



Booster Foods for Your Immune System: Healthy Notes to Consumers. A Short Review

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Abstract

This review article aims at raising and enhancing immunity to confront SARS-CoV-2 virus (the causative agent of COVID-19 disease) using dietary approaches. Because there is no effective treatment although some medicines approved by FDA, or a successful protective vaccine, the choice to combat this disease and one of the solutions depends on preventing and elevating level of immunity. Therefore, this review reports available scientific evidence that healthy eating can help enhancing the immune system and prevent diseases. Targeting consumers globally to notice much important types of healthy food (mentioned in this review) may help to build up a healthy immune body resistant against viruses and other bugs.

Keywords: Immunity; Food; COVID-19; Boosting Immune System

Introduction

The indications, attributes and treatment options of the COVID-19 are getting increasingly comprehended as the worldwide pandemic progresses; but the importance of adapted nourishment in the protection process is often under assessed. Nutrient inadequacy such as micronutrients seem to correlate with decreased immune function and the contrast would be best in assisting with battling against infection [1].

General wellbeing systems to improve quality of life as patients start their recovery from COVID-19 that is involving immune-nutrition could be an alternative way to promote immunity and increase health statues [2]. Ongoing research is elaborating the role of the essential nutrients that may play a role in boosting up immunity and public health.

Part I: Immuno-fortified food

Garlic (strongest food as an immune booster)

Garlic is known for its ability to fight the infections caused by the viruses, bacteria and fungi [3]. Garlic might help in lowering blood pressure and reduce arteriosclerosis [4]. Its enhancement properties in the immune system appears to become from the adaptive focus of sulfur-containing compounds, such as allicin, therefore garlic thought to have more than 70 other medical benefits [5].

Onions (the second most powerful food as an immune booster)

Onions are one of the most used natural remedies to combat the respiratory infections and enhancing the immune system for its antiseptic properties and the presence of many vitamins, mineral salts, sulphur, magnesium, iron and sodium, it fights many diseases such as Diabetes Mellitus, heart disease, other infectious diseases, digestive problems and more than 40 other medicinal benefits [6].

Citrus fruits

These are rich in vitamin C which include grapefruit, oranges, tangerines, and lemons, among others. Vitamin C is established to help boost the immune system and it has been believed to increase the production of white blood cells which play a crucial role in fighting variable infections [7].

Since the human body does not produce or store vitamin C, daily consumption is essential to maintain the health of the body. An example of other foods rich in vitamin C includes: tomatoes, potatoes, strawberries, green, red peppers, broccoli, kiwi, and others [8].

Broccoli and spinach

Broccoli is rich in vitamins and minerals, especially vitamins A, C and E, as well as many other antioxidants and fibers. It is one of the healthiest vegetables [9]. It has been recommended to cook broccoli as little as possible to enjoy its benefit. Spinach has been established to be rich with many antioxidants and beta-carotene, which may increase the ability of the immune system to fight infection [10]. As same as broccoli, spinach has been observed to be healthier when it is cooked as little as possible to preserve nutrients. However, mild cooking enhances vitamin A and allows the transport of other nutrients from oxalic acid [11].

Red pepper

It has been revealed that the red pepper contains double amount of the vitamin C which found in the citrus fruits. It is also a rich source of beta-carotene [12]. In addition, to its rule in the boosting the immune system, Vitamin C might help to keep the skin healthy. It has been established that Beta-carotene helps to keep skin clean [13].

Almonds and other nuts

Almonds contain vitamin E which is significant to a healthy immune system. It is a fat-soluble vitamin, which means that it needs to absorb fat properly [14]. Nuts, like almonds, they are full of vitamin E and also have healthy fats that it is rich with unsaturated fatty acids such as Omega-3. It has been shown that almonds and nuts might prevent and combat colds [14].

Chicken soup

Chicken soup has been shown to improve the cold symptoms and it might help to protect against the development of the respi-

ratory diseases. Poultry, such as: chicken, turkey, and ducks are established to be rich in vitamin B6 which is one of B complex vitamins [15].

Vitamin B6 plays a significant role in many chemical reactions that take place in human body. It has a crucial rule for the formation of new and healthy red blood cells. Broth made from boiled chicken bones contains: gelatin, chondroitin and other nutrients which have been shown to be beneficial for the healing of the intestine [16].

Green tea and black tea

Green and black tea are containing flavonoids which are a type of antioxidant. It contains high levels of Epigallocatechin Gallate (EGCG), a powerful antioxidant. EGCG has been shown to boost the function of the immune system [17]. Green tea has been shown to be a good source of L-theanine. Green tea might help in the production of anti-microbial compounds (T cells) [18].

