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Review

Foods That Improving the Immune System against Covid-19 and Its Infectiousness

Covid-19 ve Bulaşıcılığına Karşı Bağışıklık Sistemini İyileştiren Gıdalar

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Abstract

Background: The main aim of this study is to interpret nutrients that can potentially increase immunity to coronavirus (COVID-19) and reduce the risk of getting sick.

Methods: Severe acute respiratory syndrome about coronavirus [SARS-CoV] and SARSCoV-2 as known pathogenic coronaviruses for Human enter to their target cells through angiotensin-converting enzyme 2 (ACE2), which is stated by epithelial cells of the lung, intestine, kidney, and blood vessels (Fang et al., 2020, Wan et al., 2020). Moreover, cohort of patients with COVID-19 were decreased Protein C level after infection to cell (Panigada et al.). These situations could be caused cross-linked fibrin clot. In this case, inhibition of ACE2 and higher immunity of protein C could be possible reduced the risk of COVID-19. The levels of ACE2 and Protein C are potentially important. If the levels of ACE2 and Protein C could be controlled any nutrients, the risk could be potentially prevented. So, effects of ACE2 and Protein C were evaluated from literature.

Results: The level of angiotensin-converting enzyme 2 is great potential to avoid coronavirus disease (COVID-19). In this case, the nutrition foods supplied inhibition of ACE2 were evaluated in this study. In Table 1, it is showed list of the nutrition food as caused inhibition of angiotensin-converting enzyme 2 (ACE2

Conclusion: The nutrients that can potentially increase immunity to coronavirus (COVID-19) and reduce the risk of getting sick has great important in this time. It is also important to slow down the factors that cause it. The levels of ACE2 and Protein C are potentially important. If the levels of ACE2 and Protein C could be controlled any nutrients, the risk could be potentially prevented. It was noticed that the immunity against COVID-19 could be improved with Cuttlefish, Sardinelle (Sardinella aurita), Rohu (Labeo rohita), Grass carp, European Carp (Cyprinus carpio L.), Cirrhinus mrigala, Salmon (Salmo salar), Katsuo-bushi, Acetes indicus, Common Oat (Avena sativa), Goat milk protein, Kacang goat meat, Milk protein, Yoghurt beverages with quinoa, Lupin and Other legumes, Whey protein, Mungbean, Walnut protein, Peanut protein, Corn germ protein, Sunflower (Helianthus annuus L.) protein, Antioxidants and fish oil, Wheat germ protein, Rice bran protein, Sesame (Sesamum indicum L.), Egg yolk and Cucurbita ficifolia, Egg protein, Egg white protein, Fucus spiralis, Cannabis sativa L., Sweet sorghum grain protein, and Onion seeds.

Key words: COVID-19, nutrients food, immunity, ACE

Introduction

COVID-19, which emerged in the city of Wuhan, China, is a rapidly spreading disease transmitted from person to person by droplet infection. The coronavirus epidemic, which started as an epidemic at first, later turned into an endemic and was later declared a pandemic by the World Health Organization. As in the pandemic process, it is of great importance to comply with the hygiene rules and to have an adequate and balanced diet during the mutation period that occurs afterwards (1, 2).

Health risks still remain important in our country, where the mutation process is experienced after the second and third stages of the coronavirus epidemic (Covid-19). While it was previously stated that only the elderly and individuals with health problems were at risk, today it has become more contagious due to mutated viruses, and accordingly, it is seen that young people and children are also caught in the epidemic and undesirable results leading to death are encountered (3).

Although no drug has yet been found that can prevent or treat the transmission of the coronavirus, it is not yet certain that the vaccine will bring a complete solution (4). Therefore, one of the greatest measures that can be taken today is to keep our immune system strong and not to get sick as much as possible. For this, it is necessary to have a healthy and balanced diet as well as regular sleep and physical activity (5).

Especially in nutrition, it should be preferred to consume more foods containing elements that increase body resistance and strengthen the immune system. In terms of a balanced diet, it is of great importance that the foods consumed are rich in protein, fiber, vitamins, minerals and especially antioxidants (6).

Good nutrition is very important during and after an infection. Infections harm the body especially when it causes fever, the body needs extra energy and nutrients. Therefore, maintaining a healthy diet during and after the COVID-19 pandemic is crucial. While no food or dietary supplement can prevent COVID-19 infection, maintaining a healthy diet is an important part of supporting a strong immune system(7).

Angiotensin converting enzyme 2 or ACE2 for short; it is an enzyme attached to the outer surface (cell membrane) of the cells in the lungs, arteries, heart, kidneys and intestines (8).

