

Treatment and control strategies for COVID-19: Prospects and possibilities

Kinza Khan¹ and Tahir Yaqub²

¹Department of Pathobiology, Bahauddin Zakariya University, Multan, Pakistan

²Department of Microbiology, University of Veterinary and Animal Sciences, Lahore, Pakistan

Abstract: COVID-19 is a highly contagious and infectious disease, spreading rapidly worldwide. Its high spread rate has turned it into public stigma. The current study is focusing on its treatment and control strategies on the basis of the facts and figs obtained from previous studies. Supplementation of infected person with minerals and vitamin would be very beneficial for faster recovery like in any other acute viral infection. Blood of a recovered person in any outbreak is very precious because it is containing high levels of neutralizing antibodies, memory T and B cells population. Both serum and buffy coat fractions of the blood will helpful for treatment as well as prophylaxis. The S proteins (spike) of SARS CoV 2 and SARS CoV 1 have 70% similarity so the vaccine available for SARS would also be effective for COVID-19. Besides this, genome of SARS CoV 2 has been sequenced successfully and it is quite easy for the scientists to prepare DNA based vaccines and peptide-based subunit vaccines targeting the S protein of the virus. To control the spread of COVID-19, various disinfectant and antiseptics are very useful. The virus is also susceptible to heat, low pH and UV light so hot climatic conditions are also lethal to this virus.

Keywords: COVID-19, SARS CoV 2, treatment, control, corona viruses.

INTRODUCTION

The coronavirus disease 2019 (COVID-19) is a highly contagious disease which started as an epidemic in December 2019 in Wuhan city of China in Hubei Province. The disease spread rapidly across the China and to the other countries, rising as a major global health concern (Ghinai *et al.*, 2020). The etiology of this disease is a corona virus named as SARS CoV 2, for its similarity of symptoms with those produced by the severe acute respiratory syndrome (SARS) (Fauci *et al.*, 2020; Shang *et al.*, 2020). Unlike other corona viruses which utilize dipeptidyl peptidase (DPP4) and aminopeptidase N (APN) receptors for cell entry, SARS CoV 2 utilizes the same receptors as used by SARS CoV 1 i.e. Angiotensin-converting enzyme 2 (ACE2) receptors (Zohu *et al.*, 2020). Five out of six amino acid residues are different on receptor binding site of spike protein between these two viruses and SARS CoV 2 has more affinity to the ACE2 receptors than the SARS CoV 1 (Tang *et al.*, 2020). Natural reservoirs of corona viruses are bats in which they also evolutionarily shaped (Banerjee *et al.*, 2019) because it has been proposed that most of the corona viruses of humans are originated from the bats (Cui *et al.*, 2007).

The initial transmission of SARS CoV 2 is considered to be a sea food market where most of the earliest patients visited or worked (Wu *et al.*, 2020a). There after the disease progressed and now person to person contact is the main transmission mode (WHO, 2020a). Contact transmission of this virus resembles with that of influenza i.e. aerosols produced by coughing, talking or sneezing of

an infected person. When these droplets come in contact with the mucous membranes of the nearby person, the virus inside them gets enter into the next host. But the droplets do not travel long (<6ft) and do not remain suspended in air. Incubation period of the disease is 14 days and besides other common respiratory symptoms, pneumonia is the most serious and frequent manifestation of infection (Van Doremalen *et al.*, 2020). Symptomatic intensity of the disease increases with the increase of age (Wu *et al.*, 2020b).

The disease has become a public stigma due to its rapid spread among the human population across the globe. To combat this malady, several efforts are going in the area of diagnosis and treatment. Current study was designed to obtain data from previously published press to find the suitable treatment and control strategies to warfare this disease.

MATERIALS AND METHODS

An up to date search (until March 2020) was made from the following databases: PubMed, Science direct and google scholar with the key word 'COVID-19' and/or 'SARS CoV 2', 'Corona viruses', 'Treatment' and 'control'.

Findings

Treatment Strategies

Balanced Diet

Our body needs sufficient essential nutrients to maintain good health so a balanced diet containing these nutrients is necessary. Any deficiency or excess can welcome to the

*Corresponding author: e-mail: kinzakhan@bzu.edu.pk

disease (Oz *et al.*, 2017). Polysaccharides, which are active biologically e.g. glucans act as anti-inflammatory and immunomodulators in respiratory tract infections. These infections commonly infect the children and elderly persons due to immature immune system and immunosuppressive complications respectively. Major sources of glucans are yeast and *Pleurotus Ostreatus* (Josanek *et al.*, 2017).

