

## ⇒ Review Article



## Nutrition During COVID-19 Quarantine

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Based on past experience, in the context of epidemics, the nutritional status of individuals is considered as an indicator of resistance to critical situations. During quarantine, inappropriate eating patterns will increase calorie intake and lead to obesity. Unhealthy eating habits during the coronavirus disease 2019 (COVID-19) pandemic have raised the risk of obesity, followed by an increase in the incidence of cardiovascular disease, diabetes mellitus, and lung disease. Certain nutrients or food combinations can affect the body by activating the cellular immune system, modifying the production of molecular signaling, and gene expression. Dietary supplements with vitamins, bioactive lipids, flavonoids, and herbs support the human immune system against COVID-19. Since there is still no definitive cure for COVID-19 infection and owing to obligatory symbiosis with this virus in the future, the behavior and attitude as well as the lifestyle of people to maintain their health should change. To achieve the desired goal, in the future, it is increasingly necessary to look for suitable and safe food products to strengthen the immune system against diseases, especially during the COVID-19 pandemic.

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**Background**

Coronavirus disease 2019 (COVID-19) infection is a disease caused by the new coronavirus that has become a major global and pandemic threat. Coronavirus is one of the most important pathogens, mainly targeting the human respiratory system (1). The World Health Organization (WHO) has identified the disease as a global public health emergency because of the rate of spread and epidemics (2). Based on past experience, in the context of epidemics, the nutritional status of individuals is considered as an indicator of resistance to critical situations (3). Environmental problems and difficulties can have long-term effects on people's health, including environmental stressors and inadequate nutrition (4, 5). Evidence suggests that diet has a profound effect on maintaining immunity and fighting viral infections, including COVID-19. Certain nutrients or food combinations can affect the body by activating the cellular immune system, modifying the production of molecular signaling, and gene expression (6). Moreover, food ingredients have a significant effect on intestinal microbes and thus give rise to specific immune responses in the body (7). Lack of certain food, proteins, and micronutrients weaken the immune system and susceptibility to the infection.

Lack of micronutrients such as iron and zinc has a

significant effect on the immune system. Food sources of these two micronutrients include legumes as a good alternative to meat, milk, and dairy products, and green leafy vegetables and nuts. Therefore, adequate intake of iron, zinc, and vitamins B6, E, A, and B12 are essential for maintaining the function and stability of the immune system. The functioning of the immune system plays an important role in the prevention of respiratory diseases, including COVID-19. Among the factors influencing the exacerbation of the patient's condition during COVID-19 infection are underlying diseases such as diabetes mellitus, lung disease, heart disease, malnutrition, and poor eating habits (8). Therefore, the main and effective point to maintain the immune system is to prevent nutrient deficiencies in the body, which plays a key role in stimulating immune cells, and their interaction, differentiation or functional expression. The global pandemic of COVID-19 has imposed a new set of challenges on individuals with respect to maintaining a healthy diet.

**The Consequences of Quarantine**

Fundamental changes in lifestyle habits following the COVID-19 pandemic have not only led to isolationism, alienation from society, and temporary career limitations, but also made changes in dietary habits and daily

behaviors.

The consequences of imposing quarantine were closing down the activity of all the restaurants and consequently the sudden influx of people to buy and store food at home. This has led to a reduction in the consumption of fresh foods and, conversely, an increase in the consumption of highly processed foods in terms of fat, sugar, and salt. On the other hand, over-purchasing subsequently leads to over-consumption of food at home, which in turn leads to an increase in food prices and their unequal distribution. As a result, quarantining at home during the coronavirus pandemic for a long time has a direct effect on a person's life cycle, including eating habits, eating, and physical activity patterns, which can lead to sedentary behavior or low-energy activity. At home, people spend more time in quarantine, sitting, or lying down (9). Decreased level of physical activity has a negative effect on people's physical and mental health. As a result, the new conditions of the coronavirus pandemic have severely overshadowed the physical activity programs, logic, and healthy eating habits in people.

The sudden spread of the disease and the long-term quarantine at home have led to boredom, impatience, and the consumption of higher amounts of fats, carbohydrates, and proteins in the diet, and the multiplicity of frequent and irregular snacks in individuals. These inappropriate eating patterns increase food intake, resulting in higher calorie intake and subsequent obesity (10, 11). Gender differences in food consumption have been reported during quarantine. Cravings were higher in women than men during the quarantine. The craving for carbohydrates and the production of serotonin, in turn, have a positive effect on mood. And in a nutshell, carbohydrate-rich foods can be a way to treat stress. The effect of low carbohydrate cravings on low mood is commensurate with the food's glycemic index. Unhealthy eating habits not only increase the risk of obesity, but also increase cardiovascular disease, diabetes mellitus, and lung disease (12). Changes in dietary patterns due to the prevalence of COVID-19 disease and long-term quarantine at home have now caused fear and anxiety among many people around the world. Convincing evidence has indicated that stressful, distressing, and emotional turmoil severely affect a person's nutritional status, long-term quarantine, hearing, or reading disturbing news about the pandemic in the media have all increased pressure and stress in individuals. Meanwhile, this tempts people to overeat themselves with food to reduce stress and keep their minds busy. And over a long period of time, increased stress levels will in turn negatively change behavior, attitudes, and ultimately increase unhealthy low-quality dietary patterns (13, 14).