The transmembrane protein ACE2 serves as the main entry point for cells and causes various types of coronavirus to infiltrate into cells. When the S1 protein, located at the ends of SARS-CoV and SARS-CoV2, attaches to the enzymatic domain of ACE2 on the cell membrane, both the virus and the enzyme are taken into the cell by endocytosis. This led to the idea that reducing the amount of ACE2 in cells could help fight the coronavirus (8).

It has been realized that ACE2 and protein C can be controlled and thus the risk can be reduced with some nutrients, and some of these nutrients are given in Table 4.

In this paper, it has aimed to reveal the approaches between the relationships of nutrient and COVID-19 virus as well as ACE-II enzyme.

Protein

Proteins are linear polymers composed of 20 different L-alpha-amino acids (9). The different chemical properties of the side chains of amino acids determine the three-dimensional structure of proteins and therefore affect protein function (10).

Proteins are nitrogen-containing substances formed by amino acids. They serve as the main structural component of muscles and other tissues in the body. In addition; They are used to produce hormones, enzymes, and hemoglobin. Proteins can also be used as an energy source (11).

In order for proteins to be used by the body, they must be catalyzed into their simplest form, amino acids. 20 amino acids are required for human growth and metabolism. Twelve of these amino acids are non-essential amino acids. They can be synthesized by our body and do not need to be consumed in the diet. The other eight amino acids cannot be synthesized in the body and are defined as essential meaning they must be consumed in our diets (11) (Table 1).

Table 1. Bases amino acids found in the human body (12)

Essential amino acids	Non-essential amino acids
Phenylalanine	Glycine
Valine	Alanine
Tryptophan	Sistine
İsolosin	Tyrosine
Methionine	Aspartic Acid
Lysine	Glutamic acid
Losin	Serine
Hemi-Essential amino acids	Aspargin
Histidine	Glutamine
Arginine	Prolin

Protein C

Protein C (PC) is an important anticoagulant and antithrombotic for the human coagulation system. Protein C exerts its anticoagulant effect by inactivating FVa and FVIIIa together with protein S (PS). Protein C is found in human blood at a concentration of 4 µg/mL. In its deficiency, the risk of thrombosis in the veins is high. When these blood clots (thrombocytes) break off from the vein surface and mix with the blood stream, it can cause stroke, heart attack. A blood clot can be life-threatening if not detected and treated early (13).

Protein C (PC) is an important natural inhibitor of the human blood coagulation system. Protein C is a vitamin K-dependent glycoprotein with a molecular weight of 62,000 Daltons. Protein C is a special protein with both anticoagulant and antithrombotic functions in blood coagulation steps. Human Protein C is synthesized in the liver as a single-chain protein precursor and remains in the blood as an inactive zymogen until it is proteolytically degraded and

activated. Protein C is activated only where and when it is needed (14).
For protein C to be activated, thrombin must associate with the thrombomodulin (TM) receptor located on the endothelial cell surface. The thrombin-thrombomodulin complex formed on the endothelial cell surface binds to the inactive Protein C. Protein C becomes active as a result of thrombin-Protein C interaction. Activated protein C then complexes with protein S, a vitamin K-dependent cofactor (13) (Figure 1).

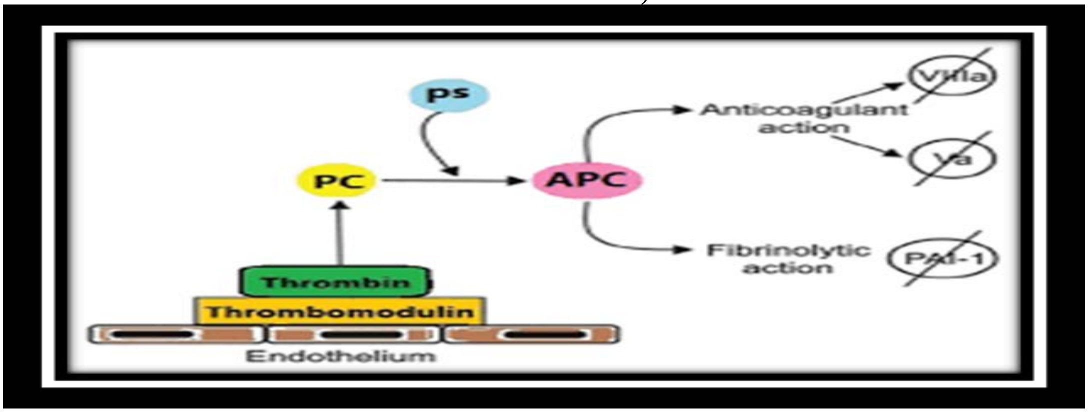

Figure 1. Model of thrombin-thrombomodulin activation of protein C (15)

Protein C is a serine protease that requires Vitamin K for its normal biosynthesis. It is a member of a vitamin K-dependent family that also includes coagulation protein factors VII, IX, X, S and Z proteins and prothrombin (16, 17) (Table 2).

