-CoV-2 infection associated respiratory disease- COVID-19 has evolved into a pandemic but, being a new form of virus, pathogenesis of disease causation is not fully understood and drugs and vaccines against this virus are still being tested so that no effective drugs or vaccines have been advised by regulatory authority. The COVID-19 pandemic continues to strongly affect people with health disadvantages, creating a heavy burden on medical systems and societies worldwide. Many don't realize that yoga is actually a science of ancient practices that came into being to deal with the difficulties, demands and stresses human beings have faced in their daily lives for millennia¹. Its many practices support our immune system, foster a higher level of healing and improve our overall health. Best of all, it offers so many sensible, nurturing and simple strategies for times like today that it can be a source of hope and promise for us all. To stay well, what really matters are the personal choices you make every single day. This includes nourishing your body, sustaining your vital energy, building your immunity, maintaining your mental health and supporting your spiritual purpose and emotional growth. Most significantly, remember *there is a powerful inner knowledge within you that you can use to derive strength, courage and support—no matter what the circumstances*. The practices and tools below can be a reference point to find faith and hope. Try them. Find out what works for you and what doesn't. Trust your choices. But most significantly, embrace the practices you find effective and comforting and use them to stay well and be strong. The Covid pandemic has brought the topic of health and wellness to an entirely new level. This global crisis makes staying healthy matter more than ever before; at the same time, it has limited the opportunities to do what we usually rely on to stay well, such as maintaining our fitness and relieving stress^{2,3}. As a wellness consultant for personal and corporate clients, I am always thinking about ways to support all aspects of a person's wellness. This includes strategies to strengthen the immune system,

alleviate anxiety and fear and help people learn how to access, transform and heal their body and mind. Here are some basic ideas from the yoga tradition you can use to support and protect your health—and that of your families, friends and employees—during this difficult time and beyond.

Immunity boosting Yoga practices

One of the greatest gifts of yoga is its many time-honoured and therapeutic practices designed to support the immune system⁴. They help us build defenses to resist physical stress such as colds and flu, as well as emotional stress that can also affect our health. We accomplish this with; yoga postures⁵, breathing techniques, and other practices that can affect the autonomic nervous system in ways either stimulate activation and strength, promote relaxation or create a state of balance⁶.

1. Move Your Body

Movement is fundamental for blood flow, a healthy respiratory system, and balanced growth throughout your life. These two practices help get you moving while building your immunity.

- **Vitality-Awakening:** 12-minute yoga practice that activates you in the morning.
- **Vitality-Stress Reduction:** 47-minute yoga practice that deepens and calms you while reducing stress

2. Focus Your Breath

Breathing is a powerful way to build stability and strength. Practicing pranayama for the immune system can be restorative to the body.

“**Analoma Ujjayi and Viloma Ujjayi** is a 5-minute breathing practice designed to create a peaceful yet focused state of body and mind.

3. Practice Meditation

Meditation calms your mind and helps you remain peaceful while maintaining a state of focused attention.

- **Tuning In** can be done in any period and includes movement, meditation and self-inquiry to help you shift your state from distraction to expansion.

4. Engage Emotionally

Intentionally taking time to tune in to your physical and emotional state helps involve you in the immediacy of your life.

- “**Standing in the Flow**” is a self-inquiry meditation that can be done anytime, day or night, to bring a felt presence to your emotional awareness.

5. Connect with Spiritual Purpose

Faith in yourself is an important element in yoga, and it comes from the trust you have in your highest self.

- **“Faith—Returning to Oneself”** is a short meditation technique you can use after any practice to deepen your inner experience and bring your awareness back to the self.

Understanding and applying these strategies can help you achieve protective health benefits such as an improved immune system and mental resilience⁷, to keep your body both physically and emotionally fit. Resilience as well as personal well-being, like all good practices, begin at home with *you*.

Yoga for Wellness

Yoga's combination of breathing, meditation and movement creates an overall sense of well-being. In fact, studies show yoga has a greater impact on enhancing mood and reducing anxiety than other forms of exercise. Yoga is an integral part of our lifestyle. It removes the impurities from the level of mind and unites everything with the spirit. For instance, insomnia could be connected to stress, anxiety or depression⁸. You have to address that issue instead of merely taking medication. This way, you have a wider perception of your own mind, body, thoughts and emotions and there's more clarity and you are able to guide your prana (life force) in a positive way to progress in life. According to the National Institutes of Health, scientific evidence shows that yoga supports stress management, mental health, mindfulness, healthy eating, weight loss and quality sleep. Yoga is not just about being able to perform complicated poses and movements. It is a holistic approach to physical and mental health, as well as a person's well-being and personal growth, health benefits of Yoga , Improves posture. Increases flexibility, Builds muscle strength. Boosts metabolism. Helps in lowering blood sugar. Increases blood flow. Keep diseases at bay. Increases self-esteem.

The power and relevance of yoga during a pandemic

On this Yoga Day, let us grab our mats and lift our spirits with yoga. We need the peace and calm that yoga brings into our lives. The relevance of yoga — amid the Covid-19 pandemic, which has upended the lives and livelihoods of millions of people around the world — has increased substantially. As we celebrate the seventh International Yoga Day on June 21, this year especially, we need to understand how its healing touch can improve our physical well-being⁹. Yoga, which originated in India and has been part of the Indian civilisation for millennia, has been a practice that aligns our mind, body and spirit, and enhances mental clarity. It is an effective tool to reduce stress and improve motor functions, which, in turn, helps keep various

health problems at bay. The pandemic has led to a substantial loss of human lives and has created unprecedented challenges for the public health system, not just in India, but across the world. The fear of this ever-mutating virus has kept many of us indoors. This forced confinement has increased the stress on our bodies and minds. This public health crisis has brought to the fore the importance of strengthening our immune systems. For this, we need to adopt a healthy lifestyle^{10,11}. Studies suggest that yoga contributes to improving the immune system since it is a combination of physical exercise, controlled breathing and mental concentration — all of which are known to have health benefits. Among the many yoga asanas, shavasana and sasakasana reduce stress which, many practitioners believe, increases the efficiency of the immune system. Breathing techniques like pranayam improve the functioning of the respiratory system. Trikonasana improves blood circulation, which benefits all our organs.

Several medical practitioners and experts have suggested that those suffering from mild symptoms of Covid-19 and who have been advised to isolate at home, could benefit from practising yoga *asanas* and breathing exercises, albeit with caution. As the virus directly affects the lungs, it is imperative to strengthen the respiratory system. Practising yoga is also advised to those who have recovered from the virus. Yogic breathing, beginner-level yoga *asanas* and meditation bring mental peace, a vital factor in the recovery process for those who have had the traumatic experience of contracting Covid-19. Apart from these, modified breathing techniques and yoga poses recommended by experts can help reduce fatigue and slowly restore energy levels among Covid-19 patients who are on the mend. Children can also benefit from yoga. As many are facing mental stress due to isolation and anxiety in an unpredictable school year, yoga can be a useful coping method. Hence, I appeal to all the parents and teachers to motivate young children to practice yoga in their daily lives. Being a country with the largest population of young people, we must make significant efforts to help them navigate through the adverse effects of the pandemic-induced disruption. Parents and teachers can and should motivate children to practise yoga. This will help improve physical flexibility and enhance concentration in these challenging times.

Our way of life has changed, most likely, forever. Across the world, yoga has come to be recognised as an effective tool in improving health, which, in turn, helps maintain an all-important work-life balance. Today, yoga has gained an enormous following globally and could well be considered one of the pillars of India's soft power.

References:

1. Khalsa SBS. Why do yoga research: who cares and what good is it? (2007) *Int J YogaTher*, 17:19–20.
2. McEwen BS. Central effects of stress hormones in health and disease: Understanding the protective and damaging effects of stress and stressmediators. (2008) *Eur J Pharmacol*; 583:174-85.
3. L. A. Uebelacker, G. Epstein-Lubow, B. A. Gaudiano, G. Tremont, C. L. Battle, and I. W. Miller, “Hatha yoga for depression: critical review of the evidence for efficacy, plausible mechanisms of action, and directions for future research,” (2010) *Journal of Psychiatric Practice*, vol. 16(1), 22–33.
4. S. A. Saeed, D. J. Antonacci, and R. M. Bloch, “Exercise, yoga, and meditation for depressive and anxiety disorders,” *American Family Physician*, (2010), 8(8), 981–987.
5. C. S. Chong, M. Tsunaka, H. W. Tsang, E. P. Chan, and W.M. Cheung, “Effects of yoga on stress management in healthy adults: a systematic review,” (2011) *Alternative Therapies in Health and Medicine*, 17(1), 32–38.
6. Ross A, Thomas S. The health benefits of yoga and exercise: A review of comparison studies. (2010) *J Altern Complement Med* ;16:3-12.
7. 1. Field T (2016) *Yoga Research Review. Complement Ther Clin Pract* 24: 145-161.
8. Khalsa SB. —Yoga as a Therapeutic Intervention: A Bibliometric Analysis of Published Research Studies, (2004) *Indian Journal of Physiology and Pharmacology*: 48(3), 269–85.
9. Pilkington K, et al. —Yoga for Depression: The Research Evidence, *Journal of Affective Disorders* (Dec. 2005): 89(1–3), 13–24.
10. Swami Vishnu Devananda, —The complete illustrated book of Yoga, Three River Press, NY 1988.
11. Sri Swami Sivananda, *Yoga In Daily Life- Divine Life Society Publication*, Distt. Tehri-Garhwal, Uttar Pradesh, Eighth Edition: 1999.

COVID-19 PANDEMIC: ECONOMIC, SOCIAL, PSYCHOLOGICAL, POLITICAL, EDUCATIONAL AND LITERARY IMPACT ON GENDER EQUALITY

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Abstract:

“During recession greed dies, frugality survives.” - Amit Kalantri, Wealth of Words

COVID-19 anthropogenic pandemic disaster has triggered the current economic, social, psychological, political and literary pandemonium. The global indexes of women empowerment and development on the subject of Gender Equality have significantly declined. The International agencies working towards giving a better, egalitarian society providing economic, social, political equality and better physical as well as mental health to feminine inhabitant of the planet Earth have recognized this crisis period as a danger that may wipe off the progress and achievements of last few decades. The UNWOMEN (United Nation organization dedicated and committed for women empowerment and Gender Equality) has expressed their concerns and requested the global leadership and their own offices in harshly affected regions that women are the most effected, front runner in this difficult time. The agencies have seen this pandemic has having equal effect on both genders but the socio-economic effects of the slowdown have harshly hit empowerment, medical facilities and sanitization of women and the aftermaths of the man made disaster will have long term influence on the female workforce, students.

Women, who largely constitute the front face, first in line of the business, belong to the unorganized employment, vulnerable to job loss in case of turmoil in businesses, are highly affected during the social, economic, political and educational breakdown during the COVID-19 shutdowns. Various domestic help, migrants, factory workers, front desk officers have lost their jobs and earnings and are struggling for livelihood. In the post-pandemic restart of economic activities, the fairer sex will be at high risk of contracting the disease, will be responsible for the well being and good health of their families, and hence will have to sacrifice their earnings and employment. The economic stress on the family income and expensive use of technology in education and higher education will lead to loss of educational opportunities; also the stressed medical and sanitization facility has affected the medical facility for expecting women.

This research paper aims to study how this disastrous pandemic, stemmed before the world has impacted goal of Gender Equality through the economic, social, psychological, political, educational and literary impact. The research work summarizes that the oppressed gender is harshly affected in all aspects and irreparable loss is acknowledged across the sphere, but concludes with the positive note there lays a ray of sunshine amidst the dark clouds, there lays an opportunity among the crisis.

Keywords: COVID-19, Pandemic, disastrous, pandemonium, global indexes, gender equality, women empowerment

Introduction:

The ongoing situation relating to the global pandemic and health emergency has far reaching consequences, unforeseen emergency like situations, unimagined out reach and long lasting effect. The present situation, effects and efforts are only dealing with the control of the spread of the disease, efforts to find medical remedy as cure and vaccine, quarantine it. The political, cultural, social and economic efforts and effects are only to limit the exposure of the extremely contagious virus and the repercussions are uncertain, continuing and deep-rooted. Global recession the world is facing due to the Corona crisis has emphasized the potential threat to political and economic sovereignty to some already-enfeebled countries. The current pandemic is a just a beginning of a greater financial and economic crisis and the progressive spread with the surprise element of uncertainty may bring to surface the pent-up economic and geopolitical dysfunctions.

The adversely effected national economies will have a greater setback leading to severely eroded political and economic autonomy of such countries. The Civil and Human Rights are harshly pressed in the current situation, the idea of personal liberty and freedom is subjected to severe restrictions. The freedom of press is reportedly to be curbed and curtailed in certain countries. The democracy itself has been oppressed in some countries like Hungary, where the Prime Minister *Viktor Orban* has been granted '*the power to rule by decree*' for an indefinite period (nytimes.com). The closure of schools, colleges, university and educational institutions has affected the educational system worldwide affecting the future of the children, learners, women and girls. The data available so far has shown the widening gap of inequality in the spread and fatalities due to coronavirus disease. The low-income families and women are at high risk of contracting the disease and to die from it (ASPE, 2021).

The hypothesis behind the case includes that poorer families are more likely to live in crowded housing such as slums, and women are most likely to work in low skill jobs, such as supermarkets, elder care, health care etc. – an essential service during the crisis. Many women working in unorganized sector are unemployed, taking other alternative high-risk jobs. Millions of the oppressed gender, children and specially girl child are denied access to basic healthcare and specialized healthcare during corona infection as they are uninsured and or underinsured (UN, 2020). The social consideration or distancing, addressing instructions, quarantine and isolation have frazzled the psychological well being of mankind. Man being a social animal needs companionship, social environment, friendly and happy social environment. Exacerbated by the social limiting due to spread control guidelines, fear, unemployment, depleted economic conditions, financials factors, uncertainty, unemployment and anxiety has raised a concern for a potential spike in cases of suicides and other mental disorders. Chaos and negative effects of the COVID-19 pandemic has created a calamitous future (ncbi.nlm.nih.gov).

The social distancing norms has limited the personal gathering and stay at home situation. The personal get together has been technologically upgraded to teleconferencing and various other methods, which has increased the screen time of the children and adults causing mental stress, and physical health issues, having significant complications of mental health crisis. Cases of domestic violence and intimate partner violence have increased attributed to the lock down amid the COVID-19 pandemic spread. The abusers are now controlling the large amount of daily life of their victims further added up with increased aggression in behavior due to insecurity, instability, social and financial stress. The alcohol consumption culture has also changed leading to more intoxication and aggression in behavior of addicts. The opinion and concerns of the elderly, common man and women are suppressed in formulating action to fight the corona pandemic, which is of foremost importance.

The lack of voice of common public and unscientific approach to curb the menace of present pandemic has adversely affected the gender parity, and lead to erosion of all achievements towards an egalitarian society in last few decades. The data are extremely uncertain at present and coping the steps and initiatives of a country as a model to fight corona can be highly risk oriented as the war of words to this virus of truth is on among countries. The model adopted by a developed nation and spread in a developed nation may have a different pattern in comparison to a developing and or under developed nation. The limited healthcare expertise and resources may also adversely affect the spread of the pandemic and necessary steps to control the outreach by the governments. A more care-oriented, positive, practical though emotional measures are needed to fight the spread and after effects of the present pandemic

control and later on aftershocks. The research paper is aimed to study the various aspects of the pandemic on gender parity and suggest measures to save the progress so far and way ahead to achieve an equal society.

Economic impact:

The economic downturn due to the spread control initiatives and subsequently during the future recovery stage will have substantial implications on Gender Parity due to the global COVID-19 pandemic. The general recession caused during economic slowdown as regular course of economic activity has more job loss for men; in comparison the pandemic hit global economic shutdown has lead to a downturn in economic activity of sectors with high female employment. The employment drop related to social distancing and lock down has severely impacted the women and girl related services and economic activities such as day care, child care, health care, personal hygiene, retail and banking etc. The current pandemic has affected the working mothers as they have been stressed out of their jobs due to rising need of unpaid domestic work, childcare and elder care at home. Women are largely employed in low-skill employment, unorganized informal sector with inadequate labour law protection, which has resulted economic disparity among women and men due to loss of job, income and family earnings (WHO, 2020; Bonotti and Zech, 2021).

Women are particularly most vulnerable economically, her personal finances are weaker than men, and their position in the labour market is extremely unsecure too. Moreover, women are more likely to be single parents and are likely to be hit severer in the economic depression, which is in full swing and still the repercussions are indeterminate (WHO, 2020).

Social impact:

The majority of those on the front lines of the pandemic are women, since women make up major employment of all healthcare, childcare, and other social services staff globally. They also assume the primary responsibility for household and domestic work and shoulder the responsibility of the family and child bearing. They are involved in caring for infected other family members, which has subjected her to even greater risk. Past experience shows that domestic, sexual, and gender-based violence increases during the period of such crises and disasters. The restrictive conditions of quarantine, social distancing and stay-at-home measures considerably expose women and children to violent and controlling men. Women also account for the majority of the world's older population, particularly those over 80. Hence the older women are majority of potential victims of the coronavirus. Furthermore, the oppressed gender has less access to health services than men do. The situation is worse, in a patriarchal setup of

society; where the provision of sexual and reproductive-health services, including prenatal, maternal care, access to contraceptives and safe abortions are rarely available and further reduced as soon as the pandemic stepped at the doorstep of the country (UN, 2020; Bonotti and Zech, 2021).

Psychological impact:

In the world facing a global health crisis, which has affected the world population in drastic ways. Covid-19 has deepened pre-existing inequalities and exposed the gender gaps in our systems, amplifying the effects of the pandemic for the feminine gender with multi-layered exacerbated effects for women and girls.

Physical distancing and stay-at-home initiatives had larger implications for women in every sphere of their lives, physical and mental wellbeing. Women are employed in the informal economy, hold less secure jobs, earn less and save less. The sharp rise in unemployment and limited access to social protections, has affected the women adversely. As, they do not have the capacity to absorb the economic shocks; they are at greater risk of falling into poverty. In addition to this, there has been an exponential increase unpaid care work due to school closures and heightened care needs of family members at home. Women carry the burden of household responsibilities, competing home and work demands, place their jobs at further risk with cuts (inability to avail paid sick leave) and lay-offs. Single parent or female-headed households are facing significant difficulty in supporting themselves and their families. Loss of financial independence along with control of finances keeps women bound to relationships and increases their vulnerability to experience exploitation and abuse. This along with restriction of movement, limited decision-making capacity and lowered social bargaining power, further threaten their safety and autonomy at home (Serafini *et al.*, 2020).

Family members use deliberate and neglectful tactics to exert power, including continuously finding fault with them, belittling their effort, refusing access to jointly owned money and threatening to cause harm. Neglectful strategies involve withholding interaction, invalidating their feelings and communicating to a woman that she is inferior. Psychological abuse is often a precursor to physical and sexual violence in relationships; depriving them of basic needs, causing harm, using coercion, manipulation or guilt to have sex and making offensive statements about one's sexuality or body. Covid-19 has presented a scenario of increased incidence of family abuse, intimate partner violence, and greater complication in reporting and seeking help. With diminished community support, disconnection from social networks and inability to seek temporary refuge from 'outside spaces' or have access to 'private spaces', women are experiencing chronic distress. Women are trapped in an escalating cycle of

tension, power and control are vulnerable to experiencing varied mental health concerns, including depression, anxiety and trauma. Stigma and lack of (and access to) social support often lead to internalization of abuse and directing the anger, humiliation and fear towards themselves, aggravating feelings of worthlessness and helplessness. This may also result in trauma bonding. If a woman experiences abuse from a partner who also expresses love, they learn to associate love with abuse. They often rationalize, justify or minimize the abuse and are less likely to report it (WHO, 2020; Bonotti and Zech, 2021).

Political impact:

The impact on political career of women is deeply affected in negative manner. The women with added responsibility of family care and restriction to move out during and after pandemic due to fear of catching the infection are least likely to participate and rather permitted to participate in political adventure. The women employed in unorganized sector are grossly hurt for the first time by the efforts of the Government and the public at large will take this as a failure of their female leaders to step out of the house and help them. The livelihoods are harshly affected, the long term effects will be there on job market and stressed economics, the goal of the society will be diverted to the immediate recourse and the efforts made till date on empowerment of women via political participation will be sidelined for an indefinite period (RSF, 2020; Bonotti and Zech, 2021).

Educational impact:

The schools, colleges and universities are closed to control and restrict the spread of SARS-COV-2 commonly known as COVID-19. The examinations of universities boards and councils are cancelled, the students are promoted, passed or failed based on their past performances in internal examination. In the attempt to arrest the risk of transmission of disease in young population the education of the students is at high risk. The E-Learning, which has witnessed an uptick due to ubiquitous Internet facility, smartphones proliferation and technological advancement. The schools, colleges and even private classes has adopted the technological learning facility and migrated to online platform of education. But in India the majority of population leaving below the poverty line (BPL), the female child is already having less and inadequate educational participation. In these circumstances number based participation of female child is at great risk of being dropped and or will be affected harshly and negatively in terms of higher, basic and quality education. In tier 3 cities the uninterrupted electricity and Internet services is still struggling to be achieved. The absence of face-to-face interaction between the child and the teacher will have adverse learning experience. E-learning can be a

boon for urban population primarily the male members of the society, but the struggling female gender in rural and semi urban areas will have negative educational impact due to COVID-19 today and in years to come (WHO, 2020, UN, 2021).

Conclusion and Summary:

The control of spread of COVID-19 pandemic in the society is the most burning problem needed to be answered by the society, economy and governments across the globe. This Global crisis has put the global leadership in stress to save their economy, population and society. The age-old goal of women empowerment, gender parity and egalitarian society has taken a back seat and suspended during this difficult time. The golden goal of gender sensitization has given way to the limiting of corona virus outreach. The resources available with the Government planned to be spent on women and girl child development are grossly utilized and diverted for controlling the immediate contamination. The women are affected in diverse and harsh manner by the immediate action taken to control the corona virus coverage. The setback doesn't end here but the after consequences are expected to be much more spread over a larger period of time may be for a year of a decade. The need is to take the primary efforts of controlling the spread but the need is to give required attention to the women protective and gender affirmative actions.

Suggestions and Recommendations:

The COVID-19 crisis affects men and women in different ways although the spread of the virus do not discriminate of the ground of sex, measures to resolve it must take gender into account. For women and girls, vulnerabilities in the home, on the front lines of health care, and in the labour market; must be addressed by the society and the Government.

The research paper suggests a gender affirmative lens, while enacting and implementing plans, policies, stimulus every act toward inclusive, equal and sustainable economies. The women's economic lives and independence should be the core and heart of all the response to the pandemic, efforts to restart the economic process and recovery plans. The tools widely used to provide social insurance, supply-side labor market, bring more liquidity in system, provide for CAPEX, support existing business (The warriors) and encourage new entrepreneurs (The Gladiators).