### **Suitable Food in the Conditions of COVID-19**

The responsibility of individuals during the COVID-19

pandemic should be to try to maintain a healthy lifestyle, including eating a healthy diet, comprised of vegetables and fruits, and proper exercise (15). Since no cure or vaccine has been definitively developed for COVID-19, scientific communities and governments are looking for the knowledge and information required for short-term and long-term management in the event of a crisis during the epidemic to plan for safe and secure food supply to prevent the spread of the virus.

Considering the significant number of deaths of vulnerable people (those with weakened immune systems and smokers), the elderly and people with underlying diseases (16), consumption of foods rich in vitamins and other nutritious substances can strengthen the body's immune system to fight the coronavirus (17, 18). During quarantine, the increase in nutrient intake in response to cellular immunity, the function of phagocytes, and the antibody response in the body are very effective. For example, ascorbic acid (vitamin C) is essential for the growth and repair of body tissues by supporting and strengthening the immune system (19). It also limits the susceptibility of lower respiratory tract infections in certain conditions (20). Vitamin C-rich ingredients include citrus fruits, kiwi, and broccoli. Other vegetables, such as carrots, spinach, and sweet potatoes, are rich in vitamin A. This vitamin is part of a group of fat-soluble vitamins and is found in fat-soluble compounds (including retinol, retinoic acid, and beta-carotene), which play a key role in the functioning of the body's immune system and reduce susceptibility to infection (21). For example, Isotretinoin (a derivative of vitamin A) regulates its level Regulation of the enzyme angiotensin 2 and coronavirus 2 (SARS-CoV-2) is required for the enzyme angiotensin 2 to enter the lung cells as well as the cardiovascular system. (22). Furthermore, this vitamin, along with other vitamins such as D and E, may increase the body's resistance to COVID-19 (23).

The stress caused by quarantine also leads to sleep disorders, which in turn worsen the state of stress and subsequently increases food intake, thus creating a dangerously vicious cycle. Therefore, it is important to eat food that contains serotonin and melatonin at dinner. Significant varieties of plant species, including roots, leaves, fruits, and seeds such as almonds, bananas, cherries, and oats, contain melatonin or serotonin. These foods may also contain tryptophan, which is a precursor of serotonin and melatonin. Protein foods such as milk and dairy products are the main sources of the amino acid that induce sleep tryptophan. In addition, tryptophan, as the strongest appetizing peptide, is involved in regulating satiety and calorie intake by reducing carbohydrate and fat intake as well as inhibiting neuropeptide Y through serotonin (24).

Das (16) in his study referred to oral or intravenous administration of bioactive lipids (such as arachidonic

acid and other unsaturated fatty acids), which increased the resistance to SARS-CoV-2, SARS and Middle East respiratory syndrome (MERS) infections. Natural polyphenols as well as Chinese medicines are also helpful in treating viral diseases. For example, ginseng root is very useful in preventing viral respiratory diseases such as influenza (25). Flavonoid compounds from litchi, quercetin, and kaempferol grains can also inhibit the enzymatic activity of SARS 3-chymotrypsin-like protease (3CLpro), which is vital for the proliferation of SARS-CoV-2. Therefore, these compounds can be suggested as a potential factor in the treatment of SARS-CoV-2 and are also a good factor for the supportive treatment of patients with COVID-19 (26). Dietary supplements with vitamins, bioactive lipids, flavonoids, and herbs may be a means to support the human immune system against COVID-19. However, as of April 16, 2020, there is still no substantial evidence that these bioactive compounds can strengthen the body's immune system or prevent or treat COVID-19 disease. However, their potential to strengthen the human immune system highlights their future use in processed foods and their presence in the food market. During the coronavirus pandemic, boosting the body's immune system is one of the most important health goals for consumers worldwide. Therefore, in the new era of COVID-19 for which there is still no definitive cure, and because of obligatory symbiosis with this virus in the future, people's behavior and attitudes, as well as lifestyle, must be changed to maintain health. In order to achieve this goal, in the future, it is increasingly necessary to look for appropriate and safe food products to strengthen the immune system against diseases, especially in periods of crisis and pandemic (27).

### Conclusion

During the COVID-19 pandemic, sudden changes in lifestyle, social distance, and home isolation have had many social and economic consequences worldwide. Eating healthy foods during the coronavirus quarantine period can prevent the long-term side effects of quarantine, including obesity, underlying illnesses and, ultimately, reduce mortality rates.

### Authors' Contribution

In this study, MK and AA designed the study. SS and MJH wrote the initial draft. The article was revised by ANA, MK and SF.

### Conflict of interests

None

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### Ethical Approval

Not applicable.

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