Table 2. Vitamin K-dependent proteins (16)

Protein	Molecular weight (Da)	Number of polypeptide chains	Number of Gla zones	Carbohydrate content (%)	Plasma concentration (µg/mL)
Factor II	72000	1	10	8	80-90
Factor VII	50000	1	10	9-10	0.47
Factor IX	57000	1	12	17	4
Factor X	59000	2	11	15	6.4
Protein C	62000	2	9	29	4
Protein S	71000	1	11	7-8	25-35

Protein C was isolated from bovine plasma by Johan Stenflo in 1976 and was named "Protein C" because it was the third protein purified by DEAE-Sepharose. However, the function of Protein C in the physiological regulation of coagulation remained elusive for the next several years. Human plasma Protein C was purified by Kisiel in 1979 (16, 18).
Human Protein C circulates in the plasma as a zymogen and is converted to activated Protein C (APC) by specific cleavage by thrombin-bound thrombomodulin on the membranes of endothelial cells and plays a critical role in regulating the functioning of thrombin (16, 19).

Synthesis and Structural Properties of Protein C

Protein C, like all Vitamin K-dependent proteins that play a role in coagulation steps, is synthesized in the liver. This protein is synthesized as a long single-chain protein precursor consisting of 461 amino acids and is present in the blood as a two-chain inactive zymogen until it is proteolytically degraded and activated (13). The cDNA for human Protein C (hPC) encodes a protein consisting of 461 amino acids. The primary sequence of protein C is either directly detected or inferred from cDNA sequencing. Protein C is a glycoprotein with a molecular weight of 62000 Da (20). Protein C contains 23% carbohydrates and consists of 2 chains, one light (21 kDa) and the other heavy chain (41 kDa) linked by disulfide bonds (21). The structure of APC includes the interaction of the protease with the Ca2+ dependent cofactor Protein S on the membrane surface and the endothelial cell Protein C receptor (EPCR). Glutamic acid is carboxylated by reacting in the liver due to Vitamin K. This region interacts with the negatively charged phospholipid in the presence of calcium ions, and this is a prerequisite for the anticoagulant effect of APC. As protein S cofactor, it functions to regulate the anticoagulant function of APC (22) (Figure 2).

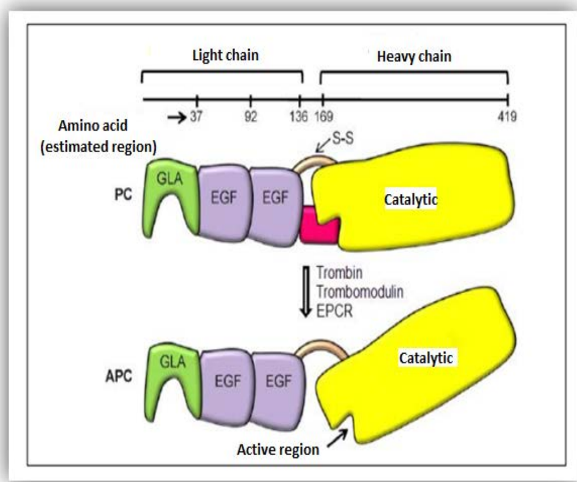

Figure 2. Protein C structure (16)

Protein C Activation

Protein C circulates in the blood as a zymogen (inactive) and is activated only where and when it is needed. For protein C to be physiologically functional, it must be converted to an active serine protease. Human Protein C activation occurs by enzymatic removal of a small activation peptide from the amino acid end of the heavy chain (21) (Figure 3).