Amino acids like arginine and glutamine have Immune-modulating effects. Arginine acts as a substrate for nitric oxide synthesis and increases the T-lymphocyte (helper cells) while glutamine is a precursor of glutathione which is required to relieve from oxidative stress and boost the cell-mediated immunity (Giontti *et al.*, 1999; Houdijk *et al.*, 1998; Morlion *et al.*, 1998).

Besides these, immune components like antibodies and cytokines are proteins in nature so inclusion of protein rich diet in routine help to induce a protective immune response against any infection.

Vitamins and mineral supplements

Fat soluble vitamins (ADEK) and microminerals i.e. zinc, copper and selenium play important role in immune modulation especially in augmentation of T and B lymphocytic immune responses illustrated in fig. 1 (Kaminogawa *et al.*, 2004). Vitamins i.e. A and E act as anti-oxidant and prevent the body from oxidative radicals of inflammatory metabolites during viral infection (Beck *et al.*, 2000; Yamshchikov *et al.*, 2009). Decrease vitamin D to A ratio also leads to the activation of viral infections (Mawson, 2012).

Inclusion of immune booster foods in diet

Nigella sativa seeds are renowned for their immune booster properties and therapeutic effects in various ailments including viral infections. Thymoquinone is the active component of these seeds for antiviral activity (Gholamnezhad *et al.*, 2015). In a study effect of *N. sativa* extract was tested on lung pathology in artificially induced inflammatory conditions in guinea pigs by using interleukin-4 and gamma interferon. The results showed a significant reduction in inflammation in test group in comparison to control group (Boskabady *et al.*, 2011).

Immunotherapy

Blood of recovered patients is very precious during an outbreak, because it contains both antigen specific antibodies as well as sensitized T-cell population, which can be used both as a treatment for the patients as well as prophylaxis for the susceptible people including medical staff and doctors, immune-compromised patients, elderly persons as well as children under 10 years of age (Roberts *et al.*, 2006). So, both serum and buffy coat fractions are effective to provide passive immunity (Hedge *et al.*, 2009). During SARS outbreak, passive serotherapy can

provide potentially immediate protection against infection for contacts and medical personnel; a cure of infected individuals is also possible. In a study, monoclonal antibodies were raised successfully against SARS CoV 1. B cells from a recovered patient were taken and immortalized by infecting them with Epstein-Barr virus (EBV). The transformed cells produced antigen specific monoclonal antibodies which efficiently neutralized antigen both in vitro and in vivo (Traggiai *et al.*, 2004).

Anti-viral Drugs

Drugs effective against coronaviruses especially against SARS CoV 1, belong to either any of these groups would also be effective to control SARS CoV 2:

1) Compound that cause blockage of S protein-ACE2-mediated viral entry; 2) Compounds that target SARS-CoV M protein; 3) Compounds that target papain-like protease 2 (PLP2); 4) Compounds that target SARS-CoV RdRp; 5) Compounds that target SARS-CoV helicase (Wu *et al.*, 2006).

Control Strategies

Vaccination

Studies have shown that SARS CoV 2 has 70% antigenic similarity with S protein of SARS CoV 1. S protein is the surface antigen known as spike protein in coronaviruses which is responsible for their entry into the host cells (Shang *et al.*, 2020). A vaccine produced against SARS CoV 1 would also provide protection against SARS CoV 2. Furthermore, genetic sequence of SARS CoV 2 has also been uploaded on NCBI database, so a recombinant vaccine can also be synthesized by using gene sequence of S protein (Shang *et al.*, 2020).

Disinfection and Antisepsis

Mechanism by which alcohols inactivate microbes is protein denaturation. At concentrations of 60%–80%, ethyl alcohol is a potent virucidal agent inactivating all of the lipophilic viruses. Isopropyl alcohol is not active against the non-enveloped enteroviruses but is fully active against the enveloped viruses so the routine sanitizers are useful to inactivate enveloped viruses including corona viruses. Soaps are useful for mechanical removal as well as react with lipid membranes of microbes for antisepsis. For disinfection, common household detergents, bleach and phenyl are effective to inactivate enveloped viruses (Rutala *et al.*, 2008; WHO, 2020b).