Education policies with sturdier provisions and ample financial backup ensuring the participation of girl child in modern era of technology based learning, aimed towards narrowing the gender based education gap to serve the long-term objective of participation with significant

role of the ‘*Viragos*’ the female warrior) in the future economy with capacity to stronger, equitable and sustainable growth.

The paper suggests applicability of social welfare schemes for large percentages of women workforce employed in agricultural sector or informal employment in semi-agricultural sector.

References:

1. <https://aspe.hhs.gov/reports/covid-19-impact-low-income-families>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7763183/>
3. <https://www.nytimes.com/2020/06/16/world/europe/hungary-coronavirus-orban.html>
4. <https://www.russellsage.org/research/funding/covid-19-pandemic>
5. <https://www.un.org/development/desa/dspd/everyone-included-covid-19.html>
6. <https://www.unwomen.org/en/digital-library/publications/2020/04/policy-brief-the-impact-of-covid-19-on-women>
7. <https://www.who.int/news/item/13-10-2020-impact-of-covid-19-on-people's-livelihoods-their-health-and-our-food-systems>
8. Bonotti Matteo and Steven T. Zech (2021): The Human, Economic, Social, and Political Costs of COVID-19. Recovering Civility during COVID-19. 2021 Mar 3: 1–36.
9. Serafini G, B Parmigiani, A Amerio, A Aguglia, L Sher, M Amore (2020): The psychological impact of COVID-19 on the mental health in the general population. QJM: An International Journal of Medicine, Volume 113, Issue 8: 531 – 537.

ROLE OF BIOMEDICAL ENGINEERING IN THE FIGHT AGAINST COVID-19

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Abstract:

COVID-19 pandemic caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) resulted in huge health and economic losses throughout the world. As with any other disease the saying “prevention is better than cure” holds true for this deadly viral disease. In order to tackle the pandemic, availability of rapid, reliable, and highly efficient diagnostic and monitoring devices is an urgent need of the hour. Biomedical engineering plays a crucial role in this context as it deals with the diagnostic tests, therapeutics, and vaccines. Engineering and medical fields have worked together to address the areas of critical need including the production and delivery of personal protective equipment (PPE kits), ventilators as well as vaccine production. The aim of this review is to highlight the work and contribution of bioengineers against the COVID-19 fight who are working continuously and judiciously in improving health services and successfully beating this virus.

Introduction:

COVID-19, a new infectious and deadly disease, declared as a pandemic by WHO in March, 2020, originated in the Wuhan city of China in December 2019. The Centre for Disease Control in China declared this respiratory infection as a complication of pneumonia caused by a novel Corona Virus named as 2019-nCoV (Wang *et al.* 2020). Clinical spectrums of COVID-2019 include severe respiratory distress, fever, cough and flu while some patients remained asymptomatic (Pan *et al.* 2020). The pandemic has created worldwide emergency affecting all countries, resulting in millions of deaths so far and has sent billions of people into lockdown. Around the globe, desperate efforts are being undertaken to end this pandemic while it has resulted in the collapsing of health systems and has triggered lasting geopolitical and economic issues. Future outbreaks of CoVs are unavoidable due to changes in the climate and

ecology and increased interaction of humans with animals. As such there is a need to develop effective therapeutics and vaccines against CoVs (Chen *et al.* 2020).

The detection of a new variant (Omicron) in South Africa is associated with rapid increase in COVID-19 incidence and positivity rates (National Institute for Communicable Diseases 2021 and Sky News 2021). The World Health Organization (WHO) on November 26, 2021 designated lineage B. 1. 1. 529 of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) as a variant of concern (VOC), Omicron (World Health Organization 2021). Omicron has over 50 mutations including 32 mutations on the spike protein. The increasing mutations of Cov-19 virus and emergence of new variants suggest that one vaccine may not be effective against all strains which challenges the control of its high transmission until natural immunity is developed and treatments are made available.

Bioengineering fields and control / prevention of COVID-19:

The unique challenges reported by epidemiologists, immunologists and medical doctors in combating this pandemic has presented biomedical science and engineering as a promising area to serve medical science in combating the SARS-CoV-2 infection (Tu *et al.* 2020).

These multidisciplinary engineering fields are applied to design and develop preventive methods, diagnostics, monitoring, and therapeutic strategies like nanotechnology, vaccine engineering, pharmaceuticals, medical devices, computation, bioimaging, sensing, etc. to tackle the propagation of SARS-CoV-2, detect and monitor the evolution of this disease, and, ultimately, cure it. In association with several other disciplines, biomedical engineering with its wide range of application areas played an important role in the propagation of the urgent response against COVID-19 pandemic.

Biomedical devices against COVID-19:

COVID-19 urgency leads to the demand of medical supplies and emergency care equipment with special emphasis on personal protective equipment (PPE). WHO reports that monthly, 90 million protective masks, 76 million gloves, 30 million biosafety suits and 1.6 million glasses or face shields are needed (Dargaville *et al.* 2020). The Harvard University School of Design developed isolation hoods that cover half of the body of patients infected by COVID-19 and gives protection to the front-line medical personnel in addition to the patient. At present, demand for respirators and oxygen tanks on an average is 10 times greater than the capacity of health systems and there is a large-scale production of personal protective equipment (PPE) using 3D printers from face shields to masks and biosafety suits having potential to remove viruses from the surface through antiviral coatings (Dargaville *et al.* 2020). Technology

is also being used to fabricate hand-free door openers, disinfection equipment, emergency fans, air filters, robots that disinfect high-risk areas, wireless sensors to detect COVID-19 early symptoms, smart watches to measure blood oxygen saturation and valves for respirators.

Major biomedical devices in use during this pandemic include blood purification devices, haemodialysis devices, decontamination systems for personal protective equipment, infusion pumps, remote or wearable patient monitoring devices, Respiratory Assist Devices (RAD), ventilators, and ventilator accessories. In this context, the Hemolung Respiratory Assist System (RAS) is a very promising device which is used for extracorporeal carbon dioxide removal and treatment of patients with pulmonary failure due to serious infections, transplants, or other pathologies. This technology has proven to be very efficient to restore the oxygen saturation levels in critically ill patients with COVID-19.

Priority medical devices for COVID-19 prevention and treatment include cloth face masks, N₉₅ respirator, elastomeric respirator and surgical masks for general public; medical personal protective equipment include face shield and surgical gloves, PPE kits, protection goggles and powered air purifying respirators (PAPRs). Success on handling this pandemic is proportional to the availability of the medical equipment and devices that are required for diagnosis and treatment of COVID-19 including Personal Protective Equipment (PPE) kits, respirators, surgical masks, gowns, gloves, face shields, diagnostic tests and test devices, Intensive Care Unit (ICU) equipments such as beds, ventilators, pulse oximeters, oxygen concentrators, oxygen cylinders, high flow nasal cannulas (HFNC), laryngoscopes, mechanical ventilators and medical diagnostic devices like Computed Tomography (CT).

Biomedical science and prevention of COVID-19 Infection:

During the pandemic biomedical research rapidly shifted its focus towards COVID-19, with laboratories and clinical research groups worldwide working furiously to advance scientific understanding of SARS-CoV-2 virus and develop and test diagnostics, therapeutics, and vaccines. Like any other respiratory infection, the success of prevention or treatment of COVID-19 depends on the efficacy of the decontamination substances or protective equipment being used (Kampf *et al.* 2020). Several engineered nanomaterials with antiviral and virucidal properties, with high efficacy in small doses and a minimal toxicity are being used as disinfectants for the decontamination of hospital material and in places with COVID-19 patients. Silver nanoparticles (AgNPs) are being used as an antiseptic and disinfectant due to their ability to interact with the disulfide bonds of the glycoprotein/protein contents of human pathogens, such as viruses, bacteria, and fungi, and induce their cell lysis (Bhattacharjee *et al.* 2019). Copper oxide nanoparticles (CuO NPs) in addition to being cost-effective and easy to synthesize,

exhibit interesting biological properties, hence are incorporated successfully for microorganism and virus inactivation purposes on contaminated surfaces (Kumar *et al.* 2019). Titanium dioxide (TiO₂) also possess biocidal properties, hence virus titers of SARS-CoV-2 on contaminated surfaces could be quickly reduced via photocatalysis mediated by TiO₂ NPs (Kim *et al.* 2003). Other types of oxide NPs include silica NPs which are being used as antimicrobial surface coating (Botequim *et al.* 2012). Emergence of new technologies like genetics and genomics, data science, including machine learning, artificial intelligence is critical for transforming health and biomedical research.

COVID-19 diagnosis and biosensors

An important aspect in the control of COVID-19 infection or any other viral disease is to design a rapid, specific, and sensitive diagnostic tool. Detection and monitoring of emerging or re-emerging viral agents, such as West Nile virus, Hantavirus, Nipah virus, Chikungunya, Zika, a variety of influenza strains, Severe Acute Respiratory Syndrome (SARS) coronavirus, require efficient biotechnological approach relying on the use of nanomaterials (Udugama *et al.* 2020). For molecular detection of COVID-19, RT-PCR is the most reliable technique so far. Among the serological methods, lateral flow assays have been successfully used to rapidly and accurately detect COVID-19, owing to the presence of specific antibodies in blood samples of the infected patients (Oberfeld *et al.* 2020). Enzyme-linked immunosorbent assay (ELISA), a conventional molecular biology method which enables the detection and quantification of various water-soluble substances, such as antigens and antibodies is also being used for the diagnosis of COVID-19. Surface Plasmon Resonance (SPR) techniques are label-free detection methods, considered among the best standard techniques in virology and are exploited in the development of effective diagnostic tools for COVID-19 (Bay, 2020). An electrochemical biosensor (colorimetric technique) can be used for measuring current as a function of the bound amount of SARS-CoV-2 antigen (Mahari *et al.* 2020).

Artificial intelligence (AI) analyzes the behaviour of the infection in the world by monitoring millions of variables related to the coronavirus from mathematical models, projections, new outbreaks, the behaviour of industry-specific shoppers, web searches for people with COVID-19 symptoms, worldwide clinical trials and real-time news (Bragazzi *et al.* 2020). AI helps in early detection and diagnosis of the infection, monitoring the treatment and the global cases distribution, one of the great applications of AI is the tracing of individuals with viruses and monitoring them which can help in identifying the circle of infected people, also, AI is used for drug delivery design and development for vaccines.

Anti-COVID-19 drugs and vaccines:

Researchers are working to combat COVID-19 through the use of more than 160 medications at different stages of development (Bay, 2020). Promising drug combinations include the use of hydroxychloroquine sulfate and chloroquine phosphate together with Remdesivir for hospitalized patients with severe COVID-19. Several existing treatments for other related conditions are being tested and some combinations have been successfully used for specific populations, still no universal therapies have been achieved for COVID-19.

Primary target for vaccine development includes the surface glycoproteins of the SARS-CoV-2. To elicit a strong humoral immune response against the S protein is one of the prime goals of human COVID-19 vaccines (Tse *et al.* 2020). The international scientific community is actively developing vaccines and till date out of 145 possible vaccine candidates, 21 are in clinical trials in humans (WHO, 2020). An essential medicine for COVID-19 is oxygen, hence it is mandatory to assess the availability of different sources of oxygen, as well as its delivery and quick supply systems to the patient.

Conclusion:

SARS-CoV outbreak highlighted the importance of implementing health policies and developing technologies based on basic and applied sciences particularly in the fields of biomedical science and engineering, to tackle the current COVID-19 pandemic and any future outbreaks from approaches relying on computational simulations, artificial intelligence, and smart devices. One of the most important fields, nanotechnology, significantly impacts the protection, diagnosis and therapeutic solutions. Thus, need of the hour is to develop reliable and cost-effective biomedical devices that are affordable, practical, and easy-to-use products accessible for all countries worldwide, with a special emphasis on developing countries. Finally, apps, software, internet, and smart technologies are outstanding tools to monitor, control, and predict the evolution of COVID-19 pandemics. Although scientists around the world are working on the development of effective therapeutics and vaccines against COVID-19, currently, the only option left is to minimize viral transmission through social distancing, efficient public health policy and strengthening the one-health approach.

References:

1. Bay, J. 2020. COVID-19 Impact on Surface Plasmon Resonance Market. Available online: [https://www. marketwatch. com/press-release/COVID-19-impact-on-surface-plasmon-resonance-market-2020-06-04](https://www.marketwatch.com/press-release/COVID-19-impact-on-surface-plasmon-resonance-market-2020-06-04) (accessed on 30 July 2020).

2. Bhattacharjee, S., Joshi, R., Chughtai, A. A and MacIntyre, C. R. 2019. Graphene Modified Multifunctional Personal Protective Clothing. *Adv. Mater. Interfaces*, 6.
3. Botequim, D., Maia, J., Ferreira, L., Lopes, L. M. F., Simões, P. N., Ilharco, L. M and Ferreira, L. 2012. Nanoparticles and Surfaces Presenting Antifungal, Antibacterial and Antiviral Properties. *Langmuir*. 28: 7646–7656.
4. Bragazzi, N. L., Dai, H., Damiani, G., Behzadifar, M., Martini, M and Wu, J. 2020. How Big Data and Artificial Intelligence Can Help Better Manage the COVID-19 Pandemic. *Int. J. Environ. Res. Public Health*. 17: 3176.
5. Chen, Y., Liu, Q and Guo, D. 2020. Emerging coronaviruses: genome structure, replication, and pathogenesis. *J Med Virol*. cluster with SARS-CoV-2 infection. *Lancet Infect Dis*. 20 (4): 410–1.
6. Dargaville, T., Spann, K and Celina, M. 2020. Opinion to address the personal protective equipment shortage in the global community during the COVID-19 outbreak. *Polym. Degrad. Stab*. 176: 109162.
7. Kampf, G., Todt, D., Pfaender, S and Steinmann, E. 2020. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J. Hosp. Infect*. 104: 246–251.
8. Kim, S. H., Kwak, S. Y., Sohn, B. H and Park, T. H. 2003. Design of TiO₂ nanoparticle self-assembled aromatic polyamide thin-film-composite (TFC) membrane as an approach to solve biofouling problem. *J. Membr. Sci*. 211: 157–165.
9. Kumar, S. V., Bafana, A., Pawar, P., Faltane, M., Rahman, A., Dahoumane, S., Kucknoor, A and Jeryes, C. S. 2019. Optimized production of antibacterial copper oxide nanoparticles in a microwave-assisted synthesis reaction using response surface methodology. *Colloids Surfaces A Physicochem. Eng. Asp*. 573: 170–178.
10. Mahari, S., Roberts, A., Shahdeo, D. and Gandhi, S. 2020. eCovSens-Ultrasensitive Novel In-House Built Printed Circuit Board Based Electrochemical Device for Rapid Detection of nCOVID-19 antigen, a spike protein domain 1 of SARS-CoV-2. *bioRxiv*.
11. National Institute for Communicable Diseases. New COVID-19 variant detected in South Africa. Johannesburg: National Institute for Communicable Diseases; 2021 Nov 25 [cited 2021 Nov 25].
12. Oberfeld, B., Achanta, A., Carpenter, K., Chen, P., Gillette, N. M., Langat, P., Said, J. T., Schi, A. E., Zhou, A. S. and Barczak, A. K. 2020. SnapShot: COVID-19. *Cell*. 181: 954–954. e1.

13. Pan, X., Chen, D., Xia, Y., Wu, X., Li, T and Ou, X. 2020. Asymptomatic cases in a family
14. Sky News. New COVID variant: UK urgently brings in travel restrictions to stop spread of 'the worst one we've seen so far'. Sky News [Internet], 2021 Nov 25 [cited 2021 Nov 25]; UK.
15. Tse, L. V., Meganck, R. M., Graham, R. L. and Baric, R. S. 2020. The Current and Future State of Vaccines, Antivirals and Gene Therapies Against Emerging Coronaviruses. *Front. Microbiol.* 11: 658.
16. Tu, Y. F., Chien, C. S., Yarmishyn, A. A., Lin, Y. T., Luo, Y. H., Lai, W. Y., Yang, D. M., Chou, S. J and Yang, Y. P and Wang, M. L. 2020. A Review of SARS-CoV-2 and the Ongoing Clinical Trials. *Int. J. Mol. Sci.* 21: 2657.
17. Udugama, B., Kadhiresan, P., Kozlowski, H. N., Malekjahani, A., Osborne, M., Li, V. Y. C., Chen, H., Mubareka, S., Gubbay, J. B and Chan, W. C. W. 2020. Diagnosing COVID-19: The Disease and Tools for Detection. *ACS Nano.* 14: 3822–3835.
18. Wang, C., Horby, P. W., Hayden, F. G and Gao, G. F. 2020. A novel coronavirus outbreak of global health concern. *Lancet.* 395 (10223): 470–3.
19. WHO. 2020. Draft Landscape of COVID-19 Candidate Vaccines. Available online: <https://www.who.int/publications/m/item/draft-landscape-of-COVID-19-candidate-vaccines> (accessed on 3 August 2020).
20. World Health Organization. 2021. Classification of omicron (B. 1. 1. 529): SARS-CoV-2 variant of concern [Internet]. Geneva: World Health Organization; 2021 Nov 26 [cited 2021 Nov 26].

OMICRON AND 3RD WAVE OF COVID-19 IN INDIA

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Abstract:

Entire mankind has suffered from the CoVID-19 disease in one way or the other. First traced in Wuhan province of China in 2019, this disease has caused havoc. The delta variant, to which the 2nd wave of CoVID-19 was attributed, claimed approximately 5 million lives. Although in India almost 100 crore people have been vaccinated, still the experts have concerns regarding Omicron variant of Corona virus. It is being stated that omicron variant has higher spread rate as compared to its predecessors. The 3rd wave attributed to Omicron variant of corona virus is expected to peak in FEB-2022 and is expected to be less virulent as compared to 2nd wave which was attributed to delta variant. Still, WHO has warned the countries to complete mass vaccination and suggested its residents to exercise CoVID-19 Appropriate Behavior (CAB) in order to prevent its spread.

Keywords: CoVID-19, Omicron, Vaccination, Virulent, CoVID-19 Appropriate Behavior (CAB)

Introduction:

If entire mankind were to be asked the two bad years of their lives, then 2020 and 2021 will be the top selected options in the poll. The only reason behind is CoVID-19 who changed the way of lifestyle of almost everyone in one way or the other.

CoVID-19 or Corona Virus Disease was first reported in DEC-2019 in Wuhan China. The causative organism of this disease was novel corona virus or SARS CoV-2. Since then, till date, this disease has claimed almost 5,453,463 lives worldwide. Months keeps on passing and the novel corona virus kept on evolving with almost every quarter, a new variant was disclosed with delta variant being most fatal [1-4].

On 28 November 2021, a variant of corona B.1.1.529 has been designated Omicron. This has also been declared to be the variant of concern. Although knowledge available on this Omicron is limited yet this variant has created significant panic worldwide. Several states have even re-initiated night curfews and CoVID-19 appropriate behavior is being enforced to ensure that the spread of the same can be curbed [5-7].

Countries most affected by Omicron:

Till date, approximately 57 countries worldwide have reported cases of new variant, Omicron. On 28-DEC-2021, approximately 7,175 new cases and 63 deaths were registered by Korea Disease Control and Prevention Agency making South Korea one of the most affected countries. Other countries which have reported cases includes Queensland, Botswana, Nigeria, Philippines, France and United Kingdom etc. [8].

Information about Omicron:

Although the strain is quite new yet some information is available on the same information about which is presented in the table below [9-13]:

Sr. No.	Parameters	Comments
1	Transmissibility	Unclear as of now, epidemiologic studies are underway to understand this.
2	Severity of disease	Hospitalization has increased but the data to establish severity of Omicron variant is limited.
3	Effectiveness of prior SARS-CoV-2 infection	Omicron variant can reinfect people who have previously had COVID-19 with any other variant
4	Effectiveness of vaccines	Studies with technical part are underway but the vaccines have reduced overall mortality due to CoVID-19.
5	Effectiveness of current tests	PCR test is effective in establishing presence of Omicron variant in given biological sample.
6	Effectiveness of current treatments	Corticosteroids and IL6 Receptor Blockers are still being used to manage CoVID-19 due to Omicron.

Omicron and 3rd wave:

The number of cases reported in India are 7,500 and with this the 3rd wave of CoVID-19 attributed to Omicron variant of corona virus is expected to peak in FEB of 2022. National

COVID-19 Supermodel Committee's head Mr. Vidyasagar is of opinion that 3rd wave will be somewhat milder as compared to second wave since vaccination drive is in progress and Indians will have mass immunity [14].

The number of cases in 3rd wave, in India, is expected to be one lakh to two lakh cases per day still some experts have expressed their concern about high transmissibility rate of Omicron. Dr G C Khilnani, Chairman Pulmonology, Critical Care and Sleep Medicine, PSRI Hospital has suggested booster vaccination of population suffering from comorbidities [15].

Recommendations from WHO to prevent transmission of Omicron [16]:

- Physical distancing i.e., maintaining a distance of 1 meter from others.
- Wearing a well-fitting mask
- Avoiding sitting in poorly ventilated space
- Avoiding overly crowded spaces.
- Using Alcohol Based Hand Rubs (ABHR) frequently.
- Coughing and sneezing in bent elbows
- People should get themselves vaccinated when it's their turn.

