MINI-REVIEW ARTICLE

Nutritional Intervention for the Treatment and Prevention Against Novel Coronavirus-19

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Abstract: Introduction: The ongoing pandemic of Severe Acute Respiratory Syndrome coronavirus-2 (SARS COV-2) has jeopardized people’s health and the global economy. The infection caused by these viruses inflicts immunosuppression and an unprecedented range of symptoms leading to mortality. At this stage, there are no countermeasures or medicines to overcome rapid disease proliferation and aberrant immunological response.

Objectives: The study aims to determine different immunomodulatory therapeutics that could be potential agents to alleviate viral and other lethal infections and possibly rejuvenate immunological and tissue repair response against this disease.

Methods: A review of the literature was performed by screening different scientific databases to procure various immunomodulatory therapies for the treatment of SARC COV-2.

Results: A comprehensive literature review indicated that different foods rich in vitamins (A-D), selenium and iron can enhance immunological response against various deleterious infections, whereas different nutritious drinks that include hydrogen-enriched water and green tea alleviate inflammation and elicit wound healing properties. Black cumin seeds and Garlic have a myriad of biological activities due to abundant bioactive phytochemicals that play an important role in the elimination of various bacterial and viral infections.

Conclusion: These foods/supplements are relatively safe to consume and possess high toxicity profile and could be a potential nutritional intervention in order to create adequate immunity within a population to fight against this prevailing infection.

Keywords: Novel coronavirus 19, immunity, nutrition, treatment, prevention, therapeutics, severe acute respiratory syndrome coronavirus-2

1. INTRODUCTION

The emergence of Severe Acute Respiratory Syndrome coronavirus-2, also known as Novel coronavirus 19 (COVID-19), has rigorously shaken the entire world with its bewildering transmission pattern and disease nature. It was first reported in China as an endemic disease, a minuscule outbreak that turned out to be a global nightmare with more than 5.5 million cases of active SARS COV-2 infection and approximately a million mortalities due to severe viral complications worldwide. The rate of mortality is fluctuating in between 3-6%, and it is assumed that adults (age group >60) and underlying secondary conditions make them more vulnerable [1]. The fear of contracting this disease is rising among the general population and there is insufficient data about who is more likely to be infected or die with this disease [2]. This uncertainty is creating a burden of chronic stress among the population, elevating the peril of developing cortisol dysfunction [3]. The risk imposed by the stress hormone cortisol is also participating in the immunosuppression and disease development analogues to COVID-19 symptoms.

On the other hand, self-diagnosing and medication without physician consultation is not an uncommon practice [9]. Various do it yourself (DIY) and non-verified treatments listed on different online platforms indicating immune-enhancing and anti-COVID-19 properties are also on the rise, which is also putting gullible souls in great jeopardy in the ongoing pandemic [10, 11]. In these circumstances, there is a critical need for an alternate measure to control and treat this disease amid quarantine and clinical settings. Therefore, this study aims to discuss those foods and supplements which are involved in boosting immunity and holds antiviral activity that might be effective against this viral infection.
Furthermore, the COVID-19 infection has non-specific clinical manifestation and its understanding is imperative. Some common symptoms that have been observed are cough, fatigue, fever and myalgia [4]. In the preliminary stages of infection, patients may experience nausea and diarrhea before the onset of fever, whereas some encounter headaches, hemoptysis, or gustatory or olfactory dysfunction [5, 6]. In the later stages, the disease takes a violent turn causing acute respiratory distress and multiorgan failure, eventually death [7].

2. NUTRITIONAL INTERVENTION

2.1. Hydrogen Enriched Water

Hydrogen enriched water is purified water permeated with molecular hydrogen equipped with antioxidants, anti-inflammatory, and neuroprotective properties [12, 13]. The intake of such water stimulates antioxidant enzymes, i.e., superoxide dismutase, catalase-peroxidases and glutathione peroxidase in combination with other enzymes, strengthen the immune system, alleviate inflammation, and reduces oxidative stress [14, 15].

Many COVID-19 affected patients develop acute respiratory distress syndrome, which progress to pulmonary edema and lung dysfunction, ultimately havoc reaches to the kidney, heart, and liver [7]. These complications are associated with a cytokine storm, manifesting high serum levels of granulocyte stimulating factors, interferon, inflammatory cytokines, and macrophage inflammatory proteins [4]. These proteins together promote severe inflammatory response during the course of COVID-19 infection. Various molecular studies revealed anti-inflammatory properties of hydrogen-rich water as it reduces the expression of different inflammatory markers, promote phagocytic functions, expedites energy metabolism and revives immunological response to eradicate the infection and provoke tissue rehabilitation [13, 16]. Hence, it could be useful for those individuals suffering from COVID-19 disease, including those who are susceptible to infections or having underlying secondary conditions.