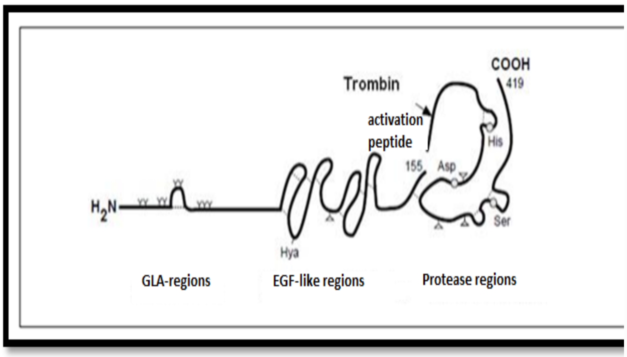

Figure 3. Human Protein C structure. Symbols: Y=Gla-sites, Hya=erytho-β-hydroxyaspartic acid, O=catalytic sites, Δ= N-linked glycosylation/glycosylation sites (16)

The Physiological Role of Protein C

All Vitamin K-dependent proteins have so far been stated to have a coagulation-related activity. In contrast, Protein C is a coagulation inhibitor and plays a critical role in regulating the functioning of thrombin (18). Many mechanisms that inhibit the spread of the coagulation process have been described on the endothelial cell surface. The anticoagulant Protein C cascade, one of the anticoagulant mechanisms, regulates blood coagulation by inactivation of Factors VIIIa and Va and increased fibrinolytic activity (23) (Figure 4).

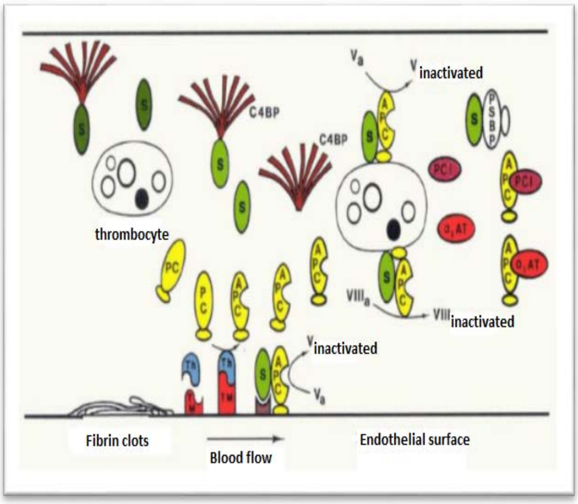

Figure 4. Formation and function of Activated Protein C (16)

Protein C Deficiency

Protein C with a half-life of 6 hours is a trace protein found in human blood at a concentration of 4 □g/mL. Serious problems occur when the amount of Protein C in the blood drops. Patients with protein C deficiency are at risk of deep vein thrombosis (DVT) and other coagulation complications as a result of tissue oxygen deprivation; some can be life threatening (13, 16) (Figure 5).

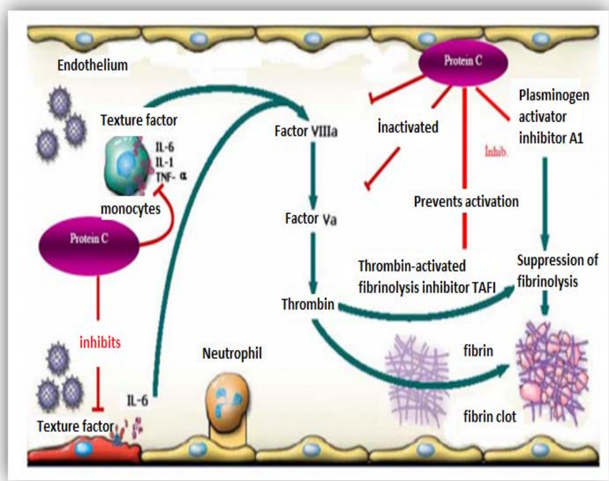

Figure 5. Protein C and the inflammation cascade (16)

PROTEIN S

The spike protein (S protein) is a broad type I transmembrane protein with up to 1,160 amino acids for avian infectious bronchitis virus (IBV) and up to 1,400 amino acids for feline coronavirus. In addition, this protein is highly glycosylated as it contains 21 to 35 N-glycosylation sites. Spike proteins are attached to trimers on the virion surface to create a distinctive "corona" or crown-like appearance. The ectodomains of all CoV spike proteins share the same organization in two domains: an N-terminal domain called S1 responsible for receptor binding and a C-terminal S2 domain responsible for fusion. The diversity of CoV is reflected in the variable spike proteins (S proteins) that transform into different forms in receptor interactions and their response to various environmental triggers of virus-cell membrane fusion (24).

Structure of Protein S

The coronavirus spike protein (S Protein) is a class I fusion protein (25, 26). Formation of an α-helix-coil structure is characteristic of this class of fusion proteins, which contains regions of C-terminal fragments that are predicted to have α-helix secondary structure and form helices. The S2 subunit is the most conserved region of the protein, while the S1 subunit is sequentially segregated between strains of even a single coronavirus. S1 contains two subdomains, the N-terminal domain (NTD) and the C-terminal domain (CTD). Both can act as receptor binding domains (RBDs) and bind various proteins and sugars (25) (Figure 6).