References:

1. Archived: WHO Timeline - COVID-19, available online at: <https://www.who.int/news/item/27-04-2020-who-timeline---covid-19> (accessed on 01-JAN-2021).
2. Kumar, A., Singh, R., Kaur, J. (2021). Wuhan to World: The COVID-19 Pandemic. *Frontiers in cellular and infection microbiology*, 11, 596201. <https://doi.org/10.3389/fcimb.2021.596201>
3. Khan, M., Adil, S. F., Alkhathlan, H. (2020). COVID-19: A Global Challenge with Old History, *Epidemiology and Progress So Far. Molecules (Basel, Switzerland)*, 26(1), 39. <https://doi.org/10.3390/molecules26010039>
4. Alturki, S. O., Connors, J., Cusimano, G. (2020). The 2020 Pandemic: Current SARS-CoV-2 Vaccine Development. *Frontiers in immunology*, 11, 1880. <https://doi.org/10.3389/fimmu.2020.01880>
5. Ashoka Bulletin, "India's COVID Story: How the country was hit worse by the pandemic" Available online at <https://www.ashoka.edu.in/stories/welcome-706#:~:text=The%20Covid%2D19%20disease%2C%20caused,reported%20on%20January%202020> (accessed 01-JAN-2022)

6. Worldometer, available online at <https://www.worldometers.info/coronavirus/> (accessed 01-JAN-2022).
7. Update on Omicron, available online at <https://www.who.int/news/item/28-11-2021-update-on-omicron> (accessed 02-JAN-2022)
8. Hindustan Times, Coronavirus digest: Omicron reported in 57 countries, WHO reports, available online at <https://www.hindustantimes.com/lifestyle/health/coronavirus-digest-omicron-reported-in-57-countries-who-reports-101639015185312.html> (accessed 02-JAN-2022).
9. Why Is Omicron So Contagious? Available online at <https://www.scientificamerican.com/article/why-is-omicron-so-contagious/> (accessed 02-JAN-2022)
10. Omicron causes a less severe illness than earlier variants, available online at <https://www.economist.com/science-and-technology/2022/01/01/omicron-causes-a-less-severe-illness-than-earlier-variants> (accessed 03-JAN-2022).
11. Abu-Raddad LJ, Chemaitelly H, Ayoub H. H. (2021). Association of Prior SARS-CoV-2 Infection With Risk of Breakthrough Infection Following mRNA Vaccination in Qatar. *JAMA*. 2021;326(19):1930–1939. doi:10.1001/jama.2021.19623
12. Latest on Omicron Variant and COVID-19 Vaccine Protection, available online at: <https://directorsblog.nih.gov/2021/12/14/the-latest-on-the-omicron-variant-and-vaccine-protection/>(accessed 03-JAN-2022).
13. Explained: What has CDC said about Omicron’s transmissibility, vaccine efficacy, treatment, available online at <https://indianexpress.com/article/explained/cdc-omicron-transmissibility-vaccine-efficacy-treatment-7658695/>(accessed 03-JAN-2022).
14. Omicron driven third wave in India likely to peak in Feb: Covid Supermodel Panel, available online at: <https://economictimes.indiatimes.com/news/india/omicron-driven-third-wave-in-india-likely-to-peak-in-feb-covid-supermodel-panel/articleshow/88359327.cms> (accessed 02-JAN-2022).
15. Experts highlight 1 worrying factor of Omicron, warn of 'inevitable' third wave, available online at: <https://www.hindustantimes.com/india-news/experts-highlight-1-worrying-factor-of-omicron-warn-of-inevitable-third-wave-101639827267345.html> (accessed 02-JAN-2022).
16. Take all measures to prevent further spread of Omicron – WHO, available online at <https://www.who.int/southeastasia/news/detail/18-12-2021-take-all-measures-to-prevent-further-spread-of-omicron-who>(accessed 02-JAN-2022).

A STUDY ON PERCEPTION OF TEACHERS TOWARDS ONLINE TEACHING DURING COVID-19 WITH SPECIAL REFERENCE TO THRISSUR DISTRICT

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Abstract:

The rise of the Corona Virus launched significant concerns for the global healthcare system. Having a primary zoonotic source, Covid-19 is creating several challenges for the whole world (WHO, 2020). The first significant outbreak of Coronavirus was recorded in December 2019 from Chin's 7th most populous city Wuhan. Within a few days, the virus spread to other countries, including Iran, Italy, and other countries. The first confirmed case outside China diagnosed on January 17 in Bangkok, Thailand. During March 2020, more than 67 countries reported confirmed cases with more than 132 deaths (WHO, 2020). However, due to briskly increasing cases, it is difficult to estimate the total number of cases due to limited access and thousands of unregistered cases. Moreover, despite many claims, the spread of Coronavirus is continued, and the number of cases is briskly increasing worldwide. To hamper the virus transmission, healthcare organizations introduced many safety measures such as wearing face masks, social distancing, self-isolation (if diagnosed positive), and even complete lockdown in many countries. In this regard, social distancing is a traditional and most effective technique to hamper virus transmission.

Keywords: online Teaching, Covid 19

Introduction:

Corona virus is considered as one of the most infectious diseases which mainly occur after contaminating the human with the rigorous acute syndrome of respiratory issues. The particular disease has been evolved like a pandemic because of extensive spread within the number of nations. The global economy has suffered and continues to suffer massive losses from the coronavirus pandemic.

Especially during the current pandemic, they minimized the physical contact and, thus are capable of reducing risk factors. However, social distancing and lockdown in many countries adversely affected daily life activities in general. Institutions are facing considerable challenges to counteract against these challenges by resorting to distance teaching systems. Despite the

current pandemic hampered education all over the world, virtual teaching and ease of access to internet services highlight facilitated the teaching system. Online teaching is the process of educating others via the internet. Various methods can be used, such as one-on-one video calls, group video calls, and webinars. In Online teaching, teachers need to create digital resources to share with their students, such as PowerPoint presentations, videos, audio lectures, and pdf guides. Both students and teachers consider online technology as a positive part of their learning system. Even besides online sources, many countries also launched television broadcast to support distance teaching during the pandemic. Online teaching is a useful tool to overcome educational challenges.

Generally, both students and teachers are equally responsible to accept online teaching which helps to continue the teaching process as access to education is today more convenient through online teaching systems.

In short this study aims to identify the factors affecting, challenges faced by the teachers and satisfaction of teachers towards online teaching also recommend solutions for better online educational system.

Statement of the problem:

Online teaching is replacing the traditional classroom environment worldwide. Especially during the current Covid-19 outbreak, online teaching is a crucial source to continue educational activities. The success of online teaching depends on the understanding of certain factors that influence the teacher's acceptance and usage of such e-learning systems. A successful online teaching system should consider the personal, social, cultural, technological, organizational and environmental factors. This study mainly aims to identify the factors affecting online teaching, problems faced by the teachers and satisfaction of teachers towards online teaching.

Significance of study:

At this situation it is very important for us to study the problems faced by teachers during Covid-19 pandemic and how it is affected the learning. This study aims to provide a discussion of the current e-learning environments including their characteristics, limitation, advantages and the major factors that affect the acceptance of such technologies and also make research on perception and problems faced by the teachers in online teaching.

Objectives:

1. To identify the factors affecting online teaching during covid-19.
2. To study the satisfaction of teachers towards online teaching during covid-19.
3. To find out the problems faced by the teachers in online teaching during covid-19.

Research Methodology:

Both primary data and secondary data have been used for conducting the study. Primary data is collected through questionnaire from a sample of 50 respondents' from St. Joseph's

College (Autonomous) Irinjalakuda, Christ College, Irinjalakuda (Autonomous), and S. N. College Nattika in Thrissur district. Secondary data has been collected from websites and journals. Both descriptive and analytical study is undertaken. The sampling technique used in the study is judgmental sampling. Simple percentage analysis; Likert scale and Ranking method are used for data analysis.

Review of literature:

Bozkurt and Sharma (2020) in his study *“Emergency Remote Teaching in a Time of Global Crisis Due to Corona Virus Pandemic”* states that rapid, unexpected and ‘forced’ transition from face-to-face to remote teaching has entailed a number of challenges and constraints but also opportunities that need to be examined. Existing literature points to an ‘emergency remote teaching’.

Hodges *et al.* (2020) in his study *“The Difference between Emergency Remote Teaching and Online Learning.”* While accounts of how higher education institutions and teacher educators responded to the transition from face-to-face to online teaching are relevant, more needs to be done in this regard. For informed and productive online teaching and learning it is important to learn more about its potential and use. As such, it is essential to go beyond emergency online practices and develop quality online teaching and learning that result from careful instructional design and planning.

Flores and Gago (2020) in his study *“Teacher Education in Times of COVID-19 Pandemic in Portugal: National, Institutional and Pedagogical Responses”* The COVID-19 pandemic has affected education, and teacher education in particular, in various ways. As a result of the closure of universities and schools, teachers and students had to rapidly adapt to remote teaching. Teacher education is no exception. The need to create learning environments for student teachers doing their teacher education preparation implied decisions, choices and adaptations in order to meet not only the expectations of students but also the requirements of teacher education as well as the conditions in which both universities and schools had to operate.

Beaunoyer *et al.* (2020) in his study *“COVID-19 and Digital Inequalities: Reciprocal Impacts and Mitigation Strategies.”* Contextual factors impacting the quality of the experience should not be ignored: limited access to technology and internet was a reality and continues to be a reality that the recent lockdowns and adoption of remote learning have exacerbated. These have not only affected the normal development of teaching and learning practices, but have also uncovered issues of digital inequality emerging from access to technology as well as differences in digital literacy that are deeply embedded in social, economic and cultural context. The COVID-19 pandemic has increased digital inequalities further and has revealed an additional

impact in terms of social support networks that are so crucial for the preservation of our interpersonal ties and social structures.

Reimers *et al.* (2020) in this study “*Supporting the continuation of teaching and learning during the COVID-19 pandemic*” For educators, the COVID – 19 pandemic is a quintessential adaptive and transformative challenge, one for which there is no preconfigured playbook that can guide appropriate responses. Education leaders must swiftly design responses –and with specific contexts in mind- as the pandemic runs its course. This brief discusses the second module of a series which presents the results of a comparative analysis of emerging educational needs and responses as the pandemic unfolds across countries around the world. The overall goal of this series is to facilitate the rapid design process and implementation of adaptive responses to the emerging education challenges, and to protect young people’s educational opportunities during and following the pandemic.

Data analysis and interpretation:

Table 1: Age of the respondents

Age	No. of Respondents	Percentage
Below 30	12	24
30 - 40	20	40
40 - 50	14	28
Above 50	4	8
Total	50	100

Table 2: Gender of the respondents

Gender	No. of Respondents	Percentage
Male	9	18
Female	41	82
Total	50	100

Table 3: Designation of the respondents

Designation	No. of Respondents	Percentage
Professor	2	4
Associate professor	9	18
Assistant professor	33	66
Guest faculty	6	12
Total	50	100

Table 4: Ways to resolve learning problems

Ways	No. of Respondents	Percentage
Create a sense of community	6	12
Help students maintain focus	11	22
Build Personal Connection with students	10	20
Increase student engagement	14	28
Others	9	18
Total	50	100

Table 5: Perceptions about online teaching

Perceptions	No. of Respondents	Percentage
Diversifying teacher's knowledge	12	24
Increase in the technical knowledge of the teacher	15	30
Helpful in completing the syllabus	10	20
Reduce communication gap	9	18
Others	4	8
Total	50	100

Table 6: Overall satisfaction towards online teaching

Satisfaction Level	No. of Respondents	Percentage
Highly Satisfied	20	40
Satisfied	15	30
Average	13	26
Dissatisfied	2	4
Highly Dissatisfied	0	0
Total	50	100

Table 7: Important role of a teacher in online classroom

No	Roles	W	5	4	3	2	1	Total	Mean	Rank
1	Proper guide	F	4	16	6	14	10	50	2.8	IV
		F _x	20	64	18	28	10	140		
2	Motivator	F	8	12	18	4	8	50	3.16	II
		F _x	40	48	54	8	8	158		
3	Co- learner	F	10	10	12	6	12	50	3	III
		F _x	50	40	36	12	12	150		
4	Role model	F	8	8	6	18	10	50	2.72	V
		F _x	40	32	18	36	10	136		
5	Effective communicator	F	20	4	8	8	10	50	3.32	I
		F _x	100	16	24	16	10	166		

Table 8: Problem faced by the teachers in online teaching

No	Problems	W	5	4	3	2	1	Total	Mean	Rank
1	Issue with internet bandwidth	F	10	8	20	5	7	50	3.24	I
		F _x	50	40	60	10	7	162		
2	Computer or device issue	F	8	10	14	6	12	50	2.92	IV
		F _x	40	40	42	12	12	146		
3	Contacting students	F	6	10	8	12	14	50	2.64	V
		F _x	30	40	24	24	14	132		
4	Time spent for preparing classes	F	12	6	10	12	10	50	2.96	III
		F _x	60	24	30	24	10	148		
5	Response from students	F	8	12	10	14	6	50	3.04	II
		F _x	40	48	30	28	6	152		

Table 9: Teachers satisfaction regarding online teaching benefits

No	Benifits	W	5	4	3	2	1	Total	Weighted Average
1	Affordability	F	10	28	10	2	0	50	3.92
		F _x	50	112	30	4	0	196	
2	Flexibility	F	32	10	5	3	0	50	4.42
		F _x	160	40	15	6	0	221	
3	Time saving	F	10	35	5	0	0	50	4.1
		F _x	50	140	15	0	0	205	
4	Wide range	F	10	30	5	5	0	50	3.9
		F _x	50	120	15	10	0	195	
5	Recognition	F	6	24	15	4	1	50	3.6
		F _x	30	96	45	8	1	180	

Table 10: Teachers attitude towards successful online teacher

No	Attitudes	W	5	4	3	2	1	Total	Weighted Average
1	I use discussion as a teaching strategy for the subject that I teach	F	8	17	20	2	3	50	3.5
		F _x	40	68	60	4	3	175	
2	As a teacher I support student centered learning	F	10	13	23	1	3	50	3.52
		F _x	50	52	69	2	3	176	
3	I facilitate and monitor appropriate interaction among students	F	16	13	17	1	3	50	3.76
		F _x	80	52	51	2	3	188	
4	I encourage independence and creativity from students	F	6	24	15	4	1	50	3.6
		F _x	30	96	45	8	1	180	
5	I am flexible in dealing with students need	F	12	26	8	2	2	50	3.88
		F _x	60	104	24	4	2	194	

Table 12: Teachers satisfaction regarding following factors

No	Factors	W	5	4	3	2	1	Total	Weighted Average
1	Communication skills	F	6	18	12	10	4	50	3.84
		F _x	60	72	36	20	4	192	
2	Net connectivity	F	8	4	20	8	10	50	2.84
		F _x	40	16	60	16	10	142	
3	Interest of students	F	12	24	8	4	2	50	3.96
		F _x	60	96	32	8	2	198	
4	Technical knowledge	F	10	20	13	3	4	50	3.58
		F _x	50	80	39	6	4	179	
5	Flexible lesson plans	F	10	35	5	0	0	50	4.1
		F _x	50	140	15	0	0	205	

Findings:

1. From a sample of 50 respondents 36 percentage of the teacher’s opinion is that students respond towards online teaching were Excellent and only 4 percentage students respond towards online teaching were poor.
2. From a sample of 50 respondents 28 percentage of teachers find a way to resolve learning problems by Increase student engagement and only 12 percentages of teachers resolve learning problems by create a sense of community.
3. From a sample of 50 respondents 30 percentage argue that it increases in the technical knowledge of the teachers and only 8 percentage argue some other perceptions about online teaching.
4. From a sample of 50 respondents 40 percentage of the teachers are highly satisfied towards online teaching and no one could be highly dissatisfied towards online teaching.
5. The most important role of a teacher in online classroom is an effective communicator for the students. The next is motivator, co-learner, proper guide and role model.
6. The major problem faced in online teaching is issue with internet bandwidth, the next is Response from students, Time spent for preparing classes, Computer or device issue and Contacting students.

7. The teachers were more satisfied with the benefit of flexibility and less satisfied with the benefit of recognition.
8. The teachers were more satisfied with their attitude of flexible in dealing with students need towards characteristics of a successful online teacher and less satisfied with the attitude of use discussion as a teaching strategy for the subject that they teach.
9. The teachers were more satisfied with the factor of flexible lesson plans and less satisfied with the factor of net connectivity.

Conclusion:

During to Covid-19 outbreak, there is an increased dependency on web-based technology. People all around the world rely heavily on online platforms to communicate, entertain, and to gather information. The study was conducted with the main objective of identify the factors affecting online teaching, problems faced by the teachers and satisfaction of teachers towards online teaching.

To conclude, this study reveals that the online experience of teaching and learning in St. Joseph's college (Autonomous) Irinjalakuda, Christ College (Autonomous) Irinjalakuda and S.N college, Nattika of thrissur district was a real challenge for both teachers and students. However, it was also an excellent opportunity for them all to learn new skill and change their way of thinking towards online learning and teaching. Additionally, Covid-19 has made the whole world aware of adopting technology and artificial intelligence in the future in educational systems as they have proven their efficiency in many fields such as in medicine, logistics and education. The experience has also helped to reinforce new styles of learning and teaching. Similarly, creating a culture of blended learning and giving adequate training for both academic students and teachers would make the process efficient. Giving more trust, flexibility, and responsibility to teachers and students would also enhance academic integrity and quality of learning.

References:

1. Michelle D. Miller – *Minds Online-Teaching effectively with technology*, 2014
2. Claire Howell Major- *Teaching Online*, 2015
3. Tobin, J.T, Mandernach, J. and Taylor, A.H – *Evaluating Online Teaching-Best practices*, 2015
4. Cooperman, L. – *The Art of Teaching Online*, 2017

5. Harasim, L – Learning Theory and Online Technologies, 2017
6. Budhair, S.S and Skipwith, K. – Best Practices in Engaging Online Learners through Active and Experiential Learning Strategies, 2017
7. Flower Darby and James M. Lang – Small Teaching Online, 2019
8. Bozkurt and Sharma (2020) Emergency Remote Teaching in a Time of Global Crisis Due to corona Virus Pandemic
9. Hodges *et al* (2020). The Difference between Emergency Remote Teaching and Online Learning.
10. Flores and Gago (2020). Teacher Education in Times of COVID-19 Pandemic in Portugal: National, Institutional and Pedagogical Responses
11. Beaunoyer, Dupere and Guitton (2020). COVID-19 and Digital Inequalities: Reciprocal Impacts and Mitigation Strategies.
12. Fernando Reimers, A Schleicher, J Saavedra, S Tuominen (2020). Supporting the continuation of teaching and learning during the COVID-19 pandemic
13. <https://www.researchgate.net>
14. <https://journals.sagepub.com>
15. <https://ijert.org>
16. <https://iopscience.iop.org>
17. <https://www.uky.edu>

IMPACT OF LOCKDOWN ON EDUCATION

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Abstract:

The year 2020 began with the instigation of a new kind of pandemic that has been named as Covid-19 by the medical experts. This brought an enforced lockdown across the world including India in the month of March in 2020. This caused educational institutions from primary to the highest level to remain closed for a long period of time that lead to the halt of education for billions of students across the world. The closing of educational institutions has most heavily affected the students belonging to deprived class and those hailing from economically weaker sections of the society. Since March 2020, when the first lockdown was imposed even after more than 18 months has passed, but the education system across the world has not returned to normalcy. The second and third probable wave of the pandemic has affected the students, teachers and all those associated to education system directly. According to UNESCO, the education of about 3.2 billion students has come to an unprecedented halt. This number is more than 90% of the total students that take admissions in any level of education. The present study deals with the effect of lockdown imposed because of Covid-19 on education system along with taking concern about the digitalization of education, effect of Covid-19 on the education of poor children and it is an effort to provide some suggestions and solutions to the problem of Covid-19 affected students.

Keywords: Covid-19, Corona Virus, Online Education, Lockdown, Online Classes

Introduction:

The Covid19 was utterly an unprecedented situation for all of the planet earth. There have been several pandemics in the last century, including various Flu pandemics, AIDs pandemics, the third cholera pandemic, and so on. However, their impact on the world was nowhere close to that of covid19 has had on the world. It badly impacted the world economy, resulting in severe lockdowns across the world, similar to if humans were imprisoned for doing harm to the nature for many past centuries. Moreover, governments implied lockdown for every

civilian, effectively shutting down most of the businesses (except grocery, vegetable, and fruits shops), similar to other business schools, colleges, and universities were entirely closed for safety reasons. This paper will discuss the impact of lockdown on the education sector, including junior school, colleges, universities, teacher's pay, schools ultimately going out of business, and several other related topics.

Junior schooling

Junior schools are considered the base root of a child's upbringing and are the leading public policy tool to raise the skills of the next generations. One of the primary reasons behind the conduct of schools for children is to raise their social skills and awareness and gradually enhance the child's ability to have fun yet understand the dynamics of the world. Being restricted at home without doing anything was the most laborious task for everyone. Kids want to have fun outside of their home because playing e-games mentally exhaust everyone and have a negative effect on the human body, so children have nowhere to go except sitting idle in their rooms which reduce their mental health hence resulting in the impaired mental health of little souls (Burgess, 2020).

Even missing a single class significantly impacts the student's skills development. A study conducted by Carlsson *et al.* (2015) shows that there are two students with the same class who had the same test. Still, one student prepared for those 10 days of extra schooling, which helped him to score higher than the rest of the class (crystallized intelligence) by 1% of a standard deviation increased the performance of the student immensely (Carlsson *et al.*, 2015). Comparing this study with the current scenario of lockdown and school closure about 12 weeks about 60 days "implies a loss of 6% of a standard deviation, which is non-trivial. They do not find a significant impact on problem-solving skills (an example of 'fluid intelligence')" (Burgess, 2020)

Additionally, according to the World Economic Forum report, more than 1.2 billion children were out of schools for several months due to lockdown. The same report also praised the e-learning system, stating that e-learning has increased information retention among kids and adults alike. E-learning was also consuming less time and reduces the traveling time for students to go to school and break times; similarly, it has reduced the stress level among the students. Because most schools shifted their learning process to e-Learning; we have seen a reduction in the use of buses which carries student to the school due to this reduction, we have seen a significant reduction in carbon emission from these verses which are in immense quantity around the world however the major problem with the e-learning process conducted by many schools is that students can not have any physical activity between their classes and relax their minds and the body.

Lack of physical activities can increase the level of obesity among young children, especially in America. This happened during the global pandemic, and the US is already suffering from a high obesity rate. According to the state of childhood obesity dot ORG obesity among children aged between 2 to 19 During the global pandemic, the main reason was the closure of schools. Additionally, teachers were not paid the complete amount off salaries because most of the schools were going out of business. teacher's pay school going out of business

Skills learning

The education system has completely shifted to an online learning structure which enabled teachers to learn online teaching methods, students learned several techniques like content writing, affiliate marketing, digital marketing, and several online platforms like un-academy, Udemy, and several other online learning platforms made learning more accessible students aspiring to work online emerged during the lockdown. Results from a study conducted by Kapasia *et al.* (2020) show that more than 70% of people are involved in online skills learning programs, and much-learned videography, adobe software, advanced languages, digital and affiliate marketing, or clear their doubts from their current degree.

Graduates

Recently passing out students has suffered significantly due to the COVID-19 pandemic. During the latter part of their studies, they have experienced severe Teaching and assessment interruptions. However, teaching and assessments might not severely damage their knowledge because they have studied for at least three years during the same degree program. The primary point to worry about is that they are graduating at the initial phase of a major global recession, which will undoubtedly impact the initial stage of their career. Studies and evidence show that during the time of such poor market conditions negatively impact the fresh graduate. They might accept a lower-paid job which will have a long-lasting impact on their career.

Undergraduate and Postgraduate students

In the lockdown period, the education of the students was poorly affected. All the public and private universities were closed, and the students suffered greatly. Especially the undergraduate and postgraduate students were apprehensive about the completion of their degrees. Universities neither canceled the exams nor did they call them physically to the campuses to attend the lectures. This whole situation was really depressing. Undergraduate students were upset about the completion of their first degree and postgraduates for their master's degree. The students needed to take a break in exams, assignment making and in this way overall degree of the students was at risk. Lockdown affected these students by the following ways:

Psychological effects

The complete lockdown was a source of depression for the students. This affected the students mentally. It causes anxiety and restlessness in the students. They were mentally disturbed. Because all the universities were closed, it was complicated for them to complete their degrees. They could not destroy their future. Hence they headed toward the online resources for their education. And these online gadgets increased the stress level of the students.

