

Food Safety and Food Resources in the Post-COVID-19 World

Kazım Şahin
Ali Adnan Hayaloğlu

Prof. Kazım Şahin

Prof. Kazım Şahin graduated from Ankara University Veterinary Faculty in 1990. Kazım Şahin is a Professor of the Nutrition at Fırat University, School of Veterinary Medicine at Department of Animal Nutrition. He is a Principal Member of the Turkish Academy of Sciences. He is also Chair of TÜBA Food, Nutrition and Health Working Group. He is also Diplomate of European College of Poultry Veterinary Science. “Scientific Award” was given by The Scientific and Technological Research Council of Turkey (TÜBİTAK) in 2019 in the field of health for its internationally superior studies on the determination of target-based molecular nutrition strategies in the prevention and treatment of chronic diseases. He has patents from the American Patent Institute.

Prof. Ali Adnan Hayaloğlu

Prof. Ali Adnan Hayaloğlu was graduated from Department of Food Engineering, at Inonu University, in 1995. He completed MSc and PhD degrees at the University of Cukurova, in 1999 and 2003. Dr. Hayaloğlu worked a part of his PhD studies in Ireland, University College as visiting student. He has mainly experience on traditional cheeses of Turkey, its manufacturing technology, chemistry, biochemistry, and volatiles developed during ripening. Recently, he has worked on profiles of cheese and non-dairy peptides, its angiotensin-converting enzyme (ACE)-inhibition activity, antioxidant and antimicrobial activities. Dr. Hayaloğlu is an active member of Turkish Science of Academy (TÜBA) and American Dairy Science Association (ADSA).

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Kazım Şahin

Fırat University

nsahinkm@yahoo.com

Ali Adnan Hayaloğlu

İnönü University

adnan.hayaloglu@inonu.edu.tr

Abstract

SARS-CoV-2, which was seen for the first time in Wuhan China in December 2019, is the cause of coronavirus disease (COVID-19). It led to pandemic and resulted in the death of important numbers of people worldwide. Despite the large scale of the pandemic, there has been no report or data of transmission of COVID-19 via consumption of food to date. But food could also lead to indirect contamination through if infected person touch it. This is why everybody should follow the recommendations of public health authorities on the washing of hands. In this study, the potential interaction of SARS-CoV-2 with food products and potential risks, the effects in food system, the practices that the food handlers can follow to prevent the contamination and the spread of the virus, what is the importance of good hygiene practices in food safety in this pandemic, the role of consumers in this process are discussed and it has underlined that the importance of safety and good hygiene practices in pandemi.

Keywords

SARS-CoV-2, COVID-19, good hygiene practices, food safety, pandemic

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Introduction

SARS CoV-2 virus known as COVID-19 (Corona Virus Disease 2019) that initially emerged in Wuhan province of China in December 2019 became a diseases with which the entire world is struggling. Due to a series of effects, such as health, economic, sociological, psychological, education, etc., of the epidemic referred to as pandemic by the World Health Organization, it is evaluated that its impact factor is higher compared to the other epidemic and virus origin diseases. It is claimed that the virus, which spreads rapidly through respiration, contact and personal immunity, has expressed some differences from the previously defined pandemic viruses.

Coronaviruses (CoVs) are RNA viruses that infect both humans and animals. This infection caused by the viruses affects the respiratory, gastrointestinal and central nervous systems. Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome Coronavirus (MERS-CoV) are contagious and lethal, and they have caused the death of thousands of people in the past two decades. The last epidemic was first discovered in Wuhan, China (Zhang et al., 2020).

COVID-19 Pandemic

After it was seen in Wuhan in December 2019, it rapidly spread to every place of China (Wang et al., 2020). The pathogen micro-organism that is detected following the isolation and identification processes related to the virus, the new 2019 coronavirus has been named as (2019-nCoV). However, then, an official declaration was made by the World Health Organization (WHO), and it was named as Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). After the serious spread exhibition of SARS-CoV-2 in progress of time, COVID-19 was announced as a pandemic by the World Health Organization on the 11th of March, 2020 (WHO, 2020a).

Although not yet certain, it is considered that the first transmission point of COVID-19 infection, which is expressed as a rapidly and easily transmittable disease, is the Huanan Seafood Market (Wuhan, China). It has been found out that two thirds of 41 cases with diagnosed diseases had relation with Huanan seafood wholesale market where also livestock are sold (Chen, 2020). Thus, as a result of the researches conducted, it was claimed that some individuals who did not visit Huanan (Wuhan, China) seafood market also infected, and so the human-to-human transmission of the disease has been proven (Shreen et al., 2020). Zhou et al., (2020), by benefiting from the array technology, identified that SARS-CoV-2 virus and the bat coronavirus has a similar gene sequence up to 96.2%. With this study, it is considered that the bat may be the infection origin of SARS-CoV-2 virus.

As of today, more than 5 million COVID-19 cases detected in total in more than 210 countries, and against this, more than 360.000 of these cases resulted with death. These numbers are exponentially increasing (JHU, 2020). Flu-like symptoms of COVID-19 generally appear 5-6 days after the infection, and symptoms including fever, cough, sore throat, shortness of breath, muscle and body aches, diarrhoea, nausea and vomiting, and in some cases, loss of smell or taste are observed. In patients with advanced course, severe acute respiratory tract failure, pneumonia, multiple organ failure and death are seen.