Aqueous solutions of 5.25%–6.15% hypochlorites, usually called household bleach have a broad-spectrum antimicrobial activity. Inactivation by chlorine can result from a number of factors, mechanism involved in inactivation of enveloped viruses include oxidation of amino acids; ring chlorination of amino acids; breaks in DNA and depressed DNA synthesis (Rutala *et al.*, 2008).

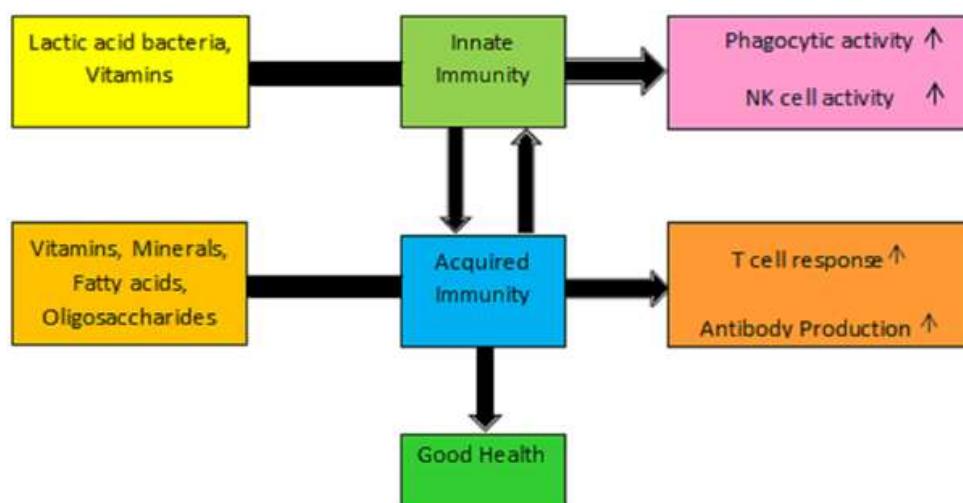


Fig. 1: Importance of essential nutrients for immune modulation

Phenol derivatives (phenolics) originate when a functional group (e.g., alkyl, phenyl, benzyl, halogen) replaces one of the hydrogen atoms on the aromatic ring. Two phenol derivatives commonly found as constituents of hospital disinfectants are *ortho*-phenylphenol and *ortho*-benzyl-*para*-chlorophenol. Mode of action of these compounds is protein denaturation. At a concentration of 2.8% *ortho*-phenylphenol and 2.7% *ortho*-benzyl-*para*-chlorophenol, they are found to be effective to inactivate enveloped viruses (Rutala *et al.*, 2008).

Environmental Factors

Coronaviruses are susceptible to high temperatures and desiccation. In a study on SARS CoV 1, the virus was found inactivated at 58°C for 30 minutes and at 68°C for 10 minutes. Unlike other coronaviruses SARS CoV 1 can survive at alkaline pH i.e. up to 11 but effectively inactivate at pH above 12 and below 3 (Darnell *et al.*, 2004; Rabenau *et al.*, 2005).

Coronaviruses are also found to be susceptible to ultraviolet radiations, SARS CoV 1 is found to be susceptible to UV rays at a wavelength of 254nm for 15 minutes (Ter Meulen *et al.*, 2006).

CONCLUSION

COVID-19 is contagious but controllable disease, by adopting certain precautionary measures. Use of balanced diet and inclusion of vitamin supplements as well as immune boosting food in routine diet will help an infected person to combat the disease and get healthy soon. In this regard, use of antiviral drugs targeting the specific parts of coronavirus would also be helpful to decrease the infection. Pre and post-exposure immunotherapy would be helpful to provide immediate protection to the susceptible population including health care personals and immune-compromised persons during the outbreak. Subunit vaccine against SARS CoV 2 targeting the spike

protein in or by using SARS CoV 1 virus in whole virus vaccine would be help to immunize the healthy population to avoid the spread of the disease. Like the other enveloped viruses, coronaviruses are also susceptible to routine disinfectants and antiseptic agents so washing hands with soap and water or using hand sanitizers will minimize the risk of infection. Washing the inanimate surfaces and regular cleaning of house with phenyl and household bleach would also keep the environment hostile for survival of coronavirus. Physical factors like high temperature above 48 °C, pH <3 or >12 and UV light at a wavelength of 254nm are also lethal for coronavirus survival.

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