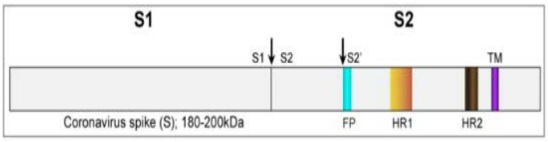

Figure 6. Severe acute respiratory syndrome (SARS)-CoV spike protein schematic (25)

The spike protein (S protein) has very important roles in viral infection and pathogenesis. S1 recognizes and binds to receptors, and then conformational changes in S2 facilitate fusion between the viral envelope and the host cell membrane. Models describing the S-mediated membrane fusion event have expanded from knowledge of S protein structures and functions (24, 26).

Spike Glycoprotein (S) The spike glycoprotein (S), formerly called "E2", forms large, petal-shaped spikes on the virion surface. The S protein can be divided from its N-terminal end outside the envelope to its C-terminal end inside the envelope, into three structural regions: These consist of a large outer region, a transmembrane region, and a short carboxyterminal cytoplasmic region, which can be subdivided into two sub-regions, S1 and S2, respectively. The S1 subregion contains the N-terminal portion of the molecule and forms the spherical portion of the spikes. It is responsible for binding to specific receptors on the surface of appropriate cells (24) (Figure 7).

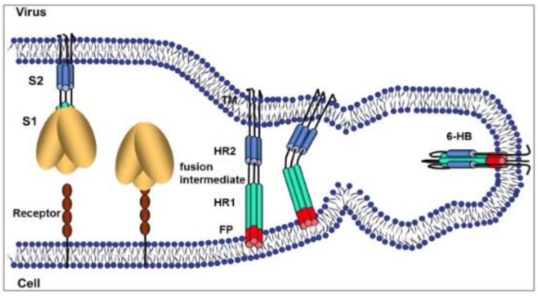

Figure 7. Schematic illustration of CoV S protein-mediated membrane fusion (25)

The S glycoprotein has adapted to species-specific differences in the host cell receptor (ACE2). The S protein binds to the specific receptor on the host cell, fusing the viral envelope with the host cell membrane; it also induces cell-cell fusion. Expression of the S protein alone can induce fusion of receptor-bearing cells (25) (Figure 8).

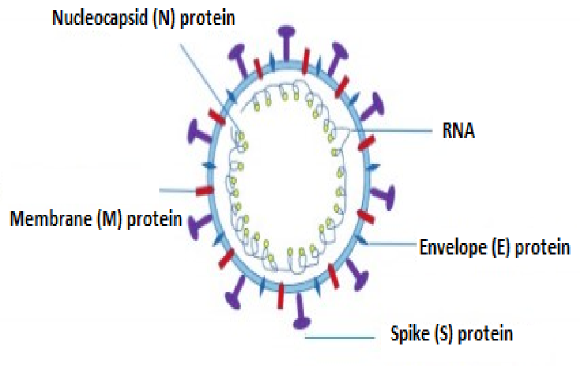

Figure 8. Schematic structure of the coronavirus(27)

The S glycoprotein is the primary factor in virus recognition by the immune system of the infected host. It is the chief inducer of neutralizing antibodies produced during infection. In conclusion, the S protein is considered as a multifunctional protein that plays an important role in cell tropism, host selection, neutralizing antibody formation, and the pathogenesis and biology of CoV infections (25) (Table 3).

Table 3. S protein-based vaccines against SARS-CoV (28)

Category	**Advantages**	**Disadvantages**
Vaccines*		
Full-length S protein	Induces effective neutralizing-antibody and T-cell responses, as well as protective immunity	Might induce harmful immune responses (64,65)
DNA-based	Easier to design; induces immunoglobulin G, neutralizingantibody and T -cell responses and/or protective immunity	Might have low efficacy in humans; repeated doses may cause toxicity (59,131)
Viral vector-based	Induces neutralizing-antibody responses, protective immunity and/or T-cell responses	Might induce ADE effect; possibly present pre-existing immunity (60,61,65)
Recombinant S protein-based	Induces high neutralizing-antibody responses and protective immunity	Mainly humoral responses; need repeated doses and adjuvants (62)
RBD	Induces highly potent neutralizing-antibody	Not identified (70-73)

	and T-cell responses and protective immunity	
DNA-based	Induces neutralizing-antibody and T-cell responses and/or protective immunity	Induces low responses; might not neutralize mutants (132-134)
Viral vector-based	Induces neutralizing-antibody responses, protective immunity and/or T-cell responses	Possible genomic integration of foreign DNA; viral vector instability (75,135)
Recombinant RBD protein-based	Safer and more effective than other RBD vaccines; induces neutralizing-antibody and T-cell responses, protective immunity and cross protection	Needs repeated doses and adjuvants (26,70-72)