It has been reported that SARS-CoV-2, which is the factor of COVID-19 infection, bind and enter the cells by means of “binding of S protein to the angiotensin converting enzyme 2 (ACE2) receptor on the surface of the cells” (Shang et al., 2020). The reveal of the fact that ACE2 is a receptor for SARS-CoV-2 naturally indicates that the organs and tissues that highly express this receptor will be the target organs for SARS-CoV-2. Although the lung alveolar epithelial cells are the densest, it is known that small intestinal enterocytes express high levels of ACE2. Therefore, in addition to the lungs, it is clear that the small intestine will be a potential target for SARS-CoV-2 (Zou et al., 2020). It is accepted that SARS-CoV-2 virus is transmitted from person to person particularly by means of droplet, taking the respiratory droplets containing the virus through the nose, mouth and eyes or by means of contact, contacting the hands infected with the virus to the nose, mouth and eyes. *The transmission of SARS-CoV-2 virus through food consumption has not been reported yet.* In addition to this, it is not yet fully known whether the virus has been detected in other clinical samples and therefore whether samples other than the droplets are the origin of the virus or not. As a matter of fact, the presence of gastrointestinal findings in most of COVID-19 patients and the detection of SARS-CoV-2 virus RNA in the stool of again most of them, even the identification of infectious virus particles there raise the question of whether the virus is transmitted via the faecal-oral path or not.

In a study conducted in children (2 months-15 years old) infected with SARS-CoV-2, the virus RNA has been found positive in rectal swabs of 8 out of 10 children. More importantly, the PCR continued to be positive in the rectal swabs

of 8 patients although the PCR in the throat and nose swabs were negative. These results also suggest that the gastrointestinal system contributes to the spreading of the virus and the transmission by faecal-oral path. However, since virus isolation has not been performed in this study, it has not been stated whether the infective virus was found or not despite the presence of nucleic acids of the virus (Xu et al. 2020).

In a study carried out in China, the presence of SARS-CoV-2 has been investigated at different times in the nasal swab, blood, sputum, stool and urine samples of COVID-19 patients, and RNA of the virus has been detected in 44 of 153 (29%) samples, but virus RNA could not be detected in 72 urine samples. One of the attractive, perhaps the most important finding of this study is that the infective virus has been isolated in the stool samples of 2 patients. This result unfortunately suggests that the faecal-oral path may play a role in the transmission of SARS-CoV-2 virus (Wang et al., 2020a). It is not known whether the identification of virus in the stool is related to the severity or symptoms of the disease. As to be less than the respiratory system findings, the gastrointestinal findings such as abdominal pain, digestive system bleeding, nausea, vomiting and diarrhoea are reported in 2-35% of COVID-19 patients. In some studies, it has been reported that before respiratory findings and high fever, gastrointestinal findings are detected in up to 10% of the patients (Wang et al., 2020b).

In a study carried out on nose, throat and stool samples, SARS-CoV-2 RNA has been found positive in 44 of 74 stool samples. During the long-term follow-up, while the nasopharyngeal swabs remained positive averagely 15 days after the initiation of the symptoms, the nasopharyngeal swabs of 41 patients whose stool samples were found positive remained positive for an average of 16 days. The stool samples of these patients remained positive for an average of 30 days. By basing on these findings, the researchers reported that once the respiratory system samples have become negative, the virus may continue replication in the gastrointestinal tract of the patients and the virus will be able to continue to disseminate approximately for 30 days after its elimination in the respiratory system (Wu et al., 2020). Since the findings reported above are relatively few patient findings, it is necessary to examine more samples to identify how often and how long the infectious virus can be detected in the stool. When it is considered that even a small amount of virus is sufficient to cause COVID-19 disease, it should be noted that even very few amount of infectious virus in the stool can play role in the dissemination of the disease (Amirian, 2020).

Meeting Food Requirement and Food Safety During COVID-19 Process

Since no treatment or vaccine has yet been developed for COVID-19 disease, the scientific community and authorities are spending serious efforts to obtain information for the management of the pandemic crises in the current period and future, and to better manage the process. During this period, the food

industry and its stakeholders also come to the fore due to the requirements of people for food to survive. Such a serious pandemic that is causing a decrease in the presence of labour by more than 25% can also lead to lack of food worldwide appears as a possibility in front of us. The authorities and research groups must quickly identify the most critical threats to the food system in order to mitigate the effects of the pandemic. In this study, the food sources available during the COVID-19 pandemic crisis period in our country have been evaluated within the scope of food safety, and the risks of food products in terms of being both source of transmission and source of spread have been investigated.

Possible Risks of SARS-CoV-2 in Foods

It is accepted that the main transmission mode of COVID-19 disease is from person to person; and in general, by means of infected droplets during sneezing, coughing or breathing. When a person sneezes, small droplets containing approximately 20.000 viruses are spread through the airway. There must be a repelling force in the air and the person must contact this spreading virus in order for viruses such as SARS-CoV-2 to spread. It is known that some viruses target specific tissues and organs, and that coronavirus targets the lungs (WHO, 2020b). The virus can stay alive for up to maximum 4-5 days on various materials such as paper, plastic, glass aluminium, wood, etc.

