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The Measures to be Taken Against COVID-19 in Food Industries: A Review

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ABSTRACT

The COVID-19 epidemic, caused by the SARS-CoV-2 virus, turned into a worldwide pandemic and caused death of about 5 million people worldwide. The virus is not proven to be transmitted to humans through foodstuffs, especially from packaged foods. However, it is possible for SARS-CoV-2, which is spread from personnel to food surfaces or food products, to cause illness in humans. It is of great importance that all employees who come into contact with food comply with the mask, distance and hygiene rules and are vaccinated quickly. Fruits and vegetables should be washed with plenty of water and cooked foods should be consumed after being cooked well over 60°C. In addition, it is of great importance to ensure the cleaning, sanitation, good hygiene practices and active packaging in all workplaces from the farm to the fork. In this study, general characteristics of SARS-CoV-2 virus, spread of COVID-19 through foods and prevention of this spread, precautions to be taken against COVID-19 in food businesses and disinfectants that should be used were provided in detail.

Key words: COVID-19, Food safety, Foodborne viruses, SARS-CoV-2.

Around the middle of December in 2019, the first coronavirus case, so called as COVID-19, was reported in China (Wuhan city) (Lee *et al.*, 2020). It is also an airborne contagious disease quite similar to the previously encountered SARS virus. Since it is a highly contagious disease among humans, it has turned into a pandemic in a short time. WHO declared the spread of COVID-19 as a pandemic on 12th of March, 2020 (Bucak and Yigit, 2021).

According to the recent information shared by the World Health Organization, this new pandemic affected about 253.64 million people and resulted in 5.10 million casualties worldwide (WHO, 2020a). In Turkey, the first COVID-19 case was announced on 11th of March, 2020 and the first mortality was reported on 17th of March, 2020 (Bucak and Yigit, 2021). By 17th of November, 2021 in Turkey, Ministry of Health reported number of covid cases as 8 178 901 and mortality as 71 724 people (Republic of Turkey Ministry of Health, 2021).

Studies have revealed that COVID-19 is transmitted through droplets and the incubation period varies between 2-14 days after contamination (Hemida and Ba Abduallah, 2020). Disease symptoms include fever, dry cough, fatigue, muscle pain and diarrhea, pneumonia, respiratory infection, nephrism and mortality. However, the symptoms of the disease may vary according to the age and body resistance of the patient and it is reported that there are infected patients who show no symptoms. COVID-19 can be contaminated from person to person or from contaminated surfaces and/or objects. Droplets of coughing or sneezing individuals may settle in mouth or nose of the people nearby through breathing and can be carried to the lungs from there. Besides, contamination and subsequent infection may occur when a person touches the mouth, nose and/or eyes after touching a surface or object with virus contamination (Yucel Sengun *et al.*, 2020).

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The World Health Organization has announced that there was no evidence of scientific studies conducted so far that food and animals used in food production were a possible source or transmission route of the COVID-19 outbreak. On the other hand, coronavirus was reported to infect surfaces and remain active for a few hours or days depending on the characteristics of the surface (Duda-Chodak *et al.*, 2020). For these reasons; the biggest responsibility of workplaces in the food industry is to prevent contamination of food by disease factors by applying “Good Hygiene Practices” correctly and completely. Another important responsibility is to protect the suppliers and other people who are contacted due to the workflow, especially the employees, in terms of COVID-19 disease, to develop systems for follow-up and to raise awareness among these people with training (Turkish Food Safety Association, 2020).

In this study, general characteristics of SARS-CoV-2, the spread of COVID-19 through food, making food safe against COVID-19, the measures that businesses that produce and sell food should take against COVID-19 and

the disinfectants that can be used in businesses to prevent this epidemic were discussed in detail.

General characteristics of SARS-CoV-2

Coronaviruses (CoV) are members of a large family and they generally cause respiratory tract diseases. Infection manifests itself either as common cold or severe respiratory tract infection. SARS and MERS viruses are among the major coronaviruses causing several diseases in humans. Toward to end of 2019, a new strain of coronavirus, so called as SARS-CoV-2, was emerged (Chhikara *et al.*, 2020) and the disease caused by SARS-CoV-2 was so called as COVID-19 disease (Duda-Chodak *et al.*, 2020). Although SARS-CoV-2 is considered to be third zoonotic coronavirus, it is the only one with a potential of pandemic (Mackenzie and Smith, 2020). This typically occurs when infected animals (cats, dogs, cattle, bats, rats, chickens, turkeys, horses, pigs, rabbits and *etc*.) are slaughtered for consumption, causing respiratory and gastrointestinal diseases (Ceylan *et al.*, 2020). The new strain (SARS-CoV-2) is an enveloped RNA virus that is surrounded by a lipid bilayer (Abu-Farha *et al.*, 2020). The virus was thought to be transmitted from wild bats to humans (Xu *et al.*, 2020). Similarly, Zhou *et al.* (2020) also indicated wild bats as the potential source of the virus because the most recent one had quite a similar sequence (96.2%) to the coronavirus found in bats.