2.2. Vitamin A

These are the group of unsaturated organic compounds that are comprised of retinoic acid, retinal, and beta carotene. It is an essential micronutrient found in different fruits and vegetables, animal and oil sources. The functions of vitamin A are to provide a protective barrier against infections, immune system maintenance, skin rehabilitation, and play a vital role in vision and reproduction [17]. Inadequate intake of vitamin severely damages immune response by impairing immunological barriers of immunoglobulin-A around mucous membranes and reduces lymphocytic response making an individual seriously vulnerable to deleterious infections [18, 19]. Some studies highlighted the importance of vitamin A in HIV infected mothers; it was observed that supplementation of vitamin A in HIV infected breastfeeding and pregnant women substantially reduced the vertical transmission of HIV among infants [20]. Other reports show that vitamin A facilitates lymphopoiesis and expression of cytokines, regulates the functions of both adaptive and innate immune cells, and directs the production of antibodies [17, 21]. Therefore, vitamin A could be a hopeful therapeutic option to expedite immunodevelopment against the SARS COV-2 virus.

2.3. Vitamin B

Vitamin B belongs to the class of water-soluble vitamins, recognized for their role as coenzyme or cofactor of various essentials enzymes involved in metabolic processes. These vitamins are further classified into eight types based on different chemical structures i.e., Vitamin B1 (Thiamine), Vitamin B2 (Riboflavin), Vitamin B3 (Nicotinamide), Vitamin B5 (Pantothenic acid), Vitamin B6 (Pyridoxine), Vitamin B7 (Biotin), Vitamin B9 (Folate) and Vitamin B12 (Cobalamin). These vitamins are commonly found in meat-related products and some carbohydrate-based food products. They play a vital role in energy-generating metabolic pathways required by cells for DNA synthesis and cell division [22]. Also, one of their astounding role is to attach themselves with antigen-presenting cells in the eradication of various microbial infections [23, 24]. Other functions of vitamin B include the elimination of MERS-COV in human plasma [25], and lung inflammation suppressor by suppressing neutrophil infiltration [26]. Deficiency of these vitamins seriously jeopardizes the host immunological role, growth and developmental processes that increase the risk of mortality in COVID-19 infected patients. Therefore, by keeping their vital role in consideration, it is strongly advised to utilize vitamin B in order to ameliorate the patient’s recovery and expedite immunity development against these deleterious infections.

2.4. Vitamin C

Vitamin C is another member of water-soluble vitamins known as Ascorbic acid. These are active anti-oxidant, sequester reactive oxygen species, repair DNA damage and regulate gene expression, act as an anticancer agent, promote the proliferation of new cells to repair damaged tissues and control immune response [27–30]. The rich sources of Vitamin C are chili peppers, red bell pepper, green bell pepper, strawberries, broccoli, kale, cauliflower, papaya, and citrus fruits. Vitamin C constructs a protective barrier to prevent microbial infiltration by directing the phagocytic activity of macrophages and neutrophils, promote proliferation and maturation of adaptive immune cells, and alleviate inflammation [31]. There are documented cases that signify the role of vitamin C in the prevention of respiratory [32] and systemic infections and provides adequate immunity against incoming various pathogens [33]. The therapeutic efficacy of vitamin C has been evaluated in COVID-19 infected patients in recent clinical trials [34]. It is observed that vitamin C expedite immunological development that led to their speedy recovery from COVID-19 infection. However, further studies are required to confirm its efficacy in large-scale clinical trials. Thus, vitamin C may perhaps be promising for the management of the COVID-19 infection.

2.5. Vitamin D

These are fat-soluble vitamins that are usually acquired from dairy products or synthesized through ultraviolet rays from sunlight. Vitamin D facilitates the absorption of cal-
cium, phosphate, and other metals in the gastrointestinal tract to mineralize bones and regulate proper neural signaling. Apart from that, they are involved in cell proliferation, DNA synthesis, immunomodulation, neuromuscular signaling and alleviate inflammation [35]. The role of vitamin D in immunoregulation is being under investigation in recent years. It is observed that adaptive immune cells such as B cells, dendritic cells, and T cells are equipped with vitamin D receptor capable of synthesizing vitamin D and also harbor and modulate these immune cells in foreign antigen recognition and differentiation [36–38]. Deficiency of Vitamin D not only affects bone integrity but also provokes autoimmunity and inflammation and increases susceptibility to lethal infections [39]. In SARS COV-2, Vitamin D functions as a cytokine storm suppressor, prevents immunosuppression and modulate both innate and adaptive immune systems against affected cells [40]. In addition, recent studies showed that patients suffering from COVID-19 infection had low vitamin D levels [41, 42]. Hence, vitamin D could be another treatment option for the treatment of COVID-19.

2.6. Selenium

An essential micronutrient mainly occurs as selenoproteins have fundamental importance in both structural and enzymatic functioning of human health. These trace metals possess biological activities such as antioxidant, antimicrobial, anti-inflammatory, hormones metabolism, DNA repair, as well as synthesis and possess immunomodulatory properties [43–45]. The deficiency of selenium compromises immune response but also incalculates rapid mutation in RNA viruses by infuriating their virulence and makes an individual vulnerable to Influenza and coxsackievirus infection [46, 47]. Selenium also regulates cytosolic glutathione peroxidases activity, Interferon-gamma, and other cytokines activity to direct proliferation of T-cells [48]. Another function of selenium is to stimulate Th1-type responses to develop antibodies against viral infections, cancer, and other deleterious allergic interaction [49]. Therefore, selenium supplementation could be a potential adjuvant for the treatment of COVID-19 infection.