Although it is certainly reported that SARS-CoV-2 is transmitted through the respiratory tract, food is questioned by the people by being considered as one of the suspicious sources, as in all infections. SARS-CoV-2, the factor of COVID-19 disease, cannot develop on food compositions and surfaces. While the bacteria can grow on the surface of the food under appropriate conditions, viruses such as SARS-CoV-2 require a living host to reproduce. Although the viruses can survive on various objects and surfaces, it is not known for how long they can survive on a food and how much is required to be taken to the body to get infected (WHO, 2020a).

The European Food Safety Authority (EFSA) and the United States Food and Drug Administration (FDA) closely monitor the situation by carrying out detailed researches on the transmission sources of COVID-19 that affected almost all countries and caused thousands of deaths. The epidemics that have been previously encountered due to viruses such as MERS-coronavirus (MERS-CoV) and SARS-coronavirus (SARS-CoV) have shown that food is not a source of transmission for relevant viruses (FDA, 2020). And in today's pandemic, there is no evidence that SARS-CoV-2 virus is different in this respect. According to the researches carried out by Food Safety agencies in EU member States, it is not possible to encounter the factor of COVID-19 disease in processed foods. In addition, the European Food Safety Authority stated that there is no data or evidence that food is a possible transmission source or route of COVID-19 virus (EFSA, 2020). Along with this, although COVID-19 is a large-scaled pandemic, there is no report of transmission through food consumption to date. As a result, there is no evidence that foods pose a risk to

public health in terms of COVID-19. On the other hand, if an infected person touches food and another healthy person comes into contact with this food, then the food can also be a source of transmission. Theoretically, the food and packages being contaminated by an infected person can be an infection source since they are carriers. In this sense, it has been determined that the way of transmission of the virus to the food is indeed that at the food companies, the personnel who do not have any symptoms of disease, but referred as carriers infect the food (Sağdıç et al., 2020). Therefore, in order to eliminate the possibility of a possible infection to occur on food, as well as in order to protect the personnel besides the food, the National Food Safety regulations and the rules regarding COVID-19 must be followed. The food companies and operators should strengthen their good hygiene practices and standard operating procedures. In this sense, the awareness of all personnel working in the production and sales chain should be raised on the subject and wearing mask and gloves should be made compulsory by the relevant management units even if there are no symptoms.

The Role of Food Businesses and Consumers at the Point of Protection from SARS-CoV-2 Virus

The researches showing that SARS-CoV-2 and other coronaviruses remain alive in the digestive system and are excreted with stool suggest that these viruses can be found for a very long time in the environments where we live and it is vital that food manufacturers and consumers pay attention to the general hygiene rules for protection.

Under the experimental conditions, it has been determined that the virus can survive on various surfaces such as plastic or cardboard, etc. used in packaging. This suggests that food packaging materials can also be a source of contamination for individuals. Therefore, some points should be taken into consideration by consumers during and after the shopping.

Points to Consider During Market Shopping

- *A minimum distance of 1.5 m must be left between the shoppers to prevent contamination.*
- *Hand shaking, hugging or other physical contacts should be avoided.*
- *If available, it is important to clean the frequently touched surfaces, such as the shopping trolleys or the handles of the basket, with a disinfectant or wipes containing disinfectant.*
- *In order to avoid a possible contamination with any pathogen present on the hands, should not be touched to other products than the product to be bought.*
- *Touching the face should be avoided.*
- *While wearing a mask at the market reduces the risk of being infected, at the same time, it can play a reminding role for the other people to respect social distance. At the same time, wearing a mask also helps prevent symptomatic people from infecting others.*

- *Particularly the vegetables and fruits should be packaged by the personnel of the market after the necessary measures are taken to prevent contact by many people.*
- *Hand disinfectant should be used, if any, before leaving the market or when waiting in the payment area.*
- *The people with symptoms such as fever or cough should avoid shopping in public places.*
- *Washing hands frequently and keeping the distance with the people is the best way to prevent disease.*

Points to Consider After Market Shopping

The recent studies conducted have shown that SARS-CoV-2 virus protects its infectious character for up to 72 hours on surfaces or objects. However, most of the viruses on the surface of commonly used materials become ineffective after the first 24 hours and lose their infectious character. A limited number of findings have been identified concerning the dissemination of disease by the virus containing particles in these products.