Financial effects:

When the world switched to online resources, not all students could afford them. The financial career of all the students was not the same. We also think that everyone can have a gadget and an internet connection nowadays. Still, there are some people living in the rural areas or some students who cannot afford mobiles, computers, laptops, and an internet connection. So it was not easy for all the students to afford the online system for their education.

- **Online education system**

The lockdown transferred the world to the online platform. With the sudden transition from this physical classroom system to the online systems in many parts of the world, some wonder if online learning will continue to be adopted after the pandemic and how such a transition will affect the global education market. And now, the teachers and the students prefer online resources for educational purposes.

- **Effects on eyesight and brain**

As we know, that lockdown caused the students to shift to the online systems. The continuous use of a mobile, computer and laptop screens caused eyesight problems as well as affecting the brains of the students. One discovery that seems to be mentioned everywhere is the "blue light." This is the light emitted by mobile phones, tablets, and laptops, which unfortunately has a negative effect on eye health.

Studies suggest that direct light on the retina, bypassing the pupil and cornea, "may cause macular degeneration." Blue light kills photoreceptive cells in the retina and is thought to affect central vision. Unlike some other cells in your body, these cells cannot regenerate after their death. This means that any harm done to them is permanent. The radiations emitted from the mobile and computer screens are absorbed by the body tissues, and due to the excessive use of these screens, brain tumors are increasing. In addition to this, the continuous use of hand-free for online classes of the students is also not safe. So, this is one of the damage that lockdown has done to our eyes and brains.

- **Schools or universities business**

One of the biggest sources of education is schools, colleges, and universities. The lockdown period locked the doors of these institutions for the students. This greatly affected the

business of these institutions. Many of the students left the schools because they could not afford to sit at home and pay the fees for schools, colleges, and universities. This thing was alarming for the owners of the institutions. Significantly, the owners of private institutions were affected the most because the government was running the government institutions. Although the government supported the private institutions, but the support was not enough for all the institutions of the country (Arora, 2020). Their business was ruined. It was a big loss for them. Many private schools were running in poor areas. They were completely closed as all the students were leaving. The owners of the institutions suffered a lot because they did not receive the fees from the student. This ruined business caused stress and depression in people of the schools, colleges, and institutions.

- **Canteen and bookshop business**

Along with the closure of the schools, people hired at the canteen and bookshops of the educational institutions lost their jobs as there were no students in the schools, so there were no things to be sold. In addition to this, the garments factory that designed the uniforms of school also had a significant loss. So the school was not in a condition to support the people hired at the canteens and bookshops. In such a case, they had to leave. Moreover, there are many street vendors outside the schools, colleges, and universities who sell the eatables—this led to the unemployment of these people. As a result of the lockdown and closure of educational institutions, they also suffered a lot (Arora, 2020).

- **Writing ability of students**

As the students shifted to the online systems, they had less opportunity to write their tasks. Especially the junior students, who need a lot of writing practice for their work, the lockdown demolished the writing abilities of students. Students became lethargic, and they preferred everything digital so, this affected the writing practice of the students. By this, the writing speed was also affected because when the student went to the schools regularly, they had to write a lot, and this created their speed of writing. But during the lockdown, when the kids were at home, they wrote very little (Arora, 2020).

- **Familiarity with the online resources and enhancement of knowledge**

A positive impact of lockdown during COVID-19 was that it made the students familiar with the online applications and gadgets. It gave them the opportunity to enhance their knowledge about everything. For instance, if the students had any difficulty in their study-related task, they could easily search all the information about the respective topic by using the internet. As the world has become a global village and most of the work is done online these days,

students must have some know-how of the online resources that can help in their educational purposes and enhance their knowledge in different fields.

There are many online websites that offer students with excellent knowledge about their academic work. Many youtube channels provide the students with the best lectures through which they can better understand their topic. In addition to this, the visual images help a child to understand the concept with more strength. Students can search their biology, physics, and chemistry information through images and this visual representation of the topic proves to be a good source for their concept building. So, lockdown granted the students with this opportunity (Arora, 2020).

- **Decreased tests conductivity and learning habit**

Due to the lockdown, the students were confined at homes. Although some institutions started their online classes, but not all the schools and colleges offered online classes. This reduced the test conductivity. When students attempt the tests at school, they develop a good habit of learning and writing. The evaluation process itself helps the students to develop critical thinking and analytical skills. But during the lockdown, the students' learning habit was spoiled. As no tests were conducted, the students could not give the practice tests of what they had learned. So this caused a decrease in the learning, especially the cramming habit of the students.

- **Increased merit of board examination**

The conductivity of exams during lockdown imposed the worst effects on the students. Some universities conducted online exams, and most of the students had not the experience with online examinations. In the case of secondary and higher secondary board examination, the exams for half subjects were conducted whereas the marks for the rest half subject were allotted by different criteria. This actually caused a lot of injustice in the results of students. Some students scored extremely good marks, and some were at a shallow level. Many students scored full marks. In this way, merit was increased (Arora, 2020).

Many colleges and universities had their closing merits and very high marks. So, the rest of the students faced difficulties. Moreover, the medical entrance exam (MDCAT) was conducted on tablets, and many students hadn't had this experience before. This was also a complicated thing for the students. Many students had come from rural areas. Some of them did not know how to use the gadget. Some students had their 100 percent preparation, but they had no experience of attempting their test on the gadget. This created a situation that some students got full marks, and some suffered a lot. This also increased the merit of medical universities, and the rest of the students faced difficulty in their admission (Arora, 2020).

Problem and Solution

No one can say when countries go back into the lockdown again; there are still lockdowns in some regions, and with the severe spread of omicron, America is already going into a soft lockdown. These lockdowns are going to cause several interruptions for the student's learning process. The primary issues that pop up are the disruptions in the internal assessment of the examination. (Burgess, 2020), replacement, cancellation, or postponement of exams, and public assessment that leads to the qualification or graduation of a student.

It has delayed one year from the young students' and aspirants' careers, and in many regions, students are given marks on the estimated calculation from their historical marks. Students are having low marks, but a high potential of scoring higher in college would still attain average marks. To overcome the lockdowns issue without the loss in learning, schools or universities need to invest resources in the online portals and assessment programs which will require training programs for the teachers or instructors about how to assess their class and how to set up the class curriculum.

Moreover, schools and colleges should postpone the assessment in case of sudden lockdown rather than skipping internal assessment. Additionally, individuals need to go for a walk near their houses or inside their house, which will provide their bodies with the essential physical activity that they miss by not going to school. However, there should be new policies about their final assessment for the new graduates. These policies might focus on the industrial requirements for the new pass out students (Arora, 2020).

Reference:

1. Arora, A. K., and Srinivasan, R. (2020). Impact of pandemic COVID-19 on the teaching–learning process: A study of higher education teachers. *Prabandhan: Indian journal of management*, 13(4), 43-56.
2. Kapasia, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., Barman, B., Das, P., and Chouhan, P. (2020). Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India. *Children and Youth Services Review*, 116, 105194. <https://doi.org/10.1016/j.chilyouth.2020.105194>
3. Simon Burgess, H. H. (2020). Schools, skills, and learning: The impact of COVID-19 on education. Retrieved from VOXeu: <https://voxeu.org/article/impact-covid-19-education>

UTILITY OF SPIRULINA AS PROTEIN SOURCE AND IMMUNOBOOSTER IN COVID PERIOD

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Abstract:

Spirulina is a photosynthetic filamentous spiral shaped blue green algae (Cyanobacterium) known for containing highest amounts of protein in the universe. *Spirulina* is highly useful as it has large content of highly digestive proteins, various amino acids, vitamins, beta carotene, Phycocyanin, minerals, essential fatty acids, pigments and polysaccharides. Tribal people of America, Mexico and some countries of Africa exploited this alga as food. Use of *Spirulina* as food supplement resulted in enhancement of the yellow pigment in the skin and yolk in poultry and flamingos, and for growth acceleration, sexual maturation and increase in fertility of cattle. Phenolic acid, taceferal and beta carotene component of *Spirulina* have shown antioxidant properties. It is proved in recent researches that *Spirulina* and its extract are effectively used as anticancer, antiviral and chronic inflammatory conditions. Proper use of *Spirulina platensis* increases the immunity in fish, chickens, humans and other mammals against various types of infections. *Spirulina sulfolipids* have also been effective against HIV. *Spirulina* also enhances the body's ability to generate new blood cells, bone marrow and stem cells, macrophagus, T-cells, natural killer cells, spleen and thymous gland. As of now, all sources of Veg and Non-Veg proteins are unable to fulfill the total demand of protein around the globe including India. According to a study, approximately 33% population across the world is suffering from several disorders associated with protein energy malnutrition. Now days, entire world including India is suffering from Covid-19, which is directly related to immunity. It is quite proven that dietary protein is very important for our immunity. This is now also a proven fact that Covid-19 entraps only the people that have weak immunity. Thus, *Spirulina* can be used as protein diet and Immunobooster. The present study is an effort to highlight this very usage of spirulina as protein source.

Keywords: Protein source, *Spirulina*, blue green algae, Immunobooster, Covid-19.

Introduction:

Spirulina is known as a gift from nature to humankind, and it is considered to be a superfood to humankind. It is a photosynthetic filamentous microalga. Spirulina has also been consumed as a food supplement due to the fact that it has significantly rich micro and macronutrient content. Some people perceive it as not a safe thing to consume, but it is a healthy thing with a smooth but weak cell wall that allows it to be easily digested either by humans or by animals. “Spirulina represents a biomass of cyanobacteria (blue-green algae) that can be consumed by humans and other animals” (Mathur, 2018).

It has valuable health benefits by having protein, vitamins, minerals, β -carotene, and fatty acids. Moreover, NASA has stated that Spirulina is not a food supplement that does not provide the human body with anything but a boost, but only 1 kilogram of Spirulina has the nutritional value of 1000 kilograms of natural fruits and vegetables. It is studied that Spirulina has two distinct species named *Arthrospira platensis* and *Arthrospira maxima*. This paper will include the benefits of Spirulina for humans and animals alike, nutritional facts per 100g, why it is known as the food for the future, Anti-Viral Aqueous extracts of Spirulina, its uses for athletes, and its work as a shield against several diseases as well as immunobooster against diseases.

Benefits of spirulina

World health organization, also known as WHO, declared Spirulina as the food for the future in 1992 because of its properties which can redress malnutrition, particularly in children. Other than being considered the best food supplement in the world, it gained immense popularity for the presence of pigments and secondary metabolites. Its Pharmacognosic properties make it unique because it includes “immuno-protective, anticancer, antidiabetic, antiviral, anti-obesity” health properties that no other supplement has, and it is found that Spirulina is the oldest life found on the earth.

Health benefits

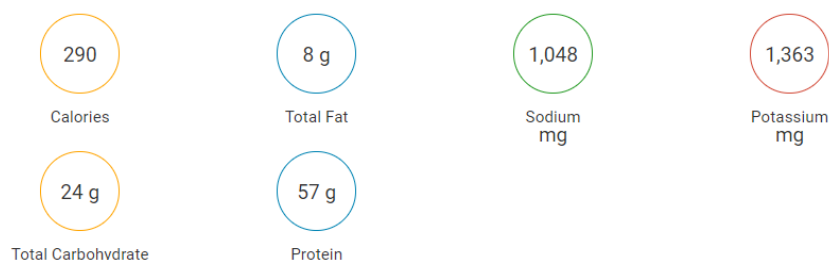
It is the most nutritionally concentrated and compact whole food with significantly higher properties of drastically reducing the risk of cancer, and several other chronic diseases and, most importantly, to prevent deadly viruses like HIV/AIDs. However, it also helps in preventing cataract formation in the eyes. The nutritional values of Spirulina are explained below:

Nutritional values

Spirulina is used after it is dried, and it contains 5% water, 8% carbohydrates, and an average of 62% of protein which is the same amount of protein found in whey protein. Besides being rich in protein, it also contains all potent amino acids required in the human body. One

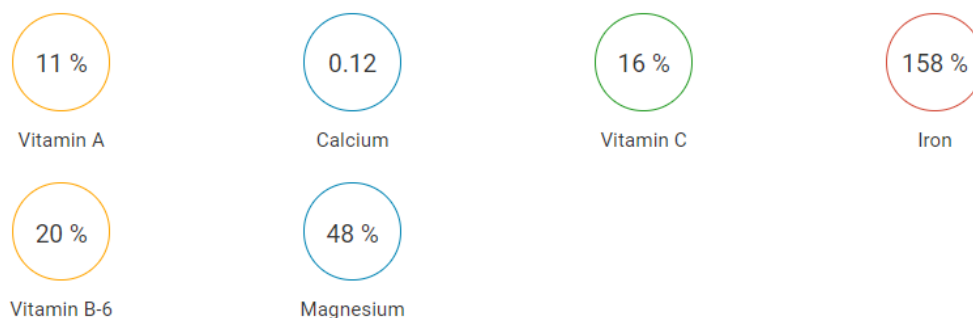
hundred grams of Spirulina contains more rich sources for the daily value required of numerous essential nutrients.

Nutritional facts Per 100 grams



Mainly, it includes several vitamins including, “Vitamin A equiv., Beta-Carotene, Lutein Zeaxanthin, Riboflavin (B2), Thiamine (B1), Niacin (B3), Pantothenic acid (B5), Vitamin B6, Folate (B9), Vitamin B12, Choline, Vitamin C, Vitamin D, Vitamin E, Vitamin K and dietary minerals, such as; Calcium, Iron, Magnesium, Manganese, Phosphorus, Potassium, Sodium, Zinc” (Capelli and Cysewski, 2010). The following are the nutritional values in Spirulina:

Vitamins and Minerals



Fight allergies

There are millions of people in the world with many kinds of allergies; some is allergic to dust, pollen, dander, dry fruits, lactose intolerance, which resulted in several other symptoms of allergies such as stuffy nose, itchy throats, and watery eyes. Animal studies stated that allergies are caused by histamine, which a chemical is found in the body cells of humans and animals alike. It causes several symptoms of allergies, such as sneezing, a watery nose, and eyes. It means that when someone is allergic to a particular thing or substance, their immune system believes that that specific substance is harmful to the body even though it is perfectly fine to consume or use (Kids Health, 2021). Histamine is the substance that is responsible for symptoms of allergic rhinitis. A study by Belay *et al.* (1993) shows that consuming Spirulina improved the symptoms of allergies like sneezing, itching, and nasal congestion.

Heavy Metal detoxification, particularly arsenic

Chronic arsenic toxicity has emerged as a global problem, and according to WHO, the US is the primary nation that is severely affected by chronic arsenic. Its initially associated with abdominal pain, and it is even more severe in the far eastern regions like India, Bangladesh, and Taiwan because of the consumption of impure water, which has a high level of arsenic in the drinking water. It is associated with severe abdominal pain, vomiting, nausea, abdominal pain, encephalopathy, and neuropathy, is also linked to chronic arsenic toxicity. However, consuming Spirulina decreased 47% of arsenic in their bodies with the consumption of Spirulina extract combined with zinc. It is also extremely high in chlorophyll, helping in removing toxins from blood hence strengthening the human immune system.

Lowers blood pressure

Pigment phycocyanin which is found in Spirulina has antihypertensive effects. It means that it is potent against blood pressure, thus, reducing the blood pressure. It is “discovered that Japanese researchers claim this is because consuming blue-green algae reverses endothelial dysfunction in metabolic syndrome” (Lybrate, 2020).

Lowers cholesterol, blood pressure, and cancer risk

Spirulina, because of its nutritional properties, can help lower blood cholesterol levels and prevent atherosclerosis. An article published in the Journal of Nutritional Science and Vitaminology in 2010 shows research in which they changed the diet of some rabbits to high cholesterol for precisely four weeks. Then later next week, the same diet was fed to the same rabbits, but this time they added about 1% and 5% of the Spirulina for the next eight weeks.

The finding of this study had shocking results; it shows that the rabbits who were fed 1% of Spirulina had 26% lower LDLL or simply known as bad cholesterol, and a 45% of reduction in the rabbits who were fed 5% of Spirulina. Serum triglycerides and total cholesterol also immensely decrease. Other than reducing cholesterol, it fights against liver disease because Spirulina functions as an antioxidant, thus, help in eliminating free radicals, which leads to preventing severe liver damage and harmful chelating metals.

Additionally, it also lowers the risk of cancer; a report published by Mayland medical center states that Spirulina lowers the risk of cancer. Protein is essential for muscles to function appropriately, and Spirulina is a plethora of protein in a minimum of quantity. Multiple animals and test-tube studies suggest that there is a significant increase in the production of antibodies and infection-fighting proteins with the consumption of Spirulina which exceptionally improves the human immune system hence resulting in lowering the risk of

cancer and other chronic diseases. Spirulina has also been tested on the pancreatic cells of humans, and a study found that experimental therapeutics immensely decreased the proliferation of pancreatic cancer cells.

It is proved that consuming Spirulina in the regular diet can help to prevent the development of various types of cancers. It also lowers blood sugar levels, alleviates Sinus issues, and helps in weight loss and bodybuilding because of high protein.

Other uses of spirulina

Spirulina has been cultivated across the globe for several decades and used as a supplementary dietary and whole food as well. It can be consumed in the form of tablets, powder form, or in the form of flakes. Spirulina has significant importance in the aquaculture and poultry industry because it is used as a feed supplement for the growth of chicken and fisheries. NASA has also used this supplement for the sake of dietary support in long-term space living and for the Mars mission.

Side effects and allergies of spirulina

With so many good impacts of Spirulina as a food supplement, there must be some side effects and allergies. One of the most critical factors behind any side-effect of Spirulina is the purity of the Spirulina consumed by a person. Suppose it is not the highest quality, then it is wholly given that it would have a significantly harmful effect on human or animal health. Notably, like anything that comes from the sea, be sure only to purchase blue-green algae that are free from contamination.

Contaminated Spirulina can cause what the real Spirulina can cure. According to WebMD, if the Spirulina is contaminated, it can pose a threat for several diseases such as liver damage, stomach pain, rapid heartbeat, severe weakness in the body, vomiting, thirst, and even leads to death. It is also suggested that pregnant women and children should not eat any kind of algae because of several deadly repercussions.

Utility of spirulina as a protein dietary source

Ever increasing population and decreasing agricultural land area in India has been a reason of great concern. Due to this, optional food items are being searched. Thus, Spirulina can prove as one of the best sources of protein. India is world's largest pulses producer, world's 23% pulses are produced in India. However, even then not everyone gets pulses in his plate of food.

It is believed that according to the weight of an individual, about 4g/kg of protein is necessary for a healthy diet, which should be taken either in the form of milk, pulses, eggs and other types of food items. In present situation in India, it is not possible at any cost. Hence,

Spirulina can be considered as the vital source of protein for health. Through large scale culture, the need of about 140 crores protein deficient population can be fulfilled.

Spirulina as immunobooster and Covid-19

Protein is used as macronutrient for our body to stay healthy. It is required in large quantities by our body to keep functioning properly. For the production of new cells, repairing of old cells and fluid balance in the body, protein is the most important nutrient. Protein is also important for keeping the immune system of our body strong. It also helps in producing antibodies, and sufficient protein intake prevents us from a number of diseases.

During Covid-19 period, it is observed that most of the deceased were either suffering from severe diseases or were deficient of protein. Hence, Spirulina can be used not only to fulfill the needs of protein intake, it is also useful in maintaining strong immunity levels and helps in fighting diseases that are caused by protein deficiency. It also builds our body strong to find the Delta and Omicron variants of the Corona virus.

Agriculture in coastal areas

Crops are grown on fertile soil, and there have been several fertilizers and chemicals invented to increase the fertility of crops. However, in the coastal areas where crops can not grow, Spirulina has significant potential for being the first crop in the coastal and alkaline region. It requires specific detailed cultivation for the crop of Spirulina. It requires a tank, depending on the quantity to be harvested, dry Spirulina per square meter of the tank. “The culture medium is made of water, and the food for Spirulina is Sodium bicarbonate (if direct CO² is not available) Magnesium sulfate, Potassium nitrate, Citric acid, Common salt, Urea, Calcium chloride, Iron sulfate, Ammonium sulfate” (Lybrate, 2020). Besides water and food, light is another essential factor that requires in a sufficient amount. According to the calculation from Lybrate, (2020), “Spirulina will only start growing when the temperature is over 52 – 59°F (14 – 15°C) and have an appreciable growth over 64°F (18°C). The optimum temperature for maximal growth is 95°- 98°F (35-37°C)” (Lybrate, 2020).

Conclusion:

A number of researches have concluded that Spirulina is one of the best Veg and Non-veg protein sources that are known to us till today. As about one third of the world's population is suffering from one or another type of disorders caused due to protein deficiency, Spirulina can serve as the best source of protein as it is proven that it also helps in fighting Covid-19 caused by Corona virus and its variants, because Corona virus targets the immune system of

our body. In this case, strong immunity is the best prevention of Covid-19 which can be attained by sufficient protein intake in the form of Spirulina. In a country like India, which owns only 2.42% of land in the world while being a home to 18% of world's population, problems of protein deficiency can be very well fought with Spirulina as a source of protein in our food which can be a boon for us.

References:

1. Belay, A., Ota, Y., Miyakawa, K., & Shimamatsu, H. (1993). Current knowledge on potential health benefits of Spirulina. *Journal of Applied Phycology*, 5(2), 235–241. <https://doi.org/10.1007/bf00004024>
2. Capelli, B., & Cysewski, G. R. (2010). Potential health benefits of spirulina microalgae*. *Nutrafoods*, 9(2), 19–26. <https://doi.org/10.1007/bf03223332>
3. Mathur, M. (2018). Bioactive molecules of Spirulina: A food supplement. *Reference Series in Phytochemistry*, 1-22. https://doi.org/10.1007/978-3-319-54528-8_97-1
4. Kids Health. (2021). Definition: Histamine (for parents) - Nemours kidshealth. KidsHealth. Retrieved January 4, 2022, from <https://kidshealth.org/en/parents/histamine.html>
5. Lybrate. (2020, August 20). Spirulina benefits and its side effects. Lybrate. Retrieved January 4, 2022, from <https://www.lybrate.com/topic/spirulina-benefits-and-side-effects#!>

DIETARY GUIDELINES TO COMBAT POST COVID COMPLICATIONS

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Introduction:

COVID-19 is the respiratory illness caused by a deadly coronavirus called SARS-CoV-2. In humans they're typically spread via airborne droplets of fluid produced by infected individuals. Most people will have mild symptoms and get better on their own. Many Covid-19 infected people are asymptomatic, some suffer with common cold and experience mild disease symptom. Adults have the highest power to defend the infection due to their strong immune system but chances of disease transmission are also high in them. (Hafeez *et al*, 2020). This virus has major impact on breakdown of immunity, so maintaining immunity is a serious concern in this condition. Covid-19 has high risk of mutation (Guo *et al*, 2020). Vaccines have been developed to combat all the strains of corona virus.