2.7. Iron

Iron is another micronutrient required for the normal development of red blood cells, electron transport chain oxidation-reduction reactions, and immune system functioning. The role of iron in immunity is somehow skeptical, but with the collaboration of innate immune cells render antimicrobial properties, activates Toll-like receptor 4 signaling and inflammatory pathways to contain an infection [50]. Whereas, iron is critical for adaptive immune cells as it is involved in the differentiation of B- and T cells. Deficiency of iron not only jeopardizes red blood cells leading to anemia but also affects T and B cells lineage, aggravate inflammation by activating interferon-gamma and reduces Interleukin-4 responses [23, 51, 52]. SARS-CoV 2 primarily infects the respiratory tract and reported to show that iron deficiency leads to acute respiratory disorders [53]. Thus, the importance of iron must not be overlooked in order to treat COVID-19 infections.

2.8. Garlic

Garlic, botanically known as Allium sativum, belongs to the class of Allium that is renowned for a myriad of biological activities such as antimicrobial, anticancer, immunomodulatory, anti-diabetic, and anti-hyperlipidemic, including anti-atherosclerosis properties [54]. The phytochemical profile is comprised of Sulphur containing compounds, flavonoids, saponins, and allyl cysteine [55]. These agents are significantly involved in elevating the immune responses by stimulating natural killer cells activity, increases T-cell infiltration, downregulates NF-kB activity, and builds a protective barrier against various infections [56]. Some of these phytochemicals have the capability to dissolve clots [57], rejuvenate damaged tissues, [58] and induce cytotoxicity in cells hijacked by microbes [59]. Most of the individuals suffering from COVID-19 infections develop atherosclerosis or thrombotic clots leading to stroke or myocardial infarction apart from their deleterious activity in the lungs [60, 61]. The phytochemicals contained in the garlic could be a promising agent to avert clot formation and rejuvenate damaged tissues and immunomodulation against these infections.

2.9. Green Tea Catechins

Green tea catechins are polyphenolic compounds that are isolated from the leaves of Camellia sinensis. These catechins are composed of epicatechin-3-gallate (ECG), epigallocatechin (EGC) epigallocatechin-3-gallate (EGCG) and epicatechin (EC) [62]. These compounds possess a multitude of pharmacological properties, i.e., antimicrobial, antioxidant, anti-inflammatory, anti-diabetic, anticancer and immunomodulatory properties [63]. The compound (epigallocatechin-3-gallate) has antiviral potential against RNA viruses such as HCV, HIV, Ebola virus, Influenza virus, and Arbovirus and could be effective against SARS COV-2 infection [64]. Whereas, a mixture of these compounds elicits promising immunomodulatory responses such as adaptive immune cell proliferation, elevated natural killer cell activity, cytokine secretion, and immunorecognition of various infectious antigens [62, 65]. This could be beneficial in increasing immune and antiviral responses to possibly avert SARS-CoV-2 proliferation.

2.10. Black Cumin Seeds (Nigella sativa L.)

Black cumin seeds are derived from Nigella sativa L. plant that is a member of the Ranunculaceae family mainly occurs in the Mediterranean and South Asian countries. The chemical composition of these seeds is comprised of unsaturated fatty acids (30-40%), volatile oil (0.1-0.4%), proteins (21%), saponins and alkaloids [66]. Traditionally, these seeds are of great importance due to high nutritional and medicinal value, since ancient times. Black seed is known for its antibacterial, antiviral, antitumor, antioxidant, and anti-inflammatory activity and also possesses other important biological properties [67, 68]. These seeds elicit antiviral response against different viruses by recruiting CD4+ helper T cells and macrophages and stimulate IFN- gamma in order to suppress the viral proliferation and disrupt the RNA integrity of different RNA viruses [69]. Different bioactive compounds reside in the black cumin seeds, among them, thymoquinone and thymohydroquinone showed promising anti-
viral activity against a wide range of viruses, including SARS COV-2 [69, 70]. It is worth considering these seeds as the best therapy option for COVID-19 infection.

**CONCLUSION**

The incidence and severity of different pathogenic infections are mostly dependent on the immune profile and with age, it also fluctuates. For a healthy life, a common factor is a need for an adequate supply of micronutrients, vital for supporting immune function (Table 1). Supplementation of essential macro- and micronutrients may help to provide the basis for optimal immune functioning. The present review recaps that micronutrients in any form can improve the disease recovery process. The deficiency of micronutrients seriously impair cellular functions and immunity makes the body susceptible to life threatening infections similar to COVID-19. However, with a sufficient quantity of macro- and micronutrients, life threatening diseases like COVID-19 could be eliminated; therefore, a balanced diet with an optimal supply of nutrients could elevate the chances to fight back with deleterious infections.

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