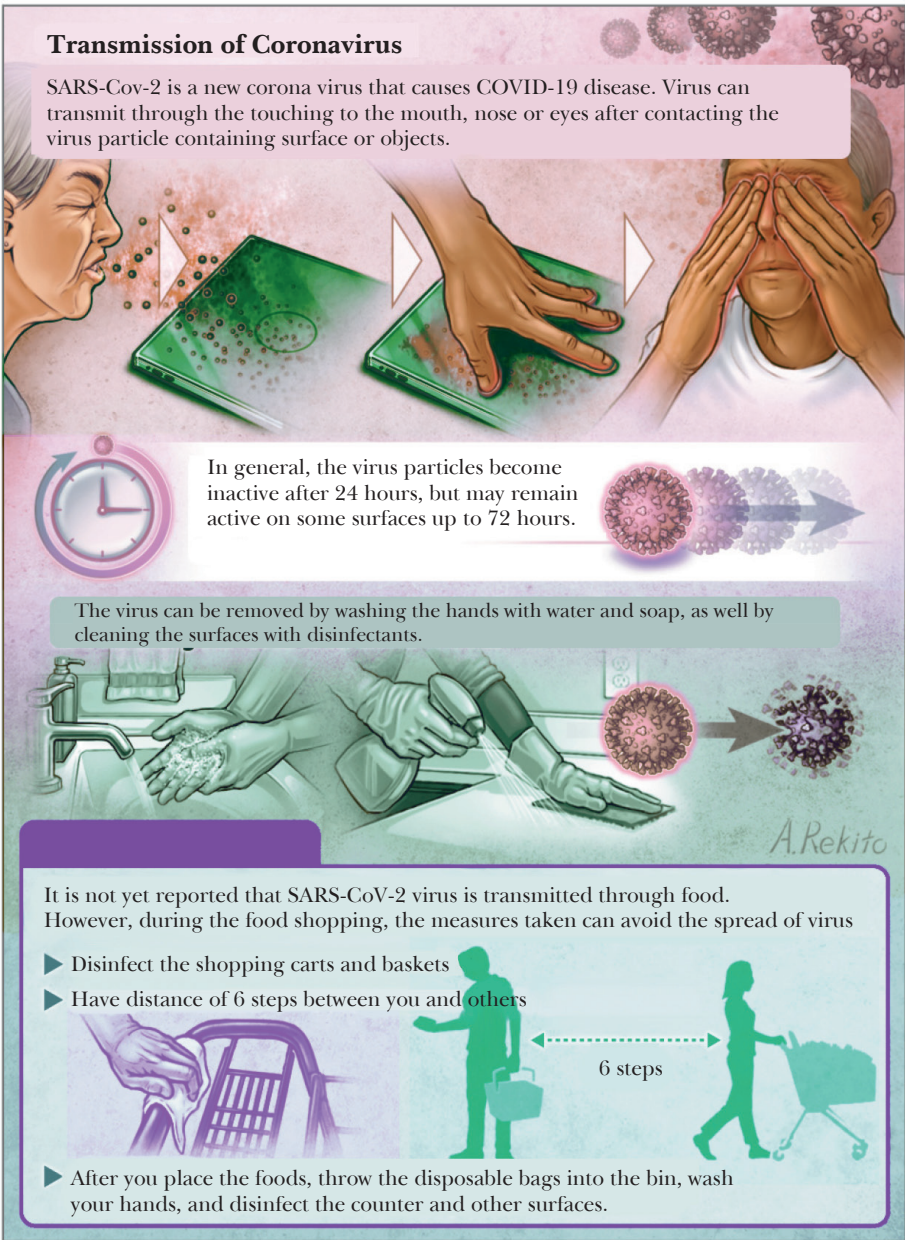
- *Hands must always be washed after removing the food from the packaging.*
- *In addition to this measure, wiping and disinfecting the surfaces are among the things that should be done.*
- *Touching the eyes, nose or mouth when using food and food packages should be avoided, and reusable shopping bags should be washed regularly.*
- *If the food will be consumed shortly after it is unpacked, it is necessary to pay attention to hand hygiene before eating.*
- *Personal items such as plates, spoons, forks and glasses should not be shared with other people.*
- *The fruits and vegetables should be rinsed well with water before consumption (Desai and Aronoff, 2020).*

When all these practices are taken into consideration, the best way to avoid COVID-19 in safe food consumption during this process is good hygiene practices. After shopping, before using the food, during the preparation and before eating, the hands should always be washed with soap and water for at least 20 seconds and dried thoroughly with disposable towels. All equipment and surfaces that are used when preparing the food must be washed and disinfected.

At this point, WHO has identified five key rules for more reliable food:

1. *Keep Clean*
2. *Separate raw and cooked foods*
3. *Cook well*
4. *Keep foods at safe temperatures*
5. *Use reliable water and raw materials (WHO, 2020b)*

Image 1. Transmission of virus and protection



Source: (Desai & Aronoff, 2020)

Subjects to Address in Food Production in New Period after COVID-19

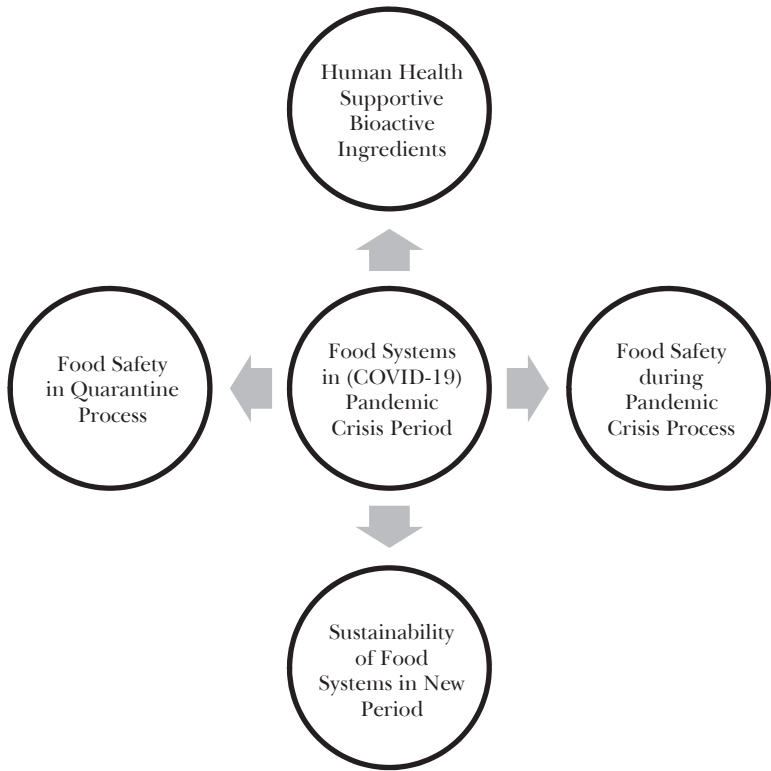
When we consider all factors of COVID-19 pandemic, there are four important aspects that should be handled in the new period by the food industry and food supply chain (Figure 1).