ACE-II ENZYME

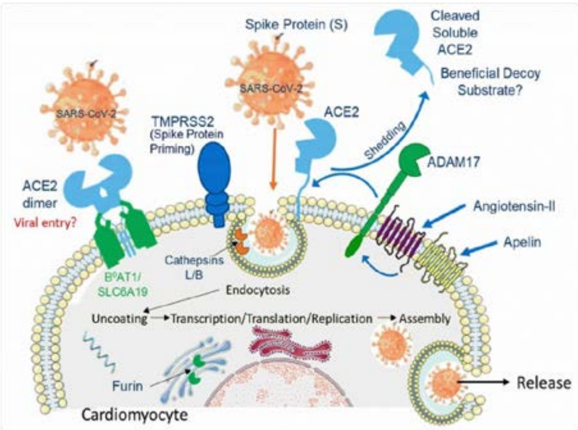

Figure 9. Schematic diagram of key proteins predicted to be expressed by human cardiomyocytes from RNASeq data (29)

Angiotensin converting enzyme 2 or ACE2 for short; It is an enzyme attached to the outer surface (cell membrane) of cells in the lungs, arteries, heart, kidneys, and intestines (30). ACE2 accelerates the hydrolysis of angiotensin II hormone, which is a vasoconstrictor, to angiotensin (1-7), thereby reducing blood pressure. In addition, ACE2 acts as the entry point into cells for some coronaviruses. The human version of the enzyme is called hACE2 (31) (Figure 9).

ACE2 counteracts the activity of angiotensin converting enzyme (ACE) by decreasing the amount of angiotensin-II and increasing. In this way, it has become a promising drug target in the treatment of cardiovascular diseases (32). Angiotensin converting enzyme 2 is a zinc-containing metalloenzyme found on the surface of endothelial cells and other cells.

ACE2 is a single-pass type I membrane protein with an enzymatically active domain on the surface of cells in lung and other organ tissues (30). The extracellular domain of ACE2 is cleaved from its transmembrane domain by another enzyme known as ceddase. Subsequently, the soluble protein obtained is released into the blood stream and excreted through the urine (33) (Figure 10).

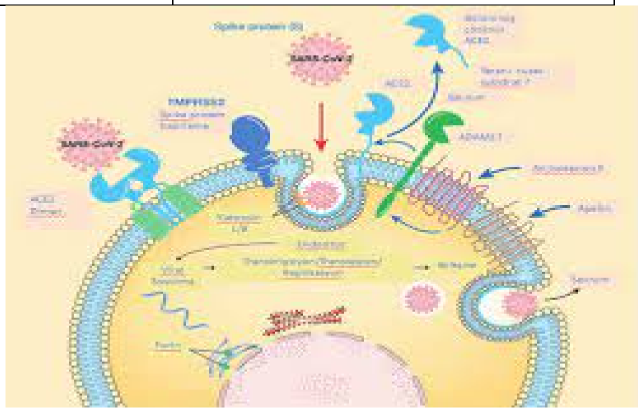

Figure 10. Life cycle of SARS-CoV-2 (34)

Position in the Body

ACE2 is known to be found in many organs. The most common sites of ACE2 binding are the cell membrane of alveolar epithelial cells of the lung, enterocytes of the small intestine, arterial and venous endothelial cells, and arterial smooth muscle cells in many organs. ACE2 mRNA is also found in the cerebral cortex, striatum, hypothalamus, and brain stem (35).

The main task of ACE2 is to act as a counterbalance to ACE. The ACE enzyme cleaves the hormone angiotensin I to the vasoconstrictor angiotensin II. ACE2 in turn cleaves the carboxyl-terminal amino acid phenylalanine from angiotensin II and hydrolyzes it to the vasodilator angiotensin (1-7). In addition, ACE2 can cleave many other peptides (36).

Entry Point to Human Body for Coronavirus

The transmembrane protein ACE2 serves as the main entry point for cells and causes various strains of coronavirus to infiltrate into the cell. To explain in more detail, when the S1 protein, located at the ends of SARS-CoV and SARS-CoV2, attaches to the enzymatic domain of ACE2 on the cell membrane, both the virus and the enzyme are taken into the cell by endocytosis (37). In addition, with this entry process, the production of the S protein in the virus begins to be carried out by the serine protease in the cell. This inhibition is considered a potential therapeutic and is currently being studied (38).