It has been seen that majority of Covid patients recover in 2-4 weeks. However, in some patients, the Covid symptoms persist beyond four weeks which known as Acute Post covid syndrome. If the symptoms remain even after 12 months, it is known as Post covid syndrome. Most common post-covid-19 symptoms are like difficulty in breathing, weakness, fatigue, palpitation, high sweating, joint and muscle pain, loss of taste and smell and sleep disturbances. There are some psychological symptoms of post-covid, which are depression and anxiety. The reasons behind post-covid-19 symptoms are mainly virus-related. Corona virus affects not only our lungs, but can affect all organs including liver, brain and kidney. So, our body takes time to recover from the infection and our immune system becomes hyperactive due to the entry of the virus. In the fight between the body and the virus, various chemicals are released which cause inflammation in our organs. In some patients, the inflammation persists for longer duration. Again some common post-covid syndromes are like Thromboembolism, which is the most feared post-covid-19 condition. It is the obstruction of a blood vessel by blood clots. It can even result in heart attack or stroke, depending on where the clots occur. Post covid syndrome includes high D-Dimer levels which include severe to serious patients and those with high D-Dimer levels may require therapeutic anti-coagulants during hospitalization as well as in the

post-covid-19 period for 2-4 weeks. Pulmonary embolism is a condition in which early signs of blood clot in lungs are shown. Symptoms include difficulty in breathing and fall in blood pressure. Such patients need to be hospitalized immediately and evaluated. Another major post-COVID-19 infection is chronic cough or post infection coughs. Dry cough can persist after recovery due to infection in our airways and resultant inflammation (Bante and Khoshla, 2021).

Post-Covid-19 symptom first gained widespread recognition among social support groups and later in scientific and medical communities. This illness is poorly understood as it affects Covid-19 survivors at all levels of disease severity, even younger adults, children, and those not hospitalized. Post-Covid symptoms may be driven by long-term tissue damage in lung, brain, and heart and pathological inflammation in from viral persistence, immune dysregulation, and autoimmunity (Young, 2021). Preliminary evidence suggests that personalized rehabilitation training may help certain long Covid cases, therapeutic drugs repurposed from other similar conditions, such as myalgic encephalomyelitis or chronic fatigue syndrome, postural orthostatic tachycardia syndrome, and mast cell activation syndrome, also hold potential. In sum, this review hopes to provide the current understanding of what is known about long COVID (Young, 2021). Therapeutic diet is given to the patient suffering from any type of disease (Tewari, 2019). The most important pharma-therapeutic foods includes garlic, turmeric, neem leaves, tulsi leaves, green tea, high anti-oxidant fruits and vegetables and many probiotics foods.

According to nutritionist, Khosla, 2021, 94% of people who died due to Covid-19 had succumbed because of co-morbidities, which has a common thread of inflammation. Hence, our diet should be anti-inflammatory and we need to eat right, keep our body fit and keep our immune system intact. We should have sufficiency of Proteins in diet, we should take Zinc, Vitamin C and Vitamin D, Vitamin B Complex, these should be taken judiciously and should not be overdone with, and these supplements play an important role in the body's regeneration. We should take protective food like anti-oxidants, anti-inflammatory food, cold-pressed oils, turmeric, ginger, tea and so on. These food help in defense mechanism of the body and contain phyto-nutrients and fibres, which are important for the body's recovery. Hence, protective food should also be taken adequately. The nutritionist also mentioned about the importance of drinking enough water. Mental health is also related to our gut which has a profound effect on our body that scientists are now calling it "second brain". Hence, if our food is not good for body, it also disturbs our mood, apart from our immunity. So we should maintain a healthy diet, take seasonal food and organic food. So below we have given some suggested food items which we can take to recover from post Covid symptoms and post Covid syndromes.

Energy based food:

Fruits and vegetables

Dietary uptake of various energy rich fruit and vegetables can aid in combating global health issue such as Covid-19. Nutrition obtained from these fruits and vegetables enhances immunity. Following table consists of fruits and vegetables that boosts immunity-

Table 1: Immune boosting fruits and vegetables

Sr. No.	Name	Scientific Name	Benefits
1	Almond	<i>Prunus amygdalus</i>	<ul style="list-style-type: none"> • Reduction of heart disease • Reduction of weight [9]
2	Pomgranate	<i>Punica granatum L</i>	<ul style="list-style-type: none"> • Antiatherogenic • Antihypertensive • anti-inflammatory effects [50]
3	Papaya	<i>Carica papaya L</i>	<ul style="list-style-type: none"> • anticancer activity • anti-amoebic activity • anti-ulcer activity [13]
4	Mango	<i>Mangifera indica</i>	<ul style="list-style-type: none"> • anti-inflammatory effect • anti-cancer activity [29]
5	Star fruit	<i>Averrhoa carambola L</i>	<ul style="list-style-type: none"> • Anti-inflammatory • anti-microbial [30]
6	Banana	<i>Musa Paradisiaca</i>	<ul style="list-style-type: none"> • Anti diabetic • Anti-inflammatory [33]
7	Red Dragon Fruit	<i>Hylocereus polyhizus</i>	<ul style="list-style-type: none"> • Antiviral activity • Anti diabetic • antimicrobial activity[28]
8	Guava	<i>Psidium guajava L</i>	<ul style="list-style-type: none"> • Antihypertensive • Hypolipidemic • Antacid and Ulcer Protectant Activity [25]
9	Cauliflower	<i>Brassica oleracea</i>	<ul style="list-style-type: none"> • Goitrogenic effect • Anti-inflammatory • Antioxidant • Anticancer activity [39]
10	Basil	<i>Ocimum sanctum L.</i>	<ul style="list-style-type: none"> • Anti oxidant • Anticancer • Anti diabetic [10]

11	Moringa	<i>Moringa oleifera</i> Lam.	<ul style="list-style-type: none"> • Anti-inflammatory • Antioxidant • Hepato and Kidney Protective Properties [27]
12	Red Spinach	<i>Amaranthus gangeticus</i> L.	<ul style="list-style-type: none"> • Anticancer activity • Antimicrobial [4]
13	Tomato	<i>Solanum lycopersicum</i> L.	<ul style="list-style-type: none"> • antiaggregatory activity [33]
14	Bean	<i>Phaseolus vulgaris</i> Linn	<ul style="list-style-type: none"> • Anti-obesity effect • Antidiabetic [44]
15	Chili	<i>Capsicum annum</i> L.	<ul style="list-style-type: none"> • Immunosuppressant and Memory Enhancing Activity • Antiangiogenic and Anti-Neoplastic Effects [40]

Plant based food:

The term, plant-based, is wider as it focuses on consumption of foods mainly from plants (fruit, vegetables, nuts, oil, whole grains, and legumes), but it can include small quantities of food from animal origin such as milk, eggs, meat and fish. Those who follow a plant-based diet might choose to substitute animal products for vegetable options, without permanent restriction of animal foods. A different report presents the higher environmental impact of meat from ruminants compared to grains, fruit and vegetables. Plant-based proteins are the most common ingredients used to prepare meat alternatives. Soy, wheat gluten and mushrooms are the main ingredients used. Plant-based milk alternatives are water-soluble extracts from legumes (chickpeas, soybeans), cereals (oats, rice), pseudo-cereals (quinoa, amarantha), nuts (almonds, cashew nuts, hazelnuts, walnuts, coconut). Microalgae are microscopic algae rich in protein, carbohydrates, lipids and other bioactive compounds. Microalgae-derived proteins have complete essential amino acids profiles and their protein content is higher than that of conventional sources, such as meat, poultry and dairy products (Alcorta et al., 2021). The amazing concept about adopting a whole Food Plant Based diet is that disease can be prevented, treated and even cured. Plant based diets are focused on fruit, vegetables, nuts, whole grains and legumes, in addition to unsaturated plant oils and modest amounts of meat and dairy. Plant-based eating was considered a vegan dietary pattern and the most frequently consumed plant-based proteins were whole grains (Estell *et al.*, 2021). A well-balanced plant-based diet acts as a major driving force for consumers who loves to maintain all-round health by meeting nutritional acceptability to prevent many health risks and post Covid symptoms.

Antioxidant rich food

Role of probiotics in improving the immune system:

Probiotics can be used as an adjunctive treatment against COVID-19 as it boost the immune system, enhance the mucosal barrier function, inhibit bacterial adherence and invasion capacity in the intestinal epithelium by being in a direct antagonism with pathogenic bacteria (Stavropoulou and Bezirtzoglou, 2020).

Table 2: Immune boosting effects and mechanism of probiotics (Ashaolu, 2020)

Probiotic organism	Immune boosting functions	Mechanism
Lactobacillus plantarum	Detoxify toxins	Binding via surface Structures
Lactobacillus kefir	Detoxify toxins	Adsorption and biotransformation
Lactobacillus helveticus	Detoxify toxins	Binding via surface Structures
Bacillus licheniformis	Detoxify toxins	Enzymic degradation
Saccharomyces cerevisiae	Detoxify toxins	Binding via surface Structures
Lactococcus lactis	Detoxify toxins	Binding via surface Structures
Streptomyces cacaoi	Detoxify toxins	Enzymic degradation
Several other Lactobacillus strains	<ul style="list-style-type: none"> • Inhibit Th2 activity • Improve oral tolerance • Reduce Inflammation • Produce IgA • Modulate anti-viral activity 	Stimulate activated T cells death Induce Tregs Weaken pro-inflammatory cytokines and chemokines by down-regulation of TLR-signals Up-regulate expression of pIgR Reduce A20 and improve IRF-3, IFN-b, MxA, Rnase
Several other Bifidobacterium strains	<ul style="list-style-type: none"> • Protect from enteropathogenic infection • Inhibit allergy • Reduce inflammation 	Produce acetate and improve intestinal defence with epithelial cells Suppress Th2 Chemokines Inhibit IL-17

Table 3: Microbial profile associated with different cereal based fermented foods (Rhee *et al.*, 2011)

Item	Raw materials	Microorganism involved
Idli	Rice (<i>Oryza sativum</i>) and black gram dhal (<i>Phaseolus mungo</i>)(4:1)	<i>Leuconostoc mesenteroides</i> , <i>Lactobacillus delbrueckii</i> , <i>Lactobacillus fermenti</i> , <i>Lactobacillus lactis</i> , <i>Streptococcus faecalis</i> , <i>Saccharomyces cerevisiae</i> , <i>Pediococcus cerevisiae</i>
Dosa	Rice (<i>O. sativum</i>) and black gram dhal (<i>P. mungo</i>) (2:1)	<i>L. mesenteroides</i> , <i>S. faecalis</i> , <i>L. fermentum</i> , <i>Bacillus amyloliquefaciens</i> , <i>L. lactis</i> , <i>L. delbrueckii</i> , and <i>Lactobacillus plantarum</i> , <i>S. cerevisiae</i> ,
Dhokla	Rice (<i>O. sativum</i>) and black gram dhal (<i>P. mungo</i>) (4:1)	<i>L. fermentum</i> , <i>L. mesenteroides</i>
Uttapam	Rice (<i>O. sativum</i>) and urad dahl (<i>Vigna mungo</i>) (3:1)	<i>Lactobacillus pentosus</i> and <i>L. plantarum</i>
Selroti	Rice (<i>O. sativum</i>) and wheatflour (<i>Triticum aestivum</i>) (3:1)	<i>Lactic acid bacteria like L. mesenteroides</i> , <i>Enterococcus faecium</i> , <i>Pediococcus entosaceus</i> , and <i>Lactobacillus curvatus</i> , <i>S. cerevisiae</i>
Ambeli	Rice (<i>O. sativum</i>) and ragi (<i>Eleusine coracana</i>)	<i>L. mesenteroides</i> , <i>L. fermentum</i> , and <i>S. faecalis</i>
Sour rice	Rice (<i>O. sativum</i>)	<i>Lactic acid bacteria like Lactobacillus bulgaricus</i> , <i>Lactobacillus casei</i> , <i>S. faecalis</i> , <i>Streptococcus thermophilus</i>

Table 4: Microbial profile associated with different vegetable based fermented foods (Garcia- Burgos *et al.*, 2020)

Item	Raw materials	Microorganism involved
Kimchi	Korean cabbage, radish, various vegetables, salt	<i>Leuconostoc. mesenteroides</i> <i>Lactobacillus. brevis</i> , <i>Lactobacillus. Plantarum</i>
Dhamuoi	cabbage, vegetable	<i>Leuconostoc. mesenteroides</i> <i>Lactobacillus. Plantarum</i>
Dakguadong	mustard leaf	<i>Lactobacillus. Plantarum</i>

Table 5: Microbial profile associated with different dairy based products

Item	Raw materials	Microorganism involved
Yoghurt	Milk	Symbiotic cultures of <i>Streptococcus thermophilus</i> and <i>Lactobacillus delbrueckii</i> subsp.bulgaricus
Kefir	Kefir grains, milk	Lactobacillus kefir, species of the genus Leuconostoc, Lactococcus and Acetobacter

As we know that diet plays a key role on the gut microbiota and can influence gut microbial richness and diversity. In the developing nation, modern diets have been transformed from diets high in fermented foods, fermented vegetables and fibre rich foods, phytochemical rich fruits, polysaccharides and lean meats to the one that is low in fibres and high in processed and convenience ready-to eat (RTE)foods, refined sugar and hydrogenated fats (Jew *et al.*, 2009). Hence, one key approach during COVID-19 pandemic is to strengthen intestinal barrier against pathogens, increase intestinal motility and lower a pro-inflammatory state (Trottein and Sokol, 2020) by adopting a more diversified diet with increase in fibre and probiotic-rich foods. Thereby, a diversified diet includes fermented dairy products, fermented cereal products, fermented soybeans, fermented vegetables and fermented dairy based products that contain naturally occurred probiotics like Lactobacillus, Bifidobacteria, Leuconostoc, Streptococcus, Saccharomyces spp. Considering the synergetic effect of microbial-diet-host interaction, food diversity is important to maintain immunity by creating a nurturing environment for microbiota cultivation (De Filippo *et. al.*, 2010).

Role of Micronutrients in boosting immunity:

1. Zinc (Zn): It has cofactor, signaling molecule properties. It has anti-inflammatory and antioxidant functions (Read *et al.*, 2019)
2. Vitamin D: It is a fat soluble vitamin which plays a major role in immunomodulatory, antioxidant and antiviral responses. (Prietl *et al.*, 2013). It decreases the expression of inflammatory cytokines and increases the levels of antioxidant NRF-2 which results in prevention of oxidative stress. (Wimalawansa *et al.*, 2019).
3. Vitamin C: It supports the function of various immune cells and also prevents infection. It also reduces the severity of respiratory infections (Driel *et al.*, 2020). As an antioxidant, it scavenges ROS, prevents lipid peroxidation and oxidative stress (Traber *et al.*, 2011)
4. Curcumin: It has broad spectrum biological actions including antibacterial, antiviral, antifungal, antioxidant and anti-inflammatory activities (Catanzaro *et al.*, 2018). It inhibits the proinflammatory cytokines production (Cho *et al.*, 2007). It has antioxidant effects both by neutralizing free radicals and also enhances the antioxidant enzyme production (Menon *et al.*, 2007).
5. Cinnamaldehyde: It is a dietary phytonutrient, known to possess anti-inflammatory properties (Liao *et al.*, 2008). It is useful in mitigation of SARS-CoV-2 which induces hyper inflammation in the lung.
6. Allicin: Garlic is a plant/herb which is classified under Allium (onion) family. Thiosulfinate in garlic extract which is identified as allicin has anti-inflammatory, anti-oxidant properties. Some of the vericidal activity showing compounds is ajoene, alicin, allyl, methyl thiosulfinate and methyl allyl thiosulfinate. (Galabov *et al.*, 2007).
7. Piperine: Black pepper has many medicinal properties. It possesses strong anti-inflammatory properties and can be repurposed for suppression of hyper inflammation induced during this pandemic situation. It is also a potent antioxidant and prevents against oxidative damage by neutralizing the free radicals, ROS and the hydroxyl radicals (Mittal *et al.*, 2000).
8. Selenium: It is found mainly in corn, garlic, onion, cabbage, broccoli. It suppresses severe inflammation in the tissues such as lungs and intestine (Avery *et al.*, 2018). It also improves the immune system through its non-enzymatic role acting as cofactor for enzymes involved in post translational modifications of proteins.
9. Propolis: It is produced by honeybees and it also have biological properties such as anti-microbial, anti-inflammatory, dermatoprotective, laxative, anti-diabetic, anti-tumor and immunomodulatory activity (Wolska *et al.*, 2019). At higher concentrations, it inhibits lymphoproliferation while at lower concentrations; it causes lymphoproliferation (Forcin,

2007). As a whole, with immunomodulatory and antiviral effects, it can be tried as a prophylactic support against COVID-19.

10. Lactoferrin: It plays a crucial role in preventing the virus entry and replication (Rosa *et al.*, 2017). It exerts immunomodulatory and antioxidant effects by inducing the T-cell activation, suppresses the interleukins levels and downregulate the ferritin (Ishikado *et al.*, 2005).
11. Quercetin: It is a well known antioxidant with anti-inflammatory and antiviral biological properties. It inhibits the viral entry and viral-cell fusion (Wu *et al.*, 2015) and also reduces the expression of proinflammatory cytokines and lung inflammation (Ganesan *et al.*, 2012). Increased ability of estradiol in affecting human genes encoding SARS-CoV-2 targets as compared to testosterone suggesting an explanation of the apparently higher male mortality in this corona pandemic (Glinsky, 2020). Table 1 and 2 suggests the nutritional interventions and diets to defend COVID-19 (Alam *et al.*, 2021).

Table 6: Nutritional interventions strategies to defend COVID-19

Nutrient Type	Applied Nutrients	Mode of Actions against COVID-19
Micronutrient	Vitamin C	Inhibit cytokine storm by reducing inflammation rate and also reduces respiratory tract infection
Micronutrient	Vitamin D	Reduces mortality rate and suppress the cytokine storm in human body
Micronutrient	Zinc	Antiviral activities and modulation of immune response
Micronutrient	Magnesium, Vitamin B12, Vitamin D	Reduces patients demands for oxygen support and intensive care
Micronutrient	High dose oral and/or IV Glutathione	Reduces respiratory diseases
Micronutrient	Copper, Iodine, Selenium, Zinc	Immune enhancers towards SARS CoV-2

Table 7: Nutritional diet for different age groups to fight against COVID-19 (Ray *et al.*, 2016)

Target groups	Complications	Recommendations	Health benefits
Pregnant and lactating women	Iron, zinc, calcium, Vitamin A, D and folic acid deficient	Protein, Zn, Ca and folate rich food. No supplementation for infants	Reduces infection by increasing the immune response
Puberty	Hormonal changes during fetus development which occur with sexual maturation	Improved family food behaviors	Induces long term immunity
Adults	Causes viral infection due to hormonal imbalance and non-communicable disease	Vitamin D supplement	Reduces anxiety and depression
Old	Zinc depletion	Zn supplement	Blocks replication of SARS CoV-2
	Low oxygen level	Iron rich food, Vitamin B6 rich food	Assists to level up oxygen content in the body
	Low Vitamin D level	Omega-3, Vitamin D, E, Ca, Mg, folate supplements	Reduce death rate as it mitigates age related complications
	Dietary fibers	Soluble fibres such as in oats, barley, apples, citrus fruits, potatoes	Mitigate constipation and shows antiviral activities
	Vitamin deficiency	Vitamin C, E, D3 supplements	Treats SARS patients to stimulate immunity
	Abnormal Vitamin E and D level causes infections	Vitamin D, C, Zn supplements	Prevents common cold

Conclusion:

Therefore from the above discussion we can conclude that we have multiple scientifically proven dietary options to combat Post-Covid 19 syndrome which can help us to regain our normal healthy body and mind.

References:

1. Alcorta, A.; Porta, A.; Tarrega, A.; Alvarez, M.D. and Vaquero, M.P, 2021. Foods for Plant-Based Diets: Challenges and Innovations. *Foods.*, 10: 293.
2. Ashaolu T.J., 2020. Immune boosting functional foods and their mechanisms: A critical evaluation of probiotics and prebiotics. *Biomedicine and Pharmacotherapy.*, 130:110625.
3. Avery J.C. and Hoffmann PR, 2018. Selenium, Selenoproteins and Immunity. *Nutrients.*, 10(9).
4. Al-Mamun, M. A., Husna, J., Khatun, M., Hasan, R., Kamruzzaman, M., Hoque, K. M., Reza, M. A., and Ferdousi, Z., 2016. Assessment of antioxidant, anticancer and antimicrobial activity of two vegetable species of *Amaranthus* in Bangladesh. *BMC complementary and alternative medicine.*, 16:157.
5. Alam S., Bhuiyan F.R., Emon T.H. and Hassan M. 2021. Review on Prospects of nutritional interventions in the care of COVID-19 patients. *Heliyon.*, 7 (e06285).
6. Bante N. and Khosla I., 2021. Post-COVID symptoms and nutrition. Ministry of Health and Family Welfare, New Delhi.
7. Cantanzaro M., Corisini E., Rosini M., Racchi M. and Lanni C., 2020. Immuno modulators Inspired by Nature: A Review on Curcumin and Echinacea. *Molecules.*
8. Cantanzaro M., Corisini E., Rosini M., Racchi M. and Lanni C., 2020. Immuno modulators Inspired by Nature: A Review on Curcumin and Echinacea. *Molecules.*
9. Chen C.Y., Lapsley K. and Blumberg J., 2006. Perspective A nutrition and health perspective on almonds. *J Sci Food Agric*, 86:2245–2250.
10. Cohen M.M., 2014. Tulsi - *Ocimum sanctum*: A herb for all reasons. *Journal of Ayurveda and integrative medicine*, 5(4): 251–259.
11. Cho J.W., Lee K.S. and Kim C.W., 2007. Curcumin attenuates the expression of IL-1beta, IL-6, and TNF-alpha as well as cyclin E in TNF-alpha-treated Haca T cells; NF-KappaB and MAPKs as potential upstream targets. *Int J Mol Med.*, 19(3):469-74.
12. De Filippo C., Cavalieri D., Di Paola M., Ramazzotti M., Poullet J. B., Massart S., 2010. Impact of diet in shaping gut microbiota revealed by a comparative study in children from Europe and rural Africa. *Proceedings of the National Academy of Sciences.*, 107(33):14691–14696.