First; while the consumers try to protect themselves and their immunity systems by implementing healthier diets, since the demand to these products will increase, it is possible that the bioactive ingredients of the food may become critical and scarcity may occur. Second; the food safety is a subject to which attention should be paid in terms of the prevention of spread of virus among the manufacturer, retailers and consumers. Third; the food reliability concerns resulting due to approximately one billion people not going out of their homes along with the quarantine practice is an important issue again to be addressed. Finally, the sustainability of the food systems during the pandemic period is another subject that should be addressed by the industry.

Providing a healthy and reliable environment to all personnel in the food production and supply chains is a must to prevent the food scarcity. For the purpose of protecting the safety and integrity of the food supply chain and to balance the international trade with the need of support, the entities authorized in food safety must prioritize the services having critical importance during the ongoing COVID-19 pandemic. In order to facilitate this, FAO and WHO have developed guidelines for the persons authorized in food safety, and FAO has provided guidance on the policy that is required to be applied for the food safety and food reliability during the pandemic process. In order to ensure and maintain safe food production, it is very important to strengthen the implementations of the available international standards developed by the Codex Alimentarius Commission and Food Import and Export Supervision and Certification (FAO, 2020).

In addition, FAO supports the measures ensuring the sustainability of the supply chains for enabling the people access to safe and nutritious foods during the pandemic. In this sense, special strategies are suggested, such as expanding the urgent food aid programs by increasing the e-commerce and ensuring urgent aid to the agricultural production of small businesses. Likewise, suggests the logistics bottlenecks having key importance (i.e.; avoiding the inter-city food transportation for the perishable foods, such as fish, vegetable and fruit, etc.) to focus on tax and trade policies in order to mobilize the supply chain and implement the financial measures in case the food prices increase. FAO realizes comprehensive studies with WHO for providing guidance service targeted for everyone in the food chain for the purpose of supporting the studies realized to protect the safety of the food supply during such a crisis (FAO, 2020).

Figure 1. Food Systems during Coronavirus Pandemic (COVID-19) Crisis Period



Food Safety and Nutrition during COVID-19 Pandemic

In order to improve the physical and mental health of the individuals during the COVID-19 pandemic, an action plan has been proposed for the purpose of maintaining optimal nutrition at individual, social, national and global levels by using an adapted version of the ecological model (Naja and Hamadeh 2020; Table 1 and Figure 3). The common denominator that guides most of the nutritional and dietary recommendations at the individual level in order to struggle with COVID-19 is associated with the link between diet and immunity. Because it is known that diet has an important effect on the immune system of the people and sensitivity to the diseases. The measures such as self-isolation and social distance in the control of the disease are very important in limiting the spread of the virus, reducing the risk of the disease and ultimately in the control of the disease. However, these measures have serious effects on both accessing to food access and method of use (Naja and Hamadeh, 2020). Because the continuous stay of the person at home has direct effects on lifestyle such as nutritional habits and physical activity losses. Even if it is short-term, low physical activity can adversely affect the physical and mental health. Continuously staying at home can lead to irregular eating habits that are associated with high calorie intake and an increased risk of obesity. In this sense, the most important responsibilities of the individuals during the

COVID-19 pandemic are to apply diets that are rich in fruits and vegetables by applying a healthy lifestyle, to do exercise during the leisure time, to try to gain healthy and balanced weight, and to get enough sleep. Furthermore, for the individuals, drinking 8-10 glasses of water in a day, reducing the sugar-added fruit juices and carbonated beverages, reducing the consumption of the saturated, trans-fat fast food products and not consuming excessive salt daily are recommended (Naja & Hamadeh 2020; WHO, 2020). In addition to this, it has been reported that vitamin D that strengthens the cellular immunity by suppressing the production of various interleukin-6, interferon gamma and tumour necrosis factor- α secreted by Th1 cells in the immune system (Grant et al., 2020), and lactoferrin, a natural anti-microbial glycoprotein, reduce the symptoms of COVID-19 (Serrano et al., 2020), however, it was stated that these clinical studies must be conducted with more comprehensive patient groups. In the treatment of patients having COVID-19 infection at moderate and severe level, it has been determined that vitamin C, with intravenous administration, is useful at doses ranging from 10-20 g/day (Cheng, 2020). It has been reported that phytochemicals such as curcumin, resveratrol, quercetin, echinacea extract, etc. support the immunity by reducing the inflammatory biomarker levels such as IL-1 β , IL-6 and TNF- α and may be protective against coronaviruses (Zahedipour et al., 2020; Marinella, 2020; Huang et al., 2020). However, there is a need for advanced level of scientific studies in order to determine the safe and therapeutic levels of these bioactive products.