This led to the idea that lowering the amount of ACE2 in cells could help fight the coronavirus. As an antithesis to this, ACE2 has also been shown to have a protective effect against viral lung injury by increasing the production of the vasodilator angiotensin 1-7 (39).

A systematic review and meta-analysis published July 11, 2012 found that “the use of ACE inhibitors resulted in a 34% reduction in pneumonia risk compared to controls. Additionally, in patients at high risk of pneumonia, particularly those with stroke and heart failure, use of ACE inhibitors It has also been shown that the risk of pneumonia is reduced by treating it (40).

WHAT IS ACE-II INHIBITOR

ACE is defined as an important enzyme in the renin-angiotensin system (RAS), which plays an important role in the regulation of blood pressure (41). RAS, which plays a role in the regulation of fluid balance and blood pressure in the body, is a proteolytic system and is one of the important metabolic pathways that are effective in the control of the cardiovascular system. In RAS, angiotensinogen protein synthesized from the liver is converted to angiotensin-I by the action of the renin enzyme secreted by the kidney. Angiotensin-I is converted to angiotensin-II, which has vasoconstrictor properties, by ACE produced in the lungs (42). The presence of angiotensin II causes an increase in blood pressure and stimulates the secretion of aldosterone. As a result, inhibition of angiotensin II formation with ACE-inhibitors prevents vasoconstriction and lowers blood pressure (43).

Therefore, ACE inhibition activity appears to be a useful method in the treatment of hypertension (44). Hypertension, a common condition worldwide, is a controllable risk factor associated with cardiovascular disease. The use of food protein-derived natural ACE inhibitor peptides in the treatment of hypertension is considered a safer alternative since they do not have side effects (45).

With this; It is reported that bioactive peptides of natural origin generally show activity at higher concentrations than their synthetic counterparts, and functional foods containing these peptides are recommended to be used for disease prevention rather than disease treatment (46).

According to ACE-II enymes, the nurtition sources that ımproving the ımmune system against Covid-19 were illustrated in Table 4.

Table 4. The nutrition food as caused inhibition of angiotensin-converting enzyme 2

Nutrition Sources	Nutrition Sources
Cuttlefish (47, 48)	Mungbean (71)
Sardinelle (*Sardinella aurita*) (49-51)	Walnut protein (72, 73)
Rohu (*Labeo rohita*) (52)	Peanut protein (74)
Grass carp (53)	Corn germ protein (75)
European Carp (*Cyprinus carpio* L.) (54)	Sunflower (*Helianthus annuus* L.) protein (76)
Cirrhinus mrigala (55)	Antioxidants and fish oil (77)
Salmon (*Salmo salar*) (56)	Wheat germ protein (78)
Katsuo-bushi (57)	Rice bran protein (79)
Acetes indicus (58)	Sesame (*Sesamum indicum* L.) (80)
Common Oat (*Avena sativa*) (59)	Egg yolk and Cucurbita ficifolia (81)
Goat milk protein (60)	Egg protein (82)
Kacang goat meat (61)	Egg white protein (83)
Milk protein (62)	Fucus spiralis (84)
Yoghurt beverages with quinoa (63)	Cannabis sativa L. (85)
Lupin and Other legumes (64)	Sweet sorghum grain protein (86)
Whey protein (65-70)	Onion seeds (87)

Nutritions

In addition to these nutrients, it is important to increase the body's resistance and improve the immune system.

The World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) recommend eating a variety of seasonal fresh local foods in our daily diet, consuming less processed foods and striking a balance between different food groups.

According to the proposal of these organizations; 50% of our daily diet is energizing foods (whole wheat bread and cereal groups, potatoes, rice, etc.), 35% is protective foods (foods containing vitamins, minerals and antioxidants such as vegetables and fruits) and 15% is protein. rich foods (fish, chicken, meat, eggs, milk, etc.).

Another protein source alternative that is quite durable and has high nutritional value is dried legumes. Green, red lentils, chickpeas, bean varieties, kidney beans, etc. foods can be consumed every day.

In addition to ensuring adequate water consumption, it will be very beneficial to use olive oil in daily nutrition.

In addition, products such as probiotic-fortified yogurt and kefir can be consumed especially during this period, as they support the immune system.