13. Devi P.S., Sreeja and Neethu K., 2017. The surprising health benefits of papaya seeds: A review. 6:424-429.
14. Driel M.L., Beller E.M., Thielemans E., Deckx L., Price-Haywood E., Clark J., et al., 2020. Oral vitamin C supplementsto prevent and treat acute upper respirstory tract infections. *Cochrane Databas syst Rev*.
15. Estell M., Hughes J., and Grafenauer S., 2021. Plant Protein and Plant-Based Meat Alternatives: Consumer and Nutrition Professional Attitudes and Perceptions. *Sustainability*., 13:1478.
16. Forcin J.M. and Bankova V., 2007. Propolis and the immune system:a review. *J ethanopharmacol.*, 113(1):1-14.
17. Ganesan S., Faris A.N., Comstock A.T., Wang W., Nanua S. and Hershenson M.B.,et al., 2012. Quercetin inhibiots rhinovirus replication in vitro and in vivo. *Antiviral res.*, 94(3):258-71.
18. García-Burgos, M., Moreno-Fernández J., Alférez, M.J.M., Díaz-Castro, J. and López-Aliaga, I., 2020. New perspectives in fermented dairy products and their health relevance. *Journal of Functional Foods*. 72:104059.
19. Glinsky G.V., 2020. Tripartite Combination of Candidate Pandemic Mitigation Agents: Vitamin D, Quercetin, and Estradiol Manifest Properties of Medicinal Agents for Targeted Mitigation of tge COVID-19 Pandemic Defined by Genomics-Guided Tracing of Sars-Cov-2 Targets in Human Cells. *Biomedicines*.
20. Galabov A.S., 2007. Virucudal agents in the eve of manorapid synergy. *GMS krankenhaushygiene Interdiszip*.
21. Guo Y.R., Cao Q.D., Hong Z.S., Tan Y.Y., Chen S.D., Jin H.J., Tan K.S., Wang D.Y. and Yan Y., 2020. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak—an update on the status. *Military Medical Research*, 7(1):1-0.
22. Hafeez A., Ahmad S., Siddqui S.A., Ahmad M. and Mishra S., 2020. A Review of COVID-19 (Coronavirus Disease-2019) Diagnosis, Treatments and Prevention. *EJMO*., 4(2):116–125.
23. Ishikado A., Imanaka H., Takeuchi T., Harada E. and Makino T., 2005. Lipsomalization of Lactoferrin enhanced it’s anti-inflammatory effects via oral administration. *Biol Pharm Bul.*, 1717-21.
24. Jew S., Abu Mweis S. S. and Jones, P. J., 2009. Evolution of the human diet: Linking our ancestral diet to modern functional foods as a means of chronic disease prevention. *Journal of Medicinal Food*, 12(5): 925–934.
25. Kafle A. and Mohapatra S.S., 2018. A review on medicinal properties of Psidiumguajava.

26. Liao B.C., Hsieh C.W., Liu Y.C., Tzeng T.T., Sun Y.W., Wung B.S., 2008. Cinnamaldehyde inhibits the tumor necrosis factor- α -induced expression of cell adhesion molecules in endothelial cells by suppressing NF- κ B activation: effects upon I κ B and Nrf2. *Toxicol Appl Pharmacol.*, 229(2):161-71.
27. Leone, A., Spada, A., Battezzati, A., Schiraldi, A., Aristil, J., and Bertoli, S., 2015. Cultivation, Genetic, Ethnopharmacology, Phytochemistry and Pharmacology of *Moringaoleifera* Leaves: An Overview. *International journal of molecular sciences*, 16(6):12791–12835.
28. Luu H. and Le T., 2021. Dragon fruit: A review of health benefits and nutrients and its sustainable development under climate changes in Vietnam. *Czech Journal of Food Sciences.*, 39(10):17222.
29. Lauricella, M., Emanuele, S., Calvaruso, G., Giuliano, M., and D'Anneo, A., 2017. Multifaceted Health Benefits of *Mangifera indica* L. (Mango): The Inestimable Value of Orchards Recently Planted in Sicilian Rural Areas. *Nutrients*, 9(5): 525.
30. Muthu, N., Lee, S. Y., Phua, K. K., and Bhore, S. J., 2016. Nutritional, Medicinal and Toxicological Attributes of Star-Fruits (*Averrhoacarambola* L.): A Review. *Bioinformation*, 12(12):420–424.
31. Mittal R. and Gupta R.L., 2000. In Vitro antioxidant activity of piperine. *Methods Find Exp Clin Pharmacol.*, 22(5):271-4.
32. Menon V.P. and Sudheer AR., 2007. Antioxidant and anti-inflammatory properties of Curcumin. *Adv Exp Med Biol.*, 595:105-25.
33. Olas B., 2019. Anti-Aggregatory Potential of Selected Vegetables-Promising Dietary Components for the Prevention and Treatment of Cardiovascular Disease. *Advances in nutrition (Bethesda, Md.)*, 10(2):280–290.
34. Oluwafemi O.O., 2019. Antidiabetic, anti-inflammatory, antibacterial, anti-helminthic, antioxidant and nutritional potential of *Musa paradisiaca*. *Asian Journal of Pharmaceutical and Clinical Research*, 12(10): 9–13.
35. Prietl B, Treiber G, Pieber TR and Amrein K., 2013. Vitamin D and Immune Function. *Nutrients.*, 5(7):2502-21.
36. Read S.A., Obeid S, Ahlenstiel C. and Ahlenstiel G, 2019. The Role of Zinc in Antiviral Immunity. *Adv Nutr.*, 10(4):696–710.
37. Rosa L, Cutone A, Lepanto MS, Paesano R and Valenti P., 2017. Lactoferrin: A Natural Glycoprotein involved in Iron and Inflammatory Homeostasis. *Int J Mol Sci.*, 18(9).

38. Ray. M., Ghosh. K., Singh. S., Mondal K.C., 2016. Folk to functional: An explorative overview of rice-based fermented foods and beverages in India. *Journal of Ethnic Foods*, 5-18.
39. Rhee S.J., Jang-Eun Lee., and Cherl-Ho Lee., 2011. Importance of lactic acid bacteria in Asian fermented foods. *Microbial Cell Factories.*, 10(Suppl 1):S5
40. Sanliar N, and GulerSaban M., 2018. The Benefits of Brassica vegetables in human health. *J Human Health Res.*, 1:104.
41. Stavropoulou E and Bezirtzoglou E., 2020. Probiotics in medicine: a long debate. *Frontiers in Immunology.*, 11, 2192.
42. Trottein, F., and Sokol, H., 2020. Potential causes and consequences of gastrointestinal disorders during a sars-cov-2 infection. *Cell Reports.*, 32(3), 107915.
43. Tewari, S., 2019. Therapeutic diet to control diseases, AkiNik Publications, 1-79.
44. Traber MG, Stevens JF, 2011. Beneficial effects from a mechanistic perspective. *Free Radic Bio Med.*, 51(5):1000-13.
45. Gamboa-Gómez, C. I., Rocha-Guzmán, N. E., Gallegos-Infante, J. A., Moreno-Jiménez, M. R., Vázquez-Cabral, B. D., and González-Laredo, R. F., 2015. Plants with potential use on obesity and its complications. *EXCLI journal*, 14, 809–831.
46. Batiha, G. E., Alqahtani, A., Ojo, O. A., Shaheen, H. M., Wasef, L., Elzeiny, M., Ismail, M., Shalaby, M., Murata, T., Zaragoza-Bastida, A., Rivero-Perez, N., MagdyBeshbishy, A., Kasozi, K. I., Jeandet, P., and Hetta, H. F., 2020. Biological Properties, Bioactive Constituents, and Pharmacokinetics of Some Capsicum spp. and Capsaicinoids. *International journal of molecular sciences*, 21(15), 5179.
47. Wimalawansa SJ., 2019. Vitamin D Deficiency: Effects on Oxidative stress, Epigenetics, Gene Regulation, and Aging. *Biology.*, 8(2).
48. Wolska K, Gorska A, Antosik K and Lugowska K., 2019. Immunomodulatory Effects of Propolis and its components on Basic Immune Cell Functions. *Indian J Pharma Sci.*, 81(4):575-88.
49. Wu W, Li R, Li X, He J, jiang S and Liu S, et al. 2015. Quercetin as an Antiviral Agent Inhibits Influenza A Virus (IAV) Entry. *Viruses.*, 8(1).
50. Yong SJ, 2021. Long COVID or post-COVID-19 syndrome: putative pathophysiology, risk factors, and treatments. *Infect Dis (Lond).*, 1-18.
51. Zarfeshany, A., Asgary, S., and Javanmard, S. H., 2014. Potent health effects of pomegranate. *Advanced biomedical research*, 3, 100.

IMPACT OF COVID-19 ON EDUCATION SYSTEM OF INDIA

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Abstract:

The spread of pandemic Covid-19 has drastically interrupted every aspects of human life including education. It has created an unprecedented test on education. In many educational institutions around the world, campuses are closed and teaching-learning has moved online. Internationalization has slowed down considerably. In India, about 32 crore learners stopped to move schools/colleges and all educational activities brought to an end. Despite of all these challenges, the Higher Education Institutions (HEIs) have reacted positively and managed to ensure the continuity of teaching-learning, research and service to the society with some tools and techniques during the pandemic. This research paper shows major impacts of Covid-19 on education system in India and to study various emerging approaches in education system of India. Due to Covid-19 pandemic, many new modes of learning, new perspectives, new trends are emerged and the same may continue as we go ahead to a new tomorrow.

Keywords: Covid-19, Higher Education, Pandemic, Online Teaching, Teaching learning Process

Introduction:

The impact of COVID-19 can be seen in every sphere of life. Especially when it comes to education; this is the biggest sector that has been adversely affected by this pandemic. It forced many great nations to enforce lockdown thereby bringing everything to an abrupt halt for a certain period of time. Right from the big businesses to educational institutions this Pandemic has literally altered and devastated the traditional ways of carrying out these things. The educational sector has been fighting to survive the crises. The teaching learning and evaluation methodologies have been completely altered by this pandemic. The digitalization of education became a necessity in order to provide seamless education.

Objective:

The present study is focused on the following objectives

1. To study the impact of Covid-19 on education system.
2. To study various emerging approaches in education system of India

Data collection and methodology:

Various reports of national and international agencies on Covid-19 pandemic are searched to collect data for current study. As it is not possible to go outside for data collection due to lockdown, information is collected from different authentic websites, journals and e-contents relating to impact of Covid-19 on education system of India.

Impact on education system in India:

Because of Covid -19 the educational institutions disrupted the structure of learning; assessment and examination which made the Indian education system go through an irreversible teaching & learning crisis. And therefore sudden shift was made from traditional face to face classroom method to the online mode of education. Online method was considered as the threat but today it has come to rescue. However there were several issues that also started coming up along with the introduction of online mode of teaching in higher educational institutions (HEIs). One of the significant questions arises regarding online learning that whether it is effective? However answer is that it is effective for those who have right access to the technology. Internet plays very vital role for better learning and for higher education.

However in the country like India all students cannot be expected to have all the required facilities due to different socio-economic background which might cause discomfort and frustration to students which might give the student the feeling of segregation and thus create digital divide between the rich who can avail all the facilities and the poor who cannot afford to purchase the equipment's that are required for E-Learning. So in India lot of people are not completely well equipped with all the facilities and many times they cannot get access to fast internet which is needed at the time of Teaching & learning process. Therefore India is still facing this challenge of digital divide. Lack of student involvement during the online classes has increased absenteeism and poor performance. Unfortunately student's passive role in the classroom became one of the significant reasons for ineffective online teaching and learning process. Mobile applications or virtual meeting platforms like Zoom, Google meet became the virtual meeting hubs. Educational institutions directed teachers to engage classes through online mode using the virtual meeting platforms like Zoom & Google meet. The teachers who were not well versed with modern technology and mobile applications had to struggle a lot to engage online classes due to the sudden shift from face to face teaching to online teaching. Some teachers were just conducting classes because they were asked to do so. A lot of students were just joining the classes to mark them present.

They hardly paid attention towards what was being taught by the teacher as the factor like class control doesn't exist on these virtual platforms. Many entrance tests, job recruitment too

got cancelled which created a negative impact on the lives of the students. All these imply towards increase in unemployment in India. Thus with the increase of unemployment situation, there were enough chances of diminishing interest for education due to the struggle for food. This growing issues has caused mental stress amongst the youngsters and youths who are the future of India. These were certain problems which affected the people in India who were severely affected due to the pandemic which created threat to the future of India. Initiatives taken by the policymakers to make the educational system learner friendly Though COVID-19 created many negative impacts on education, at the same time it has brought new dimension to the teaching learning process in India. Though there are many drawbacks of online learning, it became survivor during the worst situation in the country. It enhanced the digital literacy. People started learning and using digital technology. Electronic media was used for sharing information worldwide. Students and teacher got good opportunities to interact with different people around the globe improving the 24 Educational communications. Students preferred Open and Distance Learning (ODL) mode of learning as it encourages self-learning. The HEIs also gave their positive response by adopting different strategies during this crisis situation. UGC, MHRD also have made available teaching and learning materials for students to motivate learning. Some of the digital initiatives have proved to be very effective during the COVID crisis. Some of them are listed below: -

- 1. E-Gyankosh:** It is one of the initiatives taken by national government to sharedigital learning resources which are developed by the open and distance learning institutions in the country. Study material is also made available for the students.
- 2. Gyandarshanis:** A web- based TV channel devoted to educational and developmental needs for Open and Distance Learner. A web-based TV channel devoted to educational and developmental needs of the society.
- 3. Swayam:** It provides Massive Open Online Courses (MOOCs) with 140 universities approved credit transfer feature. Swayam Prabha provides high quality educational programs through 32 DTH channels transmitting educational contents.
- 4. e-PG Pathshala:** It is for postgraduate students. Postgraduate students can access this platform for e-books, online courses and study materials. The details of these three digital platforms are described by the author in the previous paper
- 5. National Digital Library of India (NDLI):** It is a repository of e-content on multiple disciplines for all kinds of users like students (of all levels), teachers, researchers, librarians, library users, professionals, differently-abled users and all other lifelong

learners. It is being developed at Indian Institute of Technology Kharagpur. It is designed to help students to prepare for entrance and competitive examinations, to enable people to learn and prepare from best practices from all over the world and to facilitate researchers to perform inter-linked exploration from multiple sources. It is a virtual repository of learning resources with a single-window search facility. It is also available to access through mobileapps.

6. **e-Yantra:** It provides stands on experience on embedded systems. It has about 380 Lab and made 2300+ colleges benefited.
7. **FOSSEE:** It is short form for Free/Libre and Open-Source Software for Education, which is developed to promote open-source software for education as well as professionaluse.
8. **Virtual Labs has developed web-enabled curriculum:** It is based experiments designed for remote operation. It has over 100 Virtual Labs consisting of approximately 700+ web-enabled experiments which are designed for remote-operation. It provides remoteaccess to Labs in various disciplines of Science and Engineering. These Virtual Labs caters to students at the undergraduate level, post graduate level as well as to researchscholars.
9. **National Educational Alliance for Technology (NEAT):** It is an initiative for skilling of learners in latest technologies through a Public-Private partnership model between the Government (through its implementing agency AICTE) and the Education Technology companies of India. It brings the best technological products in education pedagogy on a single platform for the convenience of learners.

Conclusion:

The purpose of education is to enable oneself to better the world in which they live. Technology today has become need of an hour. It is difficult to imagine colleges and university education without the use of digital resources which has provided different educational and academic information. However it is also necessary to understand that it shouldn't reinforce structures of power and inequality. It should not create digital divide between rich and poor, as we cannot expect in country like India to have availability of all required resources due to different socio-economic conditions in India. Online mode of learning can be the best mode of teaching if it can be accessed by all the sections of the society however it can pose threat if certain section of society cannot avail this facility and thus exclusion. It is therefore important to take cognizance of online education and plan for interventions that will prioritize greater inclusivity, connectivity and equitability. It is important that colleges and University understands

the experience and issues of the students and prepare according the further and design the study pattern in such a way that all students benefits.

Referances:

1. Choudhary, R. (2020). COVID-19 Pandemic: Impact and strategies for education sector in India. <https://government.economictimes.indiatimes.com/>.
2. Gopinath, M. (2020). Covid-19 crisis brings opportunity to expand the autonomy of public universities. The Indian Express.
3. Jena, P. K. (2020). Impact of COVID-19 on Higher Education in India. InternationalJournal of Advance Education and Research, 60-66.
4. Priyanka Dhoot. (2020). Impact of COVID-19 on Higher Education in India. International Journal of Creative Research Thoughts (IJCRT), 9-11.
5. The Hindu. 9-Shafi, Z. (2020). Impact of Covid-19 on Higher Education in India. The Indian Express.

IMPACT OF COVID-19 CRISIS ON ECONOMIC, EDUCATION, ENVIRONMENT AND MENTAL HEALTH

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Introduction:

COVID-19 has heightened human suffering, spoiled the economy, turned the lives of billions of people around the globe upside down, and significantly affected the health, economic, environmental and social domains. In early 2020, after a December 2019 outbreak in China, the WHO (World Health Organization) identified SARS-CoV-2 as a new type of corona virus. It can affect upper and lower respiratory tract and it spreads mainly through contact from person-to-person.

The previous pandemic reported in the world was H₁N₁ flu in the year 2009. Corona virus got their name from that look under a microscope. The basic of virus contains genetic material surrounded by protein spikes and the appearance of a crown like structure. The Latin word "Corona" means crown. In human, some corona viruses are identified and it to cause respiratory illness ranging from the common cold to additional diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS).

COVID-19 is related with zoonosis disease, meaning they are transmitting between animals and people. The states of emergencies established in many countries to provide conditions to care for societies from the struggle and increase of the corona virus, respond to an unexpected and grave situation which is endangering the life of millions of people around the world. This communal health crisis will not stop immediately. These extraordinary situations cause special threats and challenge to the education, environment and biodiversity structures as a whole around the world. The financial shock of the pandemic and the regulations on lockdown or stay-at-home orders are dramatic and cruel. Especially for poor, migrants, women, detainee, children and other groups are under in threat. In this chapter, give an *introduction* to the *corona virus* outbreak and the impact of lockdown due to COVID- 19 pandemic on social, environmental, economic, education and future strategies.

Background on SARS-COV-2:

World Health Organization was first alerted to a group of pneumonia of unfamiliar etiology in Wuhan, People's Republic of China on 31 December 2019. The virus was at first tentatively named 2019 novel corona virus (2019-nCoV). Subsequently the ICTV (International Committee of Taxonomy of Viruses) called as the virus SARS-CoV-2 (Gorbalenya *et al.*, 2020). COVID-19 is the illness caused by SARS-CoV-2. SARS-CoV-2 is classified as the genus Betacoronavirus, subgenus Sarbecovirus and the family Coronaviridae. It is covering, positive sense, single-stranded RNA virus with a 30-kb genome (Gorbalenya *et al.*, 2020). The virus has RNA proof reading mechanism keep the mutation speed relatively short. The genome encodes for non-structural proteins (few are vital in forming the replicase transcriptase complex), four structural proteins (spike (S), envelope (E), membrane (M), nucleocapsid (N)) and putative accessory proteins) (Naqvi *et al.*, 1866; Yoshimoto, 2020; Kim *et al.*, 2020). The virus binds to an angiotensin-converting enzyme 2(ACE2) receptor for cell entry (Lu *et al.*, 2020; Ni *et al.*, 2020; Yan *et al.*, 2020). SARS-CoV-2 is the seventh corona virus documented and it is known to transmit a disease to humans (HCoV). Four of these viruses, HCoV-229E, HCoV-NL63, HCoV-HKU1 and HCoV-OC43 are endemic, seasonal and lean to cause mild respiratory disease. The other two viruses are more virulent zoonotic Middle East Respiratory Syndrome Corona virus (MERS-CoV) and Severe Acute Respiratory Syndrome Corona virus type 1 (SARS-CoV-1). SARS-CoV-2 is genetically related with SARS-CoV-1 and both of these viruses belong to the subgenus Sarbecovirus and the genus Betacoronavirus.

Signs of Covid-19 infection:

The familiar symptoms of covid-19 disease are fever, dry cough and tiredness. Other symptoms may affect some patients contain aches and pains, nasal blockage, headache, conjunctivitis, sore throat, diarrhea, breathing trouble, respiratory symptoms, fatigue, nausea, failure of taste or smell, skin complaint, discoloration of fingers or toes and pneumonia. These symptoms are typically mild and start in on gradually. The majority people (on 80%) get back to normal from the disease without need the hospital treatment. Recently some affected persons showed no symptoms. Fatigue or muscle weakness, breathlessness, joint pain and chest pain sleep difficulties, anxiety or depression and worsening value of life are the majority common symptoms reported.

Risk people to Covid-19 infection:

The virus can infect people of all ages. Evidence suggests that some groups of people are at a high risk of getting COVID-19 disease.

i. Risk people

Aged is associated with a turn down in immune function. And persons with underlying medical problems like high blood pressure, heart problems, diabetes, cancer, chronic respiratory disease, hypertension, chronic liver disease are at top risk of serious illness of COVID-19.

ii. Pregnant women and children

The possibility for adverse motherly and neonatal outcomes associated with COVID-19 is largely unknown but medical experts guess the symptoms of COVID-19 may be severe in pregnant woman compare to non-pregnant women. It may be due to modify in their bodies and immune systems pregnant women can be poorly affected by some respiratory infections. Women with COVID-19 can breastfeed and have close contact with their newborn, but they should diligently perform respiratory and hand cleanliness. No confirmation so far those babies have active corona virus transmit from mothers.

Transmission of Covid-19

People are able to catch the corona virus from others and the disease spreads mainly from person to person through droplets from the nose or mouth which are expelled when a person affected COVID-19 coughs, sneezes or speaks. These droplets are relatively deep and rapidly go down to the ground. These droplets can stay on objects and surface around the person such as tables, doorknobs, handrails, etc. People become infected-by touching these objects or surfaces, then touching their eyes, nose and mouth.

i. Transmission by direct contact

Direct contact transmission involves physical contact between an infected person and a susceptible person and the transmit of microorganisms. Direct contact includes contact with an infected person, sexual contact, oral discharges or body lesions. This kind of transmission requires close contact with an infected person and will generally happen between members of the household or close friends and family.

ii. Transmission by indirect contact

Indirect contact transmission refers to location where at risk person is infected from contact with an infected surface. To decrease the transmission by indirect contact, regular touch surfaces should be properly clean. Usually touch surfaces such as door knob, door handle, handrail, table, bed, chair, washroom surface, cup, bowl, tray, medical instrument, electronic devices and children's toys.

Diagnosis Covid-19:

COVID-19 diagnostic testing is done to find out if infected with SARS-CoV-2, the virus that causes corona virus disease. The approved following types of tests for diagnosing a COVID-19 infection:

i. RT-PCR test

RT-PCR test is also called a molecular test and detect the genetic material of the virus using a lab technique called Reverse Transcription Polymerase Chain Reaction (RT-PCR). Fluid sample is collected by a long nasopharyngeal swab into nostril and taking fluid from the nose or using a shorter nasal swab or anterior nasal swab to obtain the sample. In some cases, a long swab is inserted into the throat (oropharyngeal swab) or may spit into a tube to produce a saliva sample. Results may be available in minutes if analyzed on site or a few days or longer in locations with test processing delays if sent to an outside lab. RT-PCR tests are very correct when well performed by a health care expert but the rapid test can miss some cases.

ii. Antigen test

This antigen test detects certain proteins in the virus. Using a lengthy nasal swab to obtain a fluid sample, some antigen tests are able to produce results within minutes. A positive antigen test end result is consider accurate when instructions are carefully followed, but there's an bigger chance of false-negative results meaning it's possible to be infected with the virus but have a negative result. Depending on the condition, the doctor may advise a RT-PCR test to confirm a negative antigen test result.