Due to the difficulties in transportation, distribution and delivery, problems in accessing food may be experienced during COVID-19 pandemic (Vallianatos et al., 2010). Pandemics, by creating uncertainty and fluctuation in consumer demands, make it difficult to keep food stocks in particular in the economy just in time. The people can stock more food than they need. Stocking can lead to excessive scarcities and rapidly increasing prices in the markets. This may have devastating consequences for the risky groups of the population. The elderly people and people with chronic diseases may be malnourished when their health concerns and limited purchasing power are taken into consideration. For this reason, it is a crucial social responsibility to expand the aid in accessing to food and food availability through a planned and reliable support system by identifying the risk levels at the communal level (Naja & Hamadeh, 2020).

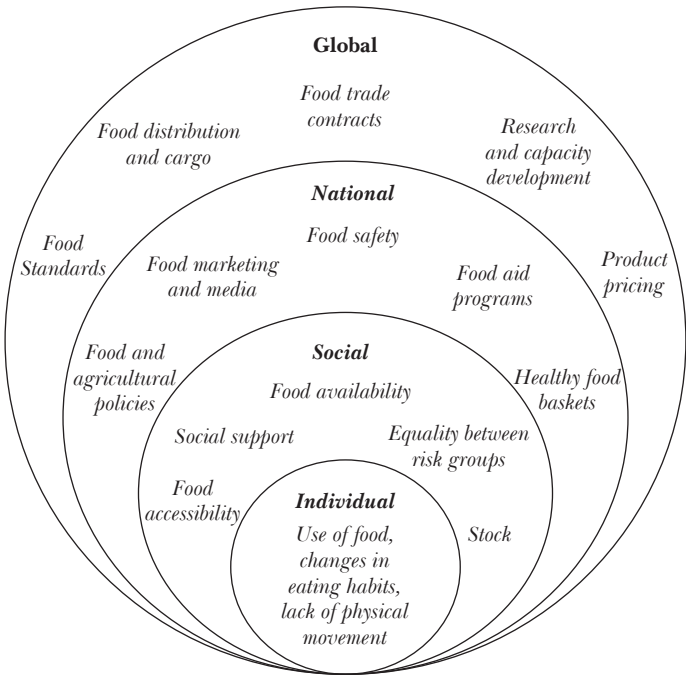
During the pandemics, each country should define, finance and distribute a food basket that supports the health related requirements of the population and includes a diet with the lowest cost against the difficulties resulting from providing adequate food. And this should include the local agricultural products of the country and minimize dependence on importing food. The policies should be established to mobilize the resources to finance the food purchases and provisions, for the tax exemption for essential foods and products, and to support the agriculture and food production industries. When the impact of the COVID-19 pandemic on the supply and demand dynamics of food is taken into consideration, the price increases reach to uncontrollable levels sometimes and become widespread. This is a situation that requires a national

effort in order to closely monitor and control the food prices and markets (Naja & Hamadeh 2020).

The governments should establish and maintain an open and bi-directional communication with the public during the pandemic. The transparency and trust that have critical importance in particular are required to ensure support and compliance (Naja & Hamadeh 2020). In order to inform the public on the sufficient food consumption and purchase, public awareness campaigns, training on nutrition, emergency news bulletins, radio and TV announcements and interviews, as well as special telephone lines for direct communication with the representatives of the government can be designated (Naja & Hamadeh 2020).

The countries that are significantly dependent on imported food in order to meet their food demand may encounter a number of risks, particularly due to the delays in the supply chain resulting from the closed border crossings. For this reason, it is essential to ensure the food supply throughout the world in order to provide a smooth flow of global trade and to prevent food insecurity in the international markets (Naja & Hamadeh 2020). The protectionist strategies that are implemented by each country should be complemented by global cooperation, solidarity and coordination between the countries to ensure that humanity gets out of this pandemic with the least loss possible.

Figure 2. An action plan recommended at individual, social, national and global level to support nutrition and food safety during COVID-19 pandemic



Source: (Naja & Hamadeh 2020)

Table 1. Recommendations to reduce the impact of COVID-19 on nutrition and food safety at individual, social, national and global levels