Honey

Honey contains antioxidants, for example: secondary plant materials, flavonoids, and ascorbic acid all are available in the natural honey [19]. It has been observed that it improves the levels of white blood cells such as: lymphocytes (both T and B cells which produce are producing plasma cells that developing antibodies), eosinophils, neutrophils, monocytes, and natural killer cells which are the essential cells of immune response to inflammation [20].

Mushrooms

Numerous investigations have been led to explain the antitumor activity of mushrooms. Therapeutic mushrooms, for example, *Ganoderma lucidum* and *Agaricus bisporus* have been proposed as a novel treatment that may improve malignant growth treatment and patients' endurance [21]. Medicinal mushrooms are accounted for to have antimicrobial, hepatoprotective, and anticancer properties. It is settled that mushrooms are proficient at invulnerable adjustment and influence hematopoietic, macrophages, T and B lymphocytes and dendritic cells [22].

Yogurt

It has been shown that the consumption of large amount of yogurt particularly among groups of patients suffering from lowered immunity, such as the elderly might activate their immune re-

sponse [23]. Subsequently, this might increase the resistance of the immune system to many diseases such as: infection, asthma, and others. It has been established that consumption of yogurt which containing probiotics (like *Lactobacillus*) might raise the levels of normal Natural Killer cells, interleukins, and titers of antibodies; which might help in improvement of the immune system [24]. Prebiotics and probiotics such as fructooligosaccharides (FOS) and various lactobacilli strains to improve gut dysbiosis and 'thereby improving overall immune response in such patients.

Improving gut health via gut microbiota of the people and patients is recommending with beneficial bacteria which have functional properties including particular probiotics, for example, *Bifidobacterium breve* M4A and different lactobacilli strains to improve gut dysbiosis and improving immune reaction in such patients. This may improve recovery patients particularly who are infected with COVID-19 [25]. Prebiotics and probiotics work by modulating immunity, including anti-inflammatory property. Moreover, beneficial bacteria can downregulate expression of ACE2 in murine gut, correlated conversely with COVID-19 quantity in fecal proabs from patients [25].

Human milk oligosaccharides

Human milk oligosaccharides (HMO) can imitate the composition of the viruses' specific receptor on human cells, binding to the virus and stop it from attacking with its objective cells [26]. The possibility interaction between histo-blood group antigens (HBGs) and noroviruses, which is detected as norovirus receptors, could be affected by HMO because of likenesses to and HBGs structure and excess in human breastmilk [27]. HMO particularly lacto-N-frucopentaose can binding to the norovirus that it hinders to tie to human mucins and guard against norovirus diseases. Symptoms of norovirus infectious are recognized by vomiting and diarrhea. In any case, infection symptoms can be more severe in children, the immunocompromised and the elderly people [28].

Fish

Selenium which has been found in fish, has been concluded to help the white blood cells in production of cytokines, which in turn expel the respiratory viruses from the body [29]. Fish is rich in omega-3 oil which helps in reduction of inflammation, increase air flow to the lungs and might protect them from colds and infections. In addition, these fatty acids are effective in: improving mood, in-

creasing the body activity, strengthening memory and protecting the body from cardiovascular disease [30].

Red meat

Zinc deficiency is clearly common among adults in America, especially vegetarians due to lack of consumption of beef which is considered a major source of this mineral that strengthening immunity [31].

Avocado

Avocado contains: monounsaturated fatty acids, iron, and zinc along with several different vitamins such as E and C that interfere with stimulating the body to produce antibodies in abundance amounts which fights and cure the microbial invasions to the body [32].

Part II: Vitamins and minerals that boost immune response

Vitamin D

Vitamin D₃, one of the important vitamins which plays a large role in the function of the immune system. It has been observed in several scientific studies that people who have a deficiency in the level of this vitamin are more likely to develop the following diseases: respiratory infections (viral and bacterial), chronic bronchial diseases, and bronchial asthma [33].

Subsequent to contemplating global information from the novel COVID-19 pandemic, scientists have found a solid connection between serious vitamin D deficiency and death rates [34]. A correlation had been clarified between vitamin D levels and cytokine storm which a hyperinflammatory condition brought about by an overactive immune response, when cytokine storm can seriously harm and damage lungs tissue and lead to intense respiratory trouble disorder and death in patients. In this manner, that having recommended levels of vitamin D could save patients against serious health problem, including death from COVID-19 [35].

Therefore, some research has stated that maintaining the level of vitamin D within the normal level or using supplements containing vitamin D within the normal can help reduce the incidence of acute respiratory diseases [36].