PCR test called the Flu SC2 Multiplex Assay can discover any of three viruses at the same time and they are as corona virus, influenza A and influenza B (flu). Only a single sample is required to confirm for above said all three viruses and it could be useful during the flu time. But a negative result does not rule out the chance of any of these infections. So the investigative process may consist of additional steps, depending upon the symptoms, possible exposures and doctor's experimental result.

Impacts due to Covid-19 lockdown

The corona crises distress the well-being, economic, education, environment and social field of people in different ways. It is likely that in most children, the long-term trouble of the corona crisis is related to the economic and social impacts on families with children.

I) Physical and mental health

The novel corona virus SARS-CoV-2 pandemic is unparalleled in latest history, with widespread impacts including high rates of death, failure of income and continued social

separation of people. The result from this crisis will have on population mental health, both in the short and long-term is mysterious. There are negligible facts about the acute phase mental health impacts of large-scale pandemic across the society. Because many nations introduce actions to control the people infected with COVID-19 and more of us are make the change to our everyday schedule.

The truth of lockdown particularly work from home, unemployment, online coaching for children and students and not have the physical activity, lack of contact with others. Adapting to way of life changes and managing the panic of contracting the virus and concern about people close who are particularly susceptible are challenging for everyone. Above said all particularly difficult for people with mental health conditions. Fortunately, there are a lot of effects that we can do to look behind our mental health and help to others require support and care.

Psychological health is a status of happiness and comfort an individual realizes by own abilities, know how to handle with the normal difficulties of life, be able to work efficiently and able to build a part in their society. It includes emotional, psychological, social welfare and it affect how can think, be aware and it leads to act. Mental health is central at all stage of life, from babyhood to adolescence. While the COVID-19 pandemic rapidly take away across the world, inducing fear, anger, anxious, depression, lack of feeling, changes in appetite, energy, interest, complication for concentration and make decisions and concern in the population with certain groups (children, older, care providers and people with underlying health conditions).

The COVID-19 pandemics have disrupt or arrest mental health services in 93% of worldwide while the demand for mental health is increasing, according to World Health Organization survey. And the pandemic is raising demand for mental health services. Depressions, isolation, lack of income, failure to relationship with others and panic is cause mental health conditions. Several people may be facing greater than before using level of alcohol and drug, reduce the rate of sleep and nervousness. Meanwhile, COVID-19 can lead the way to neurological disorders and mental related problem, such as confusion, agitation and stroke. People who have mental and neurological disorders are also more risk to SARS-CoV-2 infection they can stand a high risk of serious outcomes and even death.

Regular physical activity benefits for body and mind. It is able to decrease the high blood pressure, maintain weight and lower the risk of heart disease, stroke, diabetes and different types of cancers, the entire conditions that can increase susceptibility to COVID-19. Physical activities also strength the bone and muscle leads to increase the balance, flexibility and fitness. For older people, physical activities that improve balance and it help to prevent falls down and damage. Everyday physical activity can provide our days a routine and be a way to stay in contact with

others. It is good for mental health and reduces the risk of depression and delays the onset of mental illness and improves general feelings.

II) Economic status

The impact of corona virus epidemic on India has been basically disturbing in terms of economic level as well as a failure of human lives. Almost all the division has been adversely affected. Coupled with the humanitarian emergency and quiet action of the government, the COVID-19 has proved and declined inequalities in the Indian economy. India's GDP (Gross domestic Product) shrank 7.3% in 2020-21. This was the most terrible performance of the Indian economy in any year since independence. India's on \$2.9 trillion economy remains closed during the lockdown, apart from some important services. As shops, factories, educational institutions, transport services, business establishments were shuttered; the lockdown had a shocking impact on slowing down the financial system. The familiar sectors of the economy have been most horrible hit by the worldwide pandemic. India forced a nationwide lockdown from 25 March 2020, which crippled economic level across the states.

i. Hospitality section

As many states have imposed localized lockdown, the hospitality segment is facing a repeat of 2020. The hospitality sector includes many businesses like restaurants, beds and breakfast, pubs, bars, nightclubs and more. The division that contributes to an immense part of India's yearly GDP has hard by regulations and lockdown compulsory by the government.

ii. Tourism

The hospitality segment is linked to the tourism trade sector. The sector that employs millions of Indians started back following the first wave but the second wave of covid-19 was back for the destruction. The tourism parts give nearly 7% to India's annual GDP. It includes hotels, guest house, home stays and more. The regulations during lockdown in second wave have broken the tourism which was already stressed to get better from the failure suffered by the industry in 2020.

iii. Aviation and travel

Aviation and travel sector faced more difficulties during the second wave of COVID-19. The better travel sector is also taking beat as people are worried to step out of their homes. For wide travel sector its recovery will depend upon on whether the people in future will choose for specific services.

iv. Real estate and construction

The real estate and construction business facing in trouble during the period of lockdown and more group of migrant workers were gone the built-up region. The situation has not been severe of 2020 for this division.

v. Disruption in supply chains

India had importing 45% of electronics from China without help. Approximately 33% of machinery and 40% of organic chemicals used to be introduced from China. Even in automobile parts and fertilizers China's role in excess of 25%. The major shocking fact is more than 90% mobile phone from China to India and around 75% of pharmaceutical elements were sourced from China. During lockdown due to COVID-19, India has stopped importing these products. This growth has disrupted the supply chain and crashed different levels of supplier networks.

vi. Household income and marketing

In response to lockdown, Reserve Bank of India and the Government of India reduce the repo rate and regulatory relaxation by extending moratorium. Sluggish businesses, payments suspension and subsidized loan have impaired the strength of economy. Slow down of GDP growth, reduction in discretionary expenses and CAPEX have resulted into go down in marketing and household incomes.

vii. Stock market

From the time when COVID-19 has arrived, stock market had fall down. Both BSE Sensex and Nifty reduced by around 38% and the entire market cap has missed a staggering 27%. Certain parts such as hospitality, tourism and action have been harmfully impacted.

viii. Agriculture

Farmers were look forward to good returns from the sale of their products but they dissatisfied by lockdown and domestic food supply chains and falling farm-gate prices. Worldwide, the demand for Indian agricultural supplies fell due to the shutdown of international trade. Nationally, farmers were great effort to carry their products to the market due to lack of transport facilities and restrictions on the movement of goods.

ix. Animal husbandry field

In lockdown period, many usual consumers of milk, such as sweet shops, restaurants and hotels were close. India is the second largest exporter of beef in the world, after Brazil and exports about 100,000 tonnes of buffalo meat in every month, but exports in March 2020 was 40,000 tonnes only. Domestically, there was a pointed fall in meat sales because people believe that intake of meat would lead to COVID-19 illness. Enough animals could not be transported

from particular areas to the large slaughterhouse and closed down. Poultry farm producers also harmfully affected. In poultry field, it is estimated about 40% of the poultry producers closed down production because chicken prices down from Rs 85-90/kg to Rs 5-10/kg during the period of lockdown.

III) Education

COVID-19 has changed education for learners of all ages. The current worldwide epidemic has wreaked disaster and one of the most important systems, education. Education is definitely significant to a country's welfare and an individual's growth, but it is threatened due to COVID -19 infections. Education was also held back by the economic crisis, which reduced its output. This is being referred to as a nationalized emergency and enhance in unemployment as a result.

COVID-19 has affected educational organizations; it leads to the near-total shut down of schools, early childhood education and care (ECEC), universities and colleges. In general, all the state governments decided to temporarily shut an educational institution to control the COVID-19 infections. The pandemic caused further shocks to the system with schools forced to close down in lockdown due to COVID-19 and the conversion of students and teachers to online teaching and learning. In India, approximately 250 million learners were affected due to lockdown induce by COVID-19.

All over the country, lockdown was forced educational institutions to shut down and instructing students to abandon the standard classroom teaching mode. From this lockdown, enhance an innovation and technology which the teachers used to complete their modules. But lack of communications and infrastructure, output suffered. Remote teaching was not accessible in all family units; according to the Global internet network research, only 24% of families have constant internet connection at the same time other areas remain difficult to get the network. As a result, the government was forced to make sure that sufficient benefits and economic funds were provided.

IV) Environment

During lockdown period, medical waste generation is increased globally, which is a major threat to public health and environment. For sample collection from infected patients, diagnosis, treatment of massive number of patients and disinfection use lots of infectious and biomedical wastes are produce from hospitals to environment. To control the corona virus infection, people are using face mask, hand gloves and other safety equipment, it increase the amount of healthcare waste to surroundings. Enhance the urban waste both organic and inorganic

production has direct and indirect effects on environment like air, water and soil pollution (Islam *et al.*, 2016). In pandemic situation, restriction policies have lead to an increase in the demand of online shopping for home delivery, it eventually increase the amount of household wastes from package materials (Somani *et al.*, 2020; Zambrano-Monserrate *et al.*, 2020).

Another potential negative impact stems from the extensive use of sanitization chemicals and disinfectants containing toxic material to the environment. Its extensive production and use lead to rising amount of sanitizer package bottles that are made of hard to decompose plastics. On the other hand, waste recycling is a helpful way to stop pollution, save energy and preserve natural resources (Ma *et al.*, 2019). But during lockdown many state delayed the waste recycling actions to decrease the transmission of viral infection. In recent times, huge amount of germicide is applied into roads, commercial and residential areas to destroy the corona virus. Such extensive apply of this disinfectant may kill non-targeted useful organisms, which may produce ecological imbalance (Islam and Bhuiyan, 2016). Both directly and indirectly, the epidemic is affecting human being and also affecting the environment and weather. Furthermore, the worldwide responses of COVID-19 also teach us to work together to struggle against the threat to mankind. Although the effects of COVID-19 on the environment are short-term, united and future time-oriented attempt can make stronger environmental sustainability and save the globe from the causes of worldwide climate change.

Also, importing of agricultural products appear to be stopped due to lockdown which resulted in rising the application of pesticides and fertilizers by farmers who are in pressure to make more than planned.

Prevention Covid 19|:

Getting vaccinated against COVID-19 is a key part of prevention. Quarantine, contact tracing, screening and isolation are effective measures of *COVID-19 prevention*, particularly when integrated together. But all should also take following preventive measures to control covid-19:

i. Use face mask

Wearing a face mask in public it helps to control the infection of COVID-19 but only if worn properly, covering both your nose and mouth.

ii. Wash hands

This activity kills viruses on our hands. First, can clean with soap and water, but disinfect surfaces we touch often, like tables, doorknobs, light switches, toilets, faucets and sinks. Apply a mix of household bleach with water (1/3 cup bleach per gallon of water or 4 teaspoons bleach per quart of water) or a household disinfectant it prevent to the infection from SARS-CoV-2.

iii. Follow social distancing

Maintain social distancing methods by staying at home, limiting travel, avoiding crowded areas, using no-contact compliments and physically distancing themselves from others. Many governments are now recommending social distancing in regions affected by the outbreak. In overcrowded region, keep a distance of 2 meters (6.56 feet) from others around as much as possible. Not now mass gatherings but even shopping malls, stadiums and theatres can make a goal. In general any gathering of over ten people should be avoided or conducted virtually.

iv. Vaccination

Getting vaccinated against corona virus can lower the risk of COVID-19 pandemic. Vaccines can also prevent the serious illness and death. COVID-19 vaccines are safe and effective. It takes two weeks after fully vaccinated, to build protection (immunity) against the virus it cause the COVID-19 disease.

v. Sleep

Adequate sleep maintains the immune system it reduces the risk of illness and improves the outcomes for people fighting against the virus. On the other hand sleep deficiency weakens the body's defense system and makes people more vulnerable to contracting the virus.

vi. Physical activity

Physical activity refers to the entire movement. The ways to be energetic include; walking, cycling, active recreation, play and can be done at any level of skill or if stuck at home, watch online videos for physical exercise and follow. There are several things can do even without any tools such as yoga, meditation, dance and exercises that help maintain bodyweight and mind. Regular physical exercise can help to decrease the anxiety and get better the frame of mind.

vii. Eat healthy food

Eat a mixture of different foods including whole grains for example; wheat, maize, rice, legumes like lentils and beans, fruit and vegetables and foods from animal sources (meat, fish, eggs and milk). While no foods or dietary supplements can prevent or cure COVID-19 infection, healthy diets are important for supporting immune systems. Prefer a balanced diet and avoid junk food. Control the use of caffeine because it can aggravate stress, nervousness and sleep problems.

viii. Avoid tobacco, alcohol and drugs

Using tobacco is the higher risk of lung disease, for the reason that COVID-19 disease affects the lungs, risk increases even more. Consuming alcohol to try to manage can

make matters worse and reduce surviving skill. Keep away from taking the drugs to handle, unless doctor prescribed medications.

Recommendations:

Standard recommendation to prevent the infection includes, hand washing, use face mask and hand gloves. Avoid close contact with any person confirm the symptoms of respiratory infection such as coughing and sneezing. Self-isolation is an important control measure by who have COVID-19 signs to keep away from infecting others in the community, including family members. And who confirm the COVID-19 symptoms such as fever, throat pain, cough, etc, stay at home and do not go to public places.

If feel sick should take rest, drink sufficiently of liquid, sleep and consume nutritious rich food. Stay in a separate room from other family members and use a dedicated bathroom if possible. Clean and disinfect often touched surfaces. Each person should follow and maintain a standard lifestyle. Children require more care and love from adults during their difficult period. Keep to standard practice and plan as much as possible and it help to normal from feel sad, stressed and confused during a crisis. Conversation with people you trust, such as friends and family can help. If feel incredulous talk with doctor.

Conclusion:

A simple method to decrease SARS-CoV-2 infection rates is to avoid virus exposure. People from India should avoid traveling to countries highly affected with the virus, practice proper hygiene, and avoid consuming food that is not home cooked. Basic preventive measures such as using mask, regular hand wash and avoid direct contact with infected persons should also be practiced. Ministry of Health and Family Welfare in India enhance the awareness about the outbreak and taken necessary action to control COVID-19 disease. Our medical teams are also putting considerable efforts to develop a vaccine. We all need to be helpful, follow precautions and stay safe. COVID-19 continues to spread across the world following a route that is difficult to predict. The health, compassionate and socio-economic policies adopt by countries will decide the rapidity and strength of the recovery. The public awareness is high and it is an essential that the knowledge of communication be known and be kept at the top priority during the pandemic.

References:

1. Farm Policy News, 6 April 2020 <https://farmpolicynews.illinois.edu/2020/04/covid-19-impacting-food-purchasing-dynamics-as-ag-labor-concerns-persist/>.

2. <file:///C:/Users/Home/Downloads/WHO-2019-nCoV-laboratory-2020.6-eng.pdf>
3. Gorbalenya A, B.S., Baric R, de Groot R, Drosten C, Gulyaeva A, Haagmans B, Lauber C, Leontovich A, Neuman B, Penzar D, Perlman S, Poon L, Samborskiy D, Sidorov I, Sola I, Ziebuhr J, The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol*, 2020. 5(4): p. 536-544.
4. <https://www.frontiersin.org/articles/10.3389/fpsy.2020.579985/full>
5. <https://www.who.int/campaigns/connecting-the-world-to-combat-coronavirus/healthyathome/healthyathome---mental-health?gclid>
6. <https://www.who.int/news-room/campaigns/connecting-the-world-to-combat-coronavirus/healthyathome/healthyathome---physical-activity>
7. <https://home.kpmg/in/en/home/insights/2021/10/nep-covid-19-school-education-assessments.html#:~:text=The%20pandemic%20caused%20further%20shocks,lockdown%20induced%20by%20COVID%2D19.>
8. <https://timesofindia.indiatimes.com/readersblog/zita-janice/covid-19-and-its-impact-on-education-system-35076/>
9. <https://absyz.com/impact-of-covid-19-on-indian-economy/>
10. <https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/mental-health-covid-19/art-20482731>
11. <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/how-they-work.html>
12. International Committee on Taxonomy of Viruses (ICTV). 2020 27 July 2020]; Available from: <https://talk.ictvonline.org/>.
13. Islam S.M.D., Bhuiyan M.A.H. Impact scenarios of shrimp farming in coastal region of Bangladesh: an approach of an ecological model for sustainable management. *Aquacult. Int.* 2016;24(4):1163–1190.
14. Kim, D., et al., The Architecture of SARS-CoV-2 Transcriptome. *Cell*, 2020. 181(4): p. 914-921 e10.
15. Lu, R., et al., Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet*, 2020. 395(10224): p. 565-574.
16. Ma B., Li X., Jiang Z., Jiang J. Recycle more, waste more? When recycling efforts increase resource consumption. *J. Clean. Prod.* 2019;206:870–877.

17. Naqvi, A.A.T., *et al.*, Insights into SARS-CoV-2 genome, structure, evolution, pathogenesis and therapies: Structural genomics approach. *Biochim Biophys Acta Mol Basis Dis*, 2020. 1866(10): p. 165878.
18. Ni, W., *et al.*, Role of angiotensin-converting enzyme 2 (ACE2) in COVID-19. *Crit Care*, 2020. 24(1): p. 422.
19. Schmidhuber, Pound and Qiao (2020), *COVID-19: Channels of Transmission to Food and Agriculture*, FAO, Rome. <https://doi.org/10.4060/ca8430en>.
20. Somani M., Srivastava A.N., Gummadivalli S.K., Sharma A. Indirect implications of COVID-19 towards sustainable environment: an investigation in Indian context. *Biores. Technol. Rep.* 2020;11:100491.
21. Yan, R., *et al.*, Structural basis for the recognition of SARS-CoV-2 by full-length human ACE2. *Science*, 2020. 367(6485): p. 1444-1448.
22. Yoshimoto, F.K., The Proteins of Severe Acute Respiratory Syndrome Coronavirus-2 (SARS CoV-2 or nCoV19), the Cause of COVID-19. *Protein J*, 2020. 39(3): p. 198-216.
23. Zambrano-Monserrate M.A., Ruanob M.A., Sanchez-Alcalde L. Indirect effects of COVID-19 on the environment. *Sci. Total Environ.* 2020;728:138813.
24. <file:///C:/Users/Home/Downloads/WHO-2019-nCoV-laboratory-2020.6-eng.pdf>

COVID-19: EPIDEMIOLOGY AND REMEDIES

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Introduction:

The World Health Organization (WHO) got notified in December 2019 of a pneumonia outbreak in Wuhan, Hubei Province, China, although the cause was unknown. WHO classified the the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic a public health emergency of international concern on January 30, 2020 (PHEIC). The current outbreak of coronavirus disease was officially named Coronavirus Disease-2019 (COVID-19) by the WHO on February 11, 2020 (Sun P. et al., 2020), and the virus was named SARS-CoV-2 by the International Committee on Taxonomy of Viruses (ICTV). Many cases exceeded during the SARS period. SARS-CoV-2 is considered as the third zoonotic human coronavirus to emerge in this century, following SARS-CoV and MERS-CoV. By October 11, 2020, WHO had received data from national authorities indicating that there were more than 37 million confirmed cases of COVID-19 and 1 million deaths. The United States, India, and Brazil are the three countries in the world with the highest total number of confirmed cases. The total number of confirmed cases has considerably beyond the amount seen during the SARS outbreak. SARS-CoV-2 is the third zoonotic human coronavirus to emerge this century, following SARS-CoV and MERS-CoV.

Structure of coronavirus:

Coronaviruses are members of the Coronavirinae subfamily of the Coronaviridae family. Alphacoronavirus, Betacoronavirus, Gammacoronavirus, and Deltacoronavirus are the four genera that make up this virus family. CoVs (coronaviruses) have a genomic size of 27–32 kb and a single-stranded positive-sense RNA (ssRNA) that is greater than any other RNA virus. Outside the genome, the nucleocapsid protein (N) forms the capsid, and the genome of virus is further packed by an envelope that is made up of three structural proteins: membrane protein (M), spike protein (S), and envelope protein (E) (Brian and Baric, 2005). The genome of SARS-CoV-2, which was recently sequenced, is roughly 29.9 kb in size.

16 non-structural proteins (nsp16) are found in SARS-CoV-2. Nsp1 is a protein that plays a role in RNA processing and replication. Nsp2 affects the host cell's survival signalling system. Nsp3 is thought to be responsible for separating the translated protein. Nsp4 modifies ER membranes by including transmembrane domain 2 (TM2). During replication, Nsp5 is involved

in the polyprotein process. Nsp6 is thought to be a transmembrane domain. The combination of nsp12 and template-primer RNA was significantly boosted when nsp7 and nsp8 were present. Nsp9 is a protein that binds to ssRNA. Nsp10 is required for viral mRNA cap methylation. The RNA-dependent RNA polymerase (RdRp), which is a crucial component of coronavirus replication and transcription, is found in Nsp12. Nsp13 binds to ATP and participates in the replication and transcription processes through its zinc-binding domain. Nsp14 function as a proofreading exoribonuclease domain while Nsp15 shows Mn^{2+} dependent endoribonuclease activity Nsp16 shows a2'-O- ribosemethyltransferase activity.

Spike glycoprotein is involved in coronavirus entrance into host cells (S protein). The spike glycoproteins clump together and protrude from the viral surface as homotrimers. Because the spike glycoprotein is required for coronavirus entrance, it is a promising antiviral target. The S1 and S2 subunits make up the S protein, which is made up of two functional subunits. The S1 subunit's job is to bind to the receptor on the host cell, whereas the S2 subunit's job is to fuse the viral and host cell membranes. The S1/S2 protease cleavage site is located on the border between the S1 and S2 subunits. Host proteases cut the spike glycoprotein at the S2' cleavage site to trigger the proteins, which are required to merge the membranes of viruses and cells in the body by irreversible conformational changes in all coronaviruses. N-linked glycans are required for correct folding, neutralisation of antibodies, and extensive decoration of spike protein trimers.

The origin and evolution of SARS-CoV-2:

Scientists in Wuhan obtained whole genome sequences from five SARS-CoV-2 infected patients early in the pneumonia epidemic. SARS-CoV shares 79.5 percent sequence similarity with these genome sequences. SARS-CoV-2 is obviously different from SARS-CoV. It's thought to be a brand-new beta coronavirus that infects humans. The entire genome sequence of SARS-CoV-2 and other betacoronavirus genomes were aligned by scientists. The results show that SARS-CoV-2 is most closely related to the bat SARS-like sars - cov variant BatCov RaTG13, with a 96 percent identity. These findings show that SARS-CoV-2 is of bat origin, and that it may have developed naturally from the bat coronavirus RaTG13.