It is important to consume vegetables such as carrots, broccoli, zucchini, cabbage, cauliflower, parsley, as well as fruits such as oranges, tangerines, and apples, which are rich in vitamins A, B, C, D, E, zinc and antioxidants that strengthen the immune system. Especially since citrus fruits are rich in vitamin C, which supports the immune system, the consumption of these fruits should be emphasized, and if possible, fresh lemon should be squeezed into meals and salads.

Vitamin A helps in the formation of teeth, bones, soft tissues and mucus in a healthy way and in maintaining eye health. The antioxidant beta carotene is a fat-soluble bioactive provitamin and is converted into vitamin A, which is essential for a strong immune system. It is known to reduce susceptibility to infection and is critical as it improves immunity.

B group vitamins are water soluble vitamins. It is necessary for glucose metabolism. It helps prevent complications in the nervous system, brain, muscles, heart, stomach and intestines.

Vitamin C (ascorbic acid) is one of the essential vitamins that cannot be synthesized by humans, so it must be taken from the outside, is a natural antioxidant. Vitamin C helps improve the immune system and increases the production of white blood cells that fight infections. It has been observed that vitamin C limits the transformation of upper respiratory tract infections into lower respiratory tract infections. The most common source; citrus fruits (grapefruit, oranges, lemons, tangerines and limes).

Vitamin D provides the synthesis of antimicrobial peptides in the body and has a positive effect on antioxidant genes. It is synthesized in our body under the influence of sunlight. It is a fat-soluble vitamin and its absorption in the body increases when consumed with fat. During the COVID 19 pandemic, vitamin D supplementation is important in case of reduced contact with the sun due to quarantine and protection measures. 600 IU/day is recommended for vitamin D supplementation.

Vitamin E is also effective in strengthening the immune system. Good sources of vitamin E; green leafy vegetables, legumes and oily seeds such as hazelnuts and walnuts. 3 servings of seasonal vegetables, 15-20 hazelnuts (30 gr) or 5-6 walnuts (30 gr) and legumes (lentils, dried beans, chickpeas) 2-3 times a week should be consumed daily.

Zinc is a trace element that acts as a regulator of the immune system. It has been shown that zinc deficiency increases the risk of pneumonia, while high zinc levels decrease it. It is reported that zinc is a potential protective microcomponent against pneumonia caused by COVID 19, and a dose of 75 mg/day shortens the duration of pneumonia.

Naringenin, a naturally occurring flavonoid in foods, is commonly found in the skins of citrus fruits such as tangerines, citrus fruits, lemons and bergamot, tomatoes and figs. Antioxidant naringenin is effective against DNA-repairing, anti-cancer, bacteria and viruses, and has protective effects on heart health.

Grape seeds, blueberries, black elderberries, blackcurrants, persimmons, carob are the main sources of antioxidants and proanthocyanidins.

Attention is drawn to the importance of using citrus peels among components such as potential COVID 19 suppressive green tea and olive leaf tea.

Green tea; It is a source of antioxidants that help fight infection (Effective Ingredients: polyphenols, catechins (EGCG, EGC), caffeine, strictinin)

Ginger: Helps reduce sore throat and other inflammatory diseases (Active Ingredients: zingerone, shogaols, gingerols).

Cinnamon; Antioxidant, Neurodegenerative, antibacterial, blood sugar regulator, cholesterol lowering, heart protective (Active Ingredients: cinnamaldehyde, polyphenols, coumarin)

Clove: Antioxidant, antibacterial, protects the lungs, antique

Conclusion

The nutrients that can potentially increase immunity to coronavirus (COVID-19) and reduce the risk of getting sick has great important in this time. It is also important to slow down the factors that cause it. The levels of ACE2 and Protein C are potentially important. If the levels of ACE2 and Protein C could be controlled any nutrients, the risk could be potentially prevented. It was noticed that the immunity against COVID-19 could be improved with Cuttlefish, Sardinelle (Sardinella aurita), Rohu (Labeo rohita), Grass carp, European Carp (Cyprinus carpio L.), Cirrhinus mrigala, Salmon (Salmo salar), Katsuo-bushi, Acetes indicus, Common Oat (Avena sativa), Goat milk protein, Kacang goat meat, Milk protein, Yoghurt beverages with quinoa, Lupin and Other legumes, Whey protein, Mungbean, Walnut protein, Peanut protein, Corn germ protein, Sunflower (Helianthus annuus L.) protein, Antioxidants and fish oil, Wheat germ protein, Rice bran protein, Sesame (Sesamum indicum L.), Egg yolk and Cucurbita ficifolia, Egg protein, Egg white protein, Fucus spiralis, Cannabis sativa L., Sweet sorghum grain protein, and Onion seeds.

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