	Nutritional Recommendations During COVID-19 Pandemic
Individual	• Avoid hidden hunger caused by microelements. Because zinc, iron, selenium, iodine, vitamins A, B12 and D deficiencies are associated with many diseases. • Eat a well-balanced diet according to your nutritional requirements and avoid irregular snacks. • Eat foods rich in vitamins A, C, E, B12, zinc and iron, such as citrus, dark green leaf fruits, nuts and dairy products. • Maintain a healthy lifestyle with exercise (home exercise), regular sleep and meditation. • Stay away from smoking, alcohol and drugs. • Avoid disseminating the false information about the relationship between COVID-19 and nutrition and dietary consumption.
Social	• Raise awareness on the devastating consequences of stock and shopping in panic. • Identify and support the population at high risk of malnutrition in the community, particularly the elderly and chronic patients. • Establish a planned and reliable support system to ensure that the essential food products are reachable, accessible and affordable for all members of the community.
National	• Food assurance should be addressed as a public health concern through an integrated approach. • Ensuring the interworking of the Ministry of Health, Ministry of Food, Agriculture and Livestock and relevant scientific institutions according to a single health concept in order to improve the healthy-balanced nutrition opportunities. • Define, finance, and distribute a low-cost diet that meets the health related needs of the population, ensures the use of the local agricultural products of the country and minimizes the dependence on importing food. • Mobilize the required resources in order to finance the food purchases and provisions. • Waive on taxation for essential foods and goods. • Support the agriculture and food production industry. • Inspect and control the markets and food prices closely. • Establish networks between the private sector, international agencies and local communities. • Maintain high transparency levels that have critical importance to ensure trust, support and compliance. • Youth should be encouraged to return to the village again and their contribution to the agricultural production should be supported. • Biodiversity, particularly the endemic plant and animal species, should be protected.
Global	• Ensuring the constant flow of global trade and avoiding trade restrictions, in addition to the food and feed supplies, preventing the deterioration of the agricultural inputs' local conditions that have been already challenged by COVID-19 measures. • Reducing the import taxes and other restrictions on foodstuffs. • Biodiversity, particularly the endemic plant and animal species, should be protected.

Source: (Naja & Hamadeh 2020)

Conclusion

Due to the reporting of thousands of cases and deaths every day, the World Health Organization has declared coronavirus disease as a pandemic. A new period and process has emerged with the COVID-19 pandemic. Detailed studies are still carried out for the humanity due to the economy and food systems. With the progression of the pandemic, the scientists and the industry experts will have to struggle with various challenges in many important issues such as ensuring food safety and food reliability. At this point, during COVID-19 pandemic period, measures should be taken against a possible economic crisis through offering acceptable and economically competitive products, and developing functional foods strengthened with bioactive components and antioxidants that are beneficial for health and supporting the immunity system of the consumers. During this process, without any doubt, there is a need to avoid the practices that are performed with the logic of “usual works”, and to accelerate the efforts to develop sustainable and modern food systems. Some viruses pass into sleeping mode in passive form and present at older ages, weight loose, nutritional deficiency, or reduced body immunity under stress situations of the person (WHO, 2020b). Therefore, during this process where nutrition has a vital importance, the safe and sustainable food concepts become more important than ever. In this sense, the transmission of the factor that is causing the pandemic to the food supply chain should be prevented. According to the available information, it is considered that the transmission way of the virus to the foodstuff is in the form of transmission to the foodstuff by the infected workers who are working at the food companies, do not exhibit any symptoms of disease, but carry the virus. For this reason, it is important to raise the awareness of all personnel working in both the production and sales chain about the necessity of good hygiene practices and the obligation of using personal protective equipment such as masks and gloves, and most importantly, in comprehending all aspects of the seriousness of the pandemic process.

As a result; COVID-19 disease caused by SARS-CoV-2 virus that affects the whole world is a great risk source for the human health. The most effective way of the transmission of the disease to the healthy people is the breathing of the virus spread in the form of droplets through the cough and sneezing of an infected person. It is thought that it may be another method of spread if the person touches his own face, nose and eyes after touching contaminated surfaces (WHO, 2020a). Since there is no data yet that the disease is transmitted through food or digestion, the experts express that the transmission of the disease through food or packaging is not likely possible. There is still no certain information about whether the factor of the disease responsible for COVID-19 is present in the composition or surface of the food or not, for how long it can survive on food and whether it can infect the people or not. However, according to the current scientific studies, it is clear that, although there is no information that SARS-CoV-2 virus is transmitted through the food and food packaging, the personal hygiene rules must be ensured by considering the possibility that an infected person who carries the factor of the disease may

have contacted the food being consumed. On the other hand, it is becoming an obligation to realize all correct production and hygiene practices required to fully ensure the concept of “safe food” before the consumption of the foodstuff.