SARS-CoV-2 and SARS-like coronavirus strain BatCov RaTG13 share 96 percent of their genomic nucleotide identity. SARS-CoV-2 has a 17 percent divergence in neutral site compared to other viruses, which is substantially higher than previously estimated. The spike gene has a higher dS (synonymous alterations per synonymous site) value than some other genes, which could be due to natural selection or a high mutation rate. To identify the genetic variations, researchers received 103 SARS-CoV-2 genomes. The findings reveal that the two single nucleotide polymorphisms are linked in 101 of the 103 SARS-CoV-2 strains (SNPs). The two major kinds of severe acute respiratory (L type and S type) are identified by two SNPs located at 8,782 and 28,144, respectively. L type accounts for 70% of the total 103 strains and S

type accounts for 30%. It suggests that L type is more prevalent than the S type. However, S type is the ancestral version of SARS-CoV-2.

Epidemiology of COVID-19

SARS-CoV-2 appears to be a natural reservoir in bats. According to one report, betacoronavirus identified from pangolins shows a sequence resemblance to the presently infected human strain of up to 99 percent. SARS-CoV-2 and the coronavirus from a pangolin in Malaysia have a substantial genetic similarity, according to another study. In terms of E, M, N, and S genes, the similarity between these two viruses is 100, 98.6, 97.8, and 90.7 percent, respectively, implying that pangolins could be the intermediate host.

SARS-CoV-2 is spread through fomites and droplets through unprotected close contact between infected and uninfected people. The main source of infection is symptomatic and asymptomatic people. Indirect touch transmission is another way for the virus to spread. Virus-containing droplets infect hands, causing illness when humans come into contact with the mucous membranes of the mouth, nose, and eyes. SARS-CoV-2 transmission is not restricted to the nasal passages. SARS-CoV-2 aerosol transmission has been demonstrated in some experiments.

One study looked into the aerodynamic nature of SARS-CoV-2 during the COVID-19 outbreak by quantifying viral RNA in aerosols in two Wuhan hospitals, revealing that SARS-CoV-2 has the capacity to spread by aerosols. Because of the aerosols produced by medical operations, there is a risk of airborne route in health care facilities. It's worth noting that aerial transmission is the primary mode of COVID-19 transmission. Although nasopharyngeal swabs in certain paediatric SARS-CoV-2 infection cases are negative, rectal swabs are routinely positive, suggesting the possibility of fecal-oral transmission. SARS-CoV-2 has been shown to reproduce efficiently in human intestine organoids and epithelium in recent investigations. As a result, SARS-CoV-2 could spread through the gastrointestinal tract. Bats' intestinal cells can also be infected by SARS-CoV-2.

According to the findings of a research on COVID-19 infection in nine pregnant women, there is no evidence that pregnant women who were infected with SARS-CoV-2 late in pregnancy can transfer the virus to their infants via intrauterine vertical transmission. However, several recent researches have shown that SARS-CoV-2 can be transmitted vertically. In one case, an infant whose mother was diagnosed with SARS-CoV-2 in the third trimester was infected with the virus and developed neurological problems. In another case, despite no physical contact, the neonate's cytokine levels and anti-SARS-CoV-2 IgM antibodies were greater than normal, indicating the likelihood of transplacental transmission. The risk of SARS-CoV-2

transmission during pregnancy is low. Pregnant women infected with SARS and MERS had more severe symptoms, such as miscarriage, than those infected with SARS-CoV-2.

SARS-CoV-2 spreads mostly by person-to-person contact, which can occur in a family, hospital, community, or other group of people. In China, the majority of cases of early-stage person-to-person transmission occurred in familial clusters. This type of spread has the potential to happen during the incubation stage. It's worth noting that SARS-CoV-2 is highly transmissible during the asymptomatic or moderate stages of the disease. SARS-CoV-2 can potentially spread from person to person. Through direct contact with infected individuals, some animals, such as the tiger, dog, and cat, have been found to be infected with the virus. In Hong Kong, a 17-year-old dog was infected, marking the first occurrence of human-to-animal transmission. According to one study, the viral genomic sequences of SARS-CoV-2 found in two dogs match those found in the matching human cases, implying human-to-animal transmission. However, it's unclear if infected canines may pass the illness on to people. SARS-CoV-2 is thought to be transmitted from animals to humans. Bats are natural hosts for SARS-CoV-2, according to the sequencing analysis. SARS-CoV-2 and a coronavirus isolated from a pangolin in Malaysia are genetically very similar, and the CoVs identified from pangolins are the most comparable to SARS-CoV-2, implying that pangolins could be the intermediary host. The virus could be transmitted from intermediate hosts to susceptible people, resulting in the emergence of new diseases in humans. SARS-CoV-2 can potentially spread from animal to animal. Close contact between SARS-CoV-2 infected cats and naive cats could spread the infection. SARS-CoV-2 could potentially be transmitted in naive ferrets, either directly or indirectly.

Everyone is susceptible, according to existing epidemiologic characteristics, and the median age is around 50 years. With age, the clinical symptoms change. According to one study, patients above the age of 60 have greater levels of blood urea nitrogen, inflammatory markers, and more frequent bilateral lesions. Patients above the age of 60 are more likely to develop respiratory failure and have a longer illness course. The harshness is milder in people under the age of 60. According to one study, there have been 72,314 confirmed instances in China, with the majority of patients (87 percent) being between the ages of 30 and 79. There were no deaths among the children under the age of nine. However, the case-fatality rate (CFR) in the 70-79-year-old group is 8.0 percent, while the CFR in the 80-plus-year-old group is 14.8 percent. The CFR is 10.5, 7.3, 6.3, 6.0, and 5.6 percent for individuals with various concomitant illnesses such as cardiovascular disease, diabetes, chronic pulmonary disease, hypertension, and cancer, respectively. These findings imply that comorbid disorders are a major risk factor for COVID-19 individuals, with greater mortality rates than those who do not have underlying diseases. Patients with very severe disease were 7 years older than those with non-severe disease among the 1,099 cases confirmed with COVID-19. The median age of the 1,391 infected children is 6.7 years, and

most of them have milder symptoms (non-pneumonia or mild pneumonia) than adults. The patients who aged 65 years or above 65 years old have a higher risk of mortality from COVID-19, especially the patients with acute respiratory distress syndrome (ARDS) and comorbidities.

Symptoms of COVID-19:

COVID-19 is a coronavirus-related respiratory illness. Some people are infected but show no signs and symptoms (doctors call that being asymptomatic). The majority of people will experience minor symptoms that will go away on their own. However, some people will experience severe difficulties, such as difficulty breathing. If you're older and have another health problem such as diabetes or heart disease, you're more likely to experience more significant symptoms.

The following are the most prevalent symptoms of COVID-19 infection: Fever or chills, a dry cough and shortness of breath, feeling very tired, muscle or body aches, headache, a loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, diarrhea

Emergency symptoms:

If you have any of the following symptoms, contact a doctor or a hospital straight away: Trouble breathing, constant pain or pressure in your chest, bluish lips or face, sudden confusion, having a hard time staying awake.

If you experience any of these symptoms, you should seek medical attention as soon as possible, so call your doctor's office or the hospital before visiting. This will aid them in preparing to treat you and safeguard medical personnel and others.

COVID-19 has also been linked to strokes in some persons. Keep in mind the acronym FAST:

- Face. Is the person's face numb or sagging on one side? Is their grin crooked?
- Arms. Is one of your arms numb or weak? Does one arm slump as they try to raise both arms?
- Speech. Are they able to communicate clearly? Request that they repeat a sentence.
- Time. When someone is experiencing symptoms of a stroke, every minute counts. Immediately dial 911.

Researchers are investigating on various possible COVID-19 therapies; however the FDA has only approved the antiviral medication remdesivir (Veklury), which is intended for use in hospitalised patients. In rare situations, the FDA has given health care practitioners permission to use drugs that aren't currently approved for COVID-19, such as monoclonal antibodies.

Other COVID-19 Symptoms

COVID-19 can also cause problems including: Pinkeye, swollen eyes, fainting, guillain-barre syndrome, coughing up blood, blood clots, seizures, heart problems, kidney damage, liver problems or damage

Rashes linked to COVID-19 have been reported by certain clinicians, including purple or blue lesions on children's toes and feet. Researchers are looking at these reports to learn more about how COVID-19 affects people.

COVID-19 symptoms in children are similar to those in adults, but they are milder, according to researchers. Even if some youngsters are asymptomatic, they can spread the virus. Common symptoms in children include: Fever, cough, shortness of breath

Some COVID-19-infected children and teenagers have an inflammatory condition that may be connected to the coronavirus. Pediatric multisystem inflammatory syndrome is what doctors name it (PMIS). Fever, rash, stomach ache, vomiting, diarrhoea, and heart issues are all symptoms. It's related to toxic shock or Kawasaki illness, a blood vessel inflammatory syndrome that affects youngsters.

When should you get covid-19 tested?

If you haven't been vaccinated, you should get tested if you have any of the following symptoms:

- Do you have any COVID-19 symptoms?
- Over the course of a 24-hour period, you were within 6 feet of someone who had COVID-19 for 15 minutes or more. (This includes asymptomatic individuals.)
- You've been asked to get tested by your doctor, business, or school because you've been somewhere where you're more likely to be exposed to the virus, such as a large social gathering or a packed indoor event.

If you've been vaccinated and are experiencing COVID-19 symptoms, contact your doctor for advice. If you've been vaccinated and don't have any symptoms, there's usually no reason to be tested.

How to determine if you have a fever

It's possible that your normal body temperature is greater or lower than someone else's. It changes throughout the day as well. If you suspect you've been exposed to the virus or are experiencing symptoms, isolate yourself for at least 14 days and take your temperature every morning and evening. Keep a record of your readings. The most prevalent sign of COVID-19 is a fever, which can sometimes be below 100 degrees Fahrenheit. A fever in a child is defined as a temperature that exceeds 100 degrees Fahrenheit on an oral thermometer or 100.4 degrees Fahrenheit on a rectal thermometer. Unless you requires medical attention, stay at home. If you do need to go, seek advice from your doctor or hospital first. Inform your doctor about your condition. They may give you further advice if you're at a greater risk of complications due to your age or other medical concerns.

Isolate yourself from the world. This entails avoiding other people as much as possible, including family members. Stay in a designated "sick room" and, if possible, use a separate restroom. If you have to be around other people, wear a face mask. This includes the people with

whom you share your home. If wearing a mask makes it difficult to breathe, stand at least 6 feet away from others and cough or sneeze while covering your mouth and nose. After that, wash your hands for at least 20 seconds with soap. Get plenty of rest and drink lots of water. Over-the-counter medications may assist you in feeling better. Keep a record of your signs and symptoms. If they worsen, seek medical attention right away. Keep a record of your signs and symptoms. If they worsen, seek medical attention right away.

What does it feel like to have shortness of breath?

Shortness of breath or difficulty in breathing is referred to as dyspnea by doctors. It may appear that you: have tightness feeling in your chest, can't catch your breath, can't get enough amount of air into your lungs, can't breathe deeply, are smothering, drowning, or suffocating, have to work little bit harder than usual to breathe in or out, need to breathe in again before you're done breathing out.

You should have to monitor your oxygen levels periodically, and if they dip into the 80s, contact your doctor. If you observed your face and/or lips get a bluish tint, call 911 right away.

Difference between COVID-19 and Flu. COVID-19 and influenza (Flu) are both infectious respiratory infections caused by distinct viruses. Infection with a novel coronavirus (named SARS-CoV-2) causes COVID-19, while influenza is caused by infection with influenza viruses.

COVID-19 appears to be more contagious than flu and can cause more serious disease in certain people. It may also take longer for patients to develop symptoms, and they may be contagious for extended periods of time. In the sections below, you'll find more information regarding the differences between flu and COVID-19. Because certain flu and COVID-19 symptoms are similar, it may be difficult to distinguish between them based on symptoms alone, and testing may be required to establish a diagnosis.

Chemotherapy:

There are currently no approved therapeutic medicines or therapies for the treatment of COVID-19 due to the lack of knowledge about SARS-CoV-2. Effective and safe vaccinations, antibodies, and specific anti-SARS-CoV-2 medications are urgently needed as the global epidemic worsens. Although neutralising antibodies are likely to be effective against SARS-CoV-2 infection, costs, production sizes, and coverage rates remain unknown. Due to careless vaccine design and/or virus mutation, vaccine development also confronts challenges such as timeliness and ineffectiveness.

Antiviral medications with high potency and safety may be more difficult to produce at this time due to our limited knowledge about the virus world and host responsiveness, in contrast to vaccines, which have a very defined mechanism and route in development. This could be why there hasn't been a decent antiviral medicine accessible until now. An antiviral drug's potential in

vivo harmful effect, which is believed to be effective in vitro, may be overshadowed by its pharmacological acclaim. To overcome the inadequacies of current reductionism-based drug research, new and innovative ideas and pathways for antiviral medication design and development are required. The FDA has approved the use of ritonavir-boosted nirmatrelvir (Paxlovid) and molnupiravir as COVID-19 therapies in non-hospitalized patients with little bit mild to moderate COVID-19 who are at high risk of developing to serious disease as of December 23, 2021. Paxlovid (nirmatrelvir 300 mg plus ritonavir 100 mg) orally twice daily for 5 days.

- Sotrovimab - 500 mg should be administered as a single intravenous (IV) infusion.
- Remdesivir- 200 mg IV on Day 1 should be given followed by remdesivir 100 mg IV on Days 2 and 3.
- Molnupiravir -800 mg should be given orally twice a day for 5 days.

Recommended vaccines:

Different vaccines were recommended worldwide for COVID-19. Some are as follows.

COVISHIELD (Manufactured by Serum Institute of India), formerly ChAdOx1 nCoV-19, is a virus (ChAdOx1) that is an attenuated version of a common cold and flu virus (adenovirus). Additionally, genetic material has been introduced to the ChAdOx1 construct, which is utilised to generate Spike glycoprotein proteins from the SARS-CoV-2 coronavirus (S). The World Health Organization (WHO) endorsed the COVID-19 Vaccine (ChAdOx1-S [recombinant]), also known as COVISHIELD, by the Serum Institute of India (SII) on February 15, 2021.

COVAXIN: Bharat Biotech manufactured COVAXIN, which is an indigenous COVID-19 vaccine, in a conjunction with renowned institutes the Indian Council of Medical Research (ICMR) - National Institute of Virology (NIV). The vaccine(covaxin) is developed by using a platform which is derived from the Whole-Virion Inactivated Vero-Cells. The inactivated vaccines do not multiply, or unlikely to revert and cause disease. They also include the dead viruses or viral particles that are unable to infect human beings but can teach the immune system to produce a defensive immune response in the face of infection. So far covaxin vaccine has been given to 110.6 million of people in India as of October 2021. This vaccine was validated for emergency use by the World Health Organization (WHO) on November 3, 2021.

Sputnik V is Russian Vaccinedeveloped by using adenovirus viral vector for COVID-19 and created by the Gamaleya Research Institute of Epidemiology and Microbiology in Russia under the brand name RDIF or Gam-COVID-Vac under which it is patented and produced. It is the world's first registered combined vector vaccine for COVID-19, have been approved by the Russian Ministry of Health on August 11, 2020. V (RDIF brand name) is a COVID-19 adenovirus viral vector vaccine produced by Russia's Gamaleya Research Institute of

Epidemiology and Microbiology. 'Victory [against COVID-19]' is the meaning of the 'V' in its name.

Cadila Zydus ZyCoV-D is the world's first DNA plasmid vaccination for human use, developed by Zydus Cadila in-house against COVID-19, according to the firm. The three ZyCoV-D doses are scheduled to be given 28 days apart. On August 20, the Indian pharma regulator granted the vaccine emergency use authorization (EUA). The vaccine will be delivered using a needle-free applicator known as "PharmaJet," which ensures painless intradermal vaccine delivery while simultaneously lowering the risk of substantial side effects.

Novavax (protein vaccine) was developed by utilizing recombinant nanoparticle technology and it contains the full-length SARS-CoV-2 spike protein as well as a Matrix-M1 adjuvant (an additional vaccine component that boosts the immune response). The TGA (Therapeutic Goods Administration) gave Novavax provisional approval for the production of COVID-19 vaccine on January 19, 2021.

References:

1. Chan, J.F., Yuan, S., Kok, K.H., To, K.K., Chu, H., Yang, J., (2020). A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: A study of a family cluster. *Lancet (London Eng)* 395, 514–523. doi:10.1016/s0140-6736(20)30154-9.
2. Ghinai, I., McPherson, T.D., Hunter, J.C., Kirking, H.L., Christiansen, D., Joshi, K., (2020b). First known person-to-person transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in the USA. *Lancet (London Engl and)* 395, 1137–1144. doi:10.1016/s0140-6736(20)30607-3.
3. Gralinski, L.E., and Menachery, V. D. (2020). Return of the coronavirus: 2019- n CoV. *Viruses* 12, 135. doi:10.3390/v12020135.
4. Hu, B., Guo, H., Zhou, P., and Shi, Z.-L. (2020). Characteristics of SARS-CoV-2 and COVID-19. *Nat. Rev. Microbiol.* doi: 10.1038/s41579-020-00459-7.
5. Hu, J., He, C., Gao, Q., Zhang, G., Cao, X., Long, Q., (2020). The D614G mutation of SARS-CoV-2 spike protein enhances viral infectivity and decreases neutralization sensitivity to individual convalescent sera. *Preprint Server Biol.* doi: 10.1101/2020.06.20.161323.
6. Lai, C.C., Shih, T.P., Ko, W.C., Tang, H.J., and Hsueh, P.R. (2020). Severe acute respiratory syndrome coronavirus 2(SARS-CoV-2) and coronavirus disease-2019(COVID-19): the epidemic and the challenges. *Int. J. Antimicrobial Agents* 55, 105924. doi:10.1016/j.ijantimicag.2020.105924.

7. Lamers, M.M., Beumer, J., van der Vaart, J., Knoops, K., Puschhof, J., Breugem, T.II, (2020). SARS-CoV-2 productively infects human gut enterocytes. *Sci. (N. Y.N.Y.)*369, 50–54.doi:10.1126/science.abc1669.
8. Lamers, M.M., Beumer, J., van der Vaart, J., Knoops, K., Puschhof, J., Breugem, T.II, (2020). SARS-CoV-2 productively infects human gut enterocytes. *Sci. (N. Y.N.Y.)*369, 50–54.doi:10.1126/science.abc1669.
9. Lan, J., Ge, J., Yu, J., Shan, S., Zhou, H., Fan, S., (2020). Structure of the SARS- CoV-2 spike receptor-binding domain bound to the ACE2 receptor. *Nature*581, 215–220.doi:10.1038/s41586-020-2180-5.
10. Lee, I.C., Huo, T.II, and Huang, Y.H. (2020). Gastrointestinal and liver manifestations in patients with COVID-19. *J. Chin. Med. Assoc. JCM*83, 521–523.doi:10.1097/jcma.0000000000000319.
11. Liu, S., Xiao, G., Chen, Y., He, Y., Niu, J., Escalante, C.R., (2004). Interaction between heptadrepeat and regions in spike protein of SARS-associated coronavirus: Implications for virus fusogenic mechanism and identification of fusion inhibitors. *Lancet (London England)* 363, 938–947.doi:10.1016/s0140-6736(04)15788-7.
12. Liu, Y., Mao, B., Liang, S., Yang, J.W., Lu, H.W., Chai, Y.H., (2020). Association between age and clinical characteristics and outcomes of COVID-19. *Eur.Respirat.J.*55, 2001112.doi:10.1183/13993003.01112-2020.
13. Naqvi, A.A.T., Fatima, K., Mohammad, T., Fatima, U., Singh, I.K., Singh, A., et al. (2020). Insights into SARS-CoV-2 genome, structure, evolution, pathogenesis and the rapties: Structural genomics approach. *Biochim. Biophys. Acta Mol. Basis Dis.*1866, 165878.doi:10.1016/j.bbadis.2020.165878.
14. Singla, R., Mishra, A., Joshi, R., Jha, S., Sharma, A.R., Upadhyay, S., (2020). Human animal interface of SARS-CoV-2(COVID-19) transmission: A critical appraisal of scientific evidence. *Veterinary Res.Commun.*44, 119–130. doi: 10.1007/s11259-020-09781-01-12.
15. Sun, P., Lu, X., Xu, C., Sun, W., and Pan, B. (2020). Understanding of COVID-19 based on current evidence. *J.Med.Virol.*92, 548–551.doi:10.1002/jmv.25722.
16. Tang, S., Mao, Y., Jones, R.M., Tan, Q., Ji, J.S., Li, N., (2020). Aerosol transmission of SARS-CoV-2? evidence, prevention and control. *Environ. Int.* 44, 106039.doi:10.1016/j.envint.2020.106039.
17. Tang, X., Wu, C., Li, X., Song, Y., Yao, X., Wu, X., (2020). On the origin and continuing evolution of SARS-CoV-2. *Natl.Sci. Rev.*7, 10121023.doi:10.1093/nsr/nwaa036.
18. Wang, G., and Jin, X. (2020). The progress of 2019 novel coronavirus event in China. *J.Med.Virol.*92, 468–472.doi: 10.1002/jmv.25705.

19. Wang, C., Li, W., Drabek, D., Okba, N.M.A., vanHaperen, R., Osterhaus, A., (2020). A human monoclonal antibody blocking SARS-CoV-2 infection. *Nat. Commun.*11, 2251.doi:10.1038/s41467-020-16256-y.
20. Xiao, K., Zhai, J., Feng, Y., Zhou, N., Zhang, X., Zou, J.J., (2020). Isolation of SARS-CoV-2-related coronavirus from Malayan pangolins. *Nature*583, 286–289.doi:10.1038/s41586-020-2313-x.
21. Zhang, R., Li, Y., Zhang, A.L., Wang, Y., and Molina, M.J. (2020). Identifying airborne transmission as the dominant route for the spread of COVID-19. *Proc.Natl. Acad.Sci. U.S. A.*117, 14857–14863.doi:10.1073/pnas.2009637117.
22. Zhang, T., Wu, Q., and Zhang, Z. (2020). Probable Pangolin Origin of SARS-CoV-2 Associated with the COVID-19 Outbreak. *Curr. Biol.*CB30, 1346–1351.e1342.doi:10.1016/j.cub.2020.03.022.
23. Zhou, P., Yang, X.L., Wang, X.G., Hu, B., Zhang, L., Zhang, W., (2020). A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature* 579, 270–273.doi:10.1038/s41586-020-2012-7.
24. <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>
25. <https://www.covid19treatmentguidelines.nih.gov/about-the-guidelines/whats-new/>
26. <https://www.precisionvaccinations.com/vaccines/covishield-covid-19-vaccine>
27. <https://www.bharatbiotech.com/covaxin.html>
28. <https://www.precisionvaccinations.com/vaccines/sputnik-v-vaccine>
29. <https://www.cnbtv18.com/healthcare/zydus-cadilas-needle-free-covid-vaccine-to-be-introduced-soon-11849142.htm>
30. <https://mvec.mcri.edu.au/references/novavax-covid-19-vaccine/>

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