Vitamin D is available in these foods: fish (salmon, sardines, tuna), eggs, mushrooms, fortified food) [37]. A very important note to mention that vitamin D may prevent infection from coronavirus (COVID-19) [34].

In addition, there has been recent evidences on the relationship between vitamin D supplementation and the low chance of COVID-19 infection [38]. Despite of that, it has been found in several scientific studies that a lack of vitamin D increases the risk of developing respiratory diseases [39].

Vitamin A

One of the important vitamins which is necessary in the human body. It plays a crucial role in cell division and reproduction, fetal development, vision, as well as immune system in the human body [40]. It has been shown that it plays a significant role in the development of the lungs and alveoli [41]. It has been proved that it is an essential element to support the immune system because of its crucial role as an anti-inflammatory [42]. Researchers have proven the significance of vitamin A in increasing the defensive ability of the immune system in many infections. Vitamin A is abundant in these products: red pepper, carrots, sweet potatoes, dark-leaf vegetables, pumpkins, lettuce and dry herbs [43].

Zinc

Zinc has been shown to play a central role in the functioning of the immune system, and its deficiency exposes humans to many diseases [44]. In addition, it has been noted that acute and chronic deficiency of zinc associated with increasing the susceptibility to infections and its onset. Foods containing zinc include the following: red meat, eggs, nuts, dairy products and dark chocolate [45].

Vitamin C

One of the important vitamins in the human body and is considered an antioxidant. It plays an important role in the function of the immune system [46]. Scientific studies have proven that vitamin C deficiency weakens immunity and increases susceptibility to inflammation. The use of vitamin C has been noted to be associated with increase the ability to treat and prevent respiratory infections [46].

Vitamin E

Vitamin E is an antioxidant and plays a pivotal order in building up a good immunity [47]. It has been stated that to boost the immunity of human body, the following group of foods are highly helpful: almonds, spinach, broccoli, parsley, avocado, and soybeans [48].

These types of food are rich in vitamin E. The Vitamin E antioxidant properties via destruction of free radicals which are harmful to boost the immune system [49].

Part III: Immuno-elevated herbs

Turmeric

This bright yellow spice has been used for many years as an anti-inflammatory in the treatment of both arthritis and rheumatoid arthritis. It has been shown to be useful in treatment of influenza and respiratory infections [50]. It has been observed that high concentrations of curcumin, (which provides the turmeric its distinctive color) might help in reduction of exercise damage [51].

Ginger

Ginger (*Zingiber officinale*) has been observed to reduce the inflammation in general as well as sore throats. It might help in the relieve of both nausea and chronic pain. Ginger has been noted to has cholesterol-lowering properties [52].

Ginseng

Ginseng or Korean ginseng (*Panax ginseng meyer*) is one of the most well-known medicinal herbs and has been utilized as cancer remedial agent plant [53]. The anti-cancer activity of ginseng saponins are ascribed essentially to the existence of ginsenosides [54]. Ginsenosides are one of the pharmaceutical substances which apply their anticancer impacts by tweaking of different flagging pathways, including regulation of cell multiplication go between growth factors and vascular endothelial development factor, regulation of p53 pathway and tumor suppressors of cell cycle regulation and apoptosis. Hence, ginseng has capability in the treatment of different human diseases [55]. A clinical report showed the helpful impacts of ginseng administration of vaccinated mice with red ginseng gave improved cross-protection against antigenically distinct H1N1 and H3N2 flu infections and ginseng extracts were found antiviral to affect flu infection [56].

Liquorice

Liquorice is the English name of *Glycyrrhiza glabra* that it might be an effective medicinal substance for COVID-19 [57]. Glycyrrhizin has different biological activities and pharmacological impacts [58]. A pharmacological activity of the glycyrrhizin including binding angiotensin-converting enzyme (ACE2), downregulating proinflammatory cytokines, repressing the accumulation of intracellular reactive oxygen species [58].

Conclusion

COVID-19 pandemic is an important health dilemma that has been evolved since late December 2019 right now. Up to date, there

is no valid authenticated vaccine or drug for COVID-19.

One of the important rules for fighting COVID19 by trying to keep the level of immune system is high. Thus, general population need to improve their immune system with nutrients and food supplements.

In addition, it is crucial to keep adhering to the instructions of the Health Authorities in each country which is generally emphasizes on: commitment to social distancing, using personal protective equipment (PPE), avoiding crowded places, using of adequate hygiene for hand, avoid contact or be away from people with symptoms and signs of respiratory diseases, keep adequate and fundamental nutrient, and ask for health assistant when it is required.

Conflicts of Interest

The authors declare no conflicts of interest.

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