References

- Amirian, E.S. (2020). Potential fecal transmission of SARS-CoV-2: Current evidence and implications for public health. *Int J Infect Dis*, 95, 363-370.
- Chen, J. (2020). Pathogenicity and Transmissibility of 2019-nCoV -A quick overview and comparison with other emerging viruses. *Microbes and Infection*, DOI: 10.1016/j.micinf.2020.01.004.
- Desai, A. N., Aronoff, D. M. (2020). Food Safety and COVID-19. *JAMA*. Patient Page. Retrieved from: <https://jamanetwork.com/journals/jama/fullarticle/2764560> (20.05.2020)
- EFSA (European Food Safety Authority). (2020). *Coronavirus: no evidence that food is a source or transmission route*. Retrieved from: <https://www.efsa.europa.eu/en/news/coronavirus-noevidence-food-source-or-transmission-route> (15.05.2020)
- FAO (Food and Agriculture Organization of the United Nations). (2020). COVID-19 and Food Safety. Retrieved from: <http://www.fao.org/2019-ncov/q-and-a/food-safety/en/> (15.05.2020)
- FDA (U.S. Food and Drug Administration). (2020). Food Safety and the Coronavirus Disease 2019 (COVID-19). Retrieved from: <https://www.fda.gov/food/food-safety-during-emergencies/food-safety-and-coronavirus-disease-2019-covid-19> (20.05.2020)
- Huang YF, Bai C, He F, Xie Y, Zhou H. (2020). Review on the potential action mechanisms of Chinese medicines in treating Coronavirus Disease 2019 (COVID-19). *Pharmacol Res*. 104939.
- Grant, W. B., Lahore, H., McDonnell, S. L., Baggerly, C. A., French, C. B., Aliano, J. L., Bhattoa, H. P. (2020). Evidence that vitamin D supplementation could reduce risk of influenza and COVID 19 infections and deaths. *Nutrients*, 12(4), 988. DOI: 10.3390/nu12040988.
- Johns Hopkins University and Medicine. (2020) <https://coronavirus.jhu.edu/map.html> (17.05.2020)
- Marinella MA. (2020). Indomethacin and resveratrol as potential treatment adjuncts for SARS-CoV-2/COVID-19. *Int J Clin Pract*. e13535. DOI: 10.1111/ijcp.13535
- Naja F.Hamadeh, R. (2020). Nutrition Amid the COVID-19 Pandemic: A multi-level framework for action. *Eur J Clin Nutr*. 1-5. DOI: 10.1038/s41430-020-0634-3.
- Sağdıç, O., Kayacan, S., Dertli, E., Arıcı, M. (2020). Gıda güvenliği açısından COVID-19 etmeni SARS-CoV-2'nin değerlendirilmesi ve korunma yöntemleri. *Avrupa Bilim ve Teknoloji Dergisi*, (18), 927-933.
- Serrano, G., Kochergina, I., Albors, A., Diaz, E., Oroval, M., Hueso, G., & Serrano, J. M. (2020). Liposomal lactoferrin as potential preventative and cure for COVID-19. *International Journal of Research in Health Sciences*, 8, 8-15.
- Shang, J., Ye, G., Shi, K., Wan, Y., Luo, C., Aihara, H., Geng, Q., Auerbach, A., Li, F. (2020) Structural basis of receptor recognition by SARS-CoV-2. *Nature*, 581, 221-224
- Shereen, M. A., Khan, S., Kazmi, A., Bashir, N., Siddique, R. (2020). COVID-19 infection: origin, transmission, and characteristics of human coronaviruses. *Journal of Advanced Research*, 24, 91-98.
- Wang, W., Xu, Y., Gao, R., Lu, R., Han, K., Wu, G., Tan, W. (2020a). Detection of SARS-CoV-2 in different types of clinical specimens. *JAMA*, 323(18), 1843-1844.
- Wang, D., Hu, B., Hu, C., Zhu, F., Liu, X., Zhang, J., Zhao, Y. (2020b). Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*, 323(11), 1061-1069.

- WHO (World Health Organization). (2020a). *Coronavirus disease 2019 (COVID-19) Situation Report –51*. Retrieved from: <https://www.who.int/docs/default> (17.05.2020).
- WHO (World Health Organization). (2020b). *Five Keys to Safer Food Manual. Report–51*. Retrieved from: https://www.who.int/foodsafety/publications/consumer/manual_keys.pdf (20.05.2020).
- Wu, Y., Guo, C., Tang, L., Hong, Z., Zhou, J., Dong, X., Yin, H., Xiao, Q., Tang, Y., Qu, X., Kuang, L., Fang X., Mishra, N., Lu, J., Shan, H., Jiang, G., Huang, X. (2020). Prolonged presence of SARS-CoV-2 viral RNA in faecal samples. *Lancet Gastroenterol Hepatol*, 5(5), 434-435.
- Xu, Y., Li X., Zhu, B., Liang, H, Fang, C., Gong, Y., Guo, Q., Sun, X., Zhao, D., Shen, J., Zhang, H., Liu, H., Xia, H., Tang, J., Zhang, K., Gong, S. (2020) Characteristics of pediatric SARS-CoV-2 infection and potential evidence for persistent fecal viral shedding. *Case Reports. Nat Med*. 26(4), 502-505.
- Vallianatos M, Azuma AM, Gilliland S, Gottlieb R. 2010. Peer reviewed: food access, availability, and affordability in 3 Los Angeles communities, project CAFE, 2004–2006. *Prev Chronic Dis*, 7:1–9.
- Zahedipour F, Hosseini SA, Sathyapalan T, Majeed M, Jamialahmadi T, Al-Rasadi K, Banach M, Sahebkar A. (2020). Potential effects of curcumin in the treatment of COVID-19 infection. *Phytother Res*. DOI: 10.1002/ptr.6738
- Zhang, R., Wang, X., Ni, L., Di, X., Ma, B., Niu, S., Reiter, R. J. (2020). COVID-19: Melatonin as a potential adjuvant treatment. *Life Sciences*, 117583.
- Zheng, Y. Y., Ma, Y. T., Zhang, J. Y., Xie, X. (2020). COVID-19 and the cardiovascular system. *Nature Reviews Cardiology*, 17(5), 259-260.
- Zhou, P., Yang, X. L., Wang, X. G., Hu, B., Zhang, L., Zhang, W., Chen, H. D. (2020). A pneumonia outbreak associated with a new coronavirus of probable bat origin. *nature*, 579(7798), 270-273.
- Zou, X., Chen, K., Zou, J., Han, P., Hao, J. Z. H. (2020). The single-cell RNA-seq data analysis on the receptor ACE2 expression reveals the potential risk of different human organs vulnerable to Wuhan 2019-nCoV infection. *Front Med*. 14(2), 185-192.