The spread of potential COVID-19 through food

Viruses may contaminate foodstuffs either before or after the harvest and thus transmitted either directly or indirectly through these foodstuffs. Fecal-oral transmission is the primary route for transmission of foodborne viruses. Coronavirus species are also transmitted by aerosols and fomites (Miranda and Schaffner, 2019).

Food service providers are at the frontline confronting with COVID-19 pandemic (Olaimat *et al.*, 2020). There haven't been any studies reporting the spread of COVID-19 through food products (Olaimat *et al.*, 2020; Shahbaz *et al.*, 2020; Barman *et al.*, 2021; Jyoti and Bhattacharya, 2021). In addition, no evidence has proved about transmission of coronavirus causing respiratory tract infections through foodstuffs or package materials of these foodstuffs. Although transmission of SARS-CoV and MERS-CoV through foodstuffs has not been reported previously (Olaimat *et al.*, 2020), it was indicated that human coronavirus 229E (HuCoV-229E) could survive over ceramic tiles, glass, stainless steel, Teflon, PVC surfaces for about 5 days, over silicon rubber surfaces for around 3 days at 30–40% relative humidity and 21°C temperature conditions. Then, it was thought that SARS-CoV-2 could be transmitted through contact surfaces since the virus could survive several days on surfaces (Warnes *et al.*, 2015). Thus, Desai and Aronoff (2020) reported that viruses on the food surface may become ineffective in foods that are kept for a certain period (approximately 72 hours), but this waiting process may not be possible for foods that are kept cold or frozen.

It has been assumed that the coronavirus was transmitted from contaminated surfaces including nasal, eye or oral mucosa. Throughout the a normal day, individuals touch or get in contact with several surfaces. In some cases, an infected individual may touch several things and unwillingly contaminate the surfaces he/she touched. Then, an uninfected individual can get the virus from those previously infected surfaces again through touching. It is still unclear how frequent and significant these transmissions are. There may be several sources of infection in environments with severe viral contamination (Duda-Chodak *et al.*, 2020). Winther *et al.* (2007) indicated that transmission of the virus from mucus-contaminated sites required a contact with fingers. A regular person has a fingertip contact to turning on the lights, to dial phone numbers or to hold a mobile phone.

In the study conducted by Jalava (2020), as the common point of most COVID-19 patients; it was stated that there was an epidemic of animal-origin as they visited the Huanan seafood market in a certain period of time, the main symptoms of the patients were related to fever and respiratory tract and the contamination was through the respiratory tract rather than the food. However, to date, no studies have been conducted to investigate foodborne spread of SARS-CoV-2 virus. Present literature reviews revealed that there were only two studies reporting survival of coronaviruses on foodstuffs. It was reported that adenovirus was able to survive about 10 days at 4 °C in both lettuce and strawberries. In contrast, the coronavirus was able to survive for only two days in lettuces, but was not able to survive on strawberry surfaces (Yépiz-Gómez *et al.*, 2013). Olaimat *et al.* (2020) indicated that food surfaces could transmit the virus to hands, then to face, nose, mouth or eyes all through touching. Van Doremalen *et al.* (2014) studied the survival of MERS-CoV in different milks at 4 or 22°C and reported greater reductions in MERS-CoV titers for milks stored at 22°C than for the milks stored at 4°C and prolonged pasteurization (63°C/30 min) totally eliminated the virus.

Preventing the spread of COVID-19 through food

Food businesses or service providers should have ISO 22000 FSMS (combining ISO9001 and HACCP) certification to fight against epidemics such as COVID-19 occurring all over the world (Yucel Sengun *et al.*, 2020). Questioning and giving responsibility to employees to protect the health of employees, to prevent contamination with each other in case of illness, thus contributing to preventing the spread of the epidemic and to ensure business continuity; education and motivation should be provided. The health conditions of those who have a low immune system and chronic lung disease, cardiovascular diseases, asthma, hypertension, kidney and liver diseases, pregnant women and those who use drugs that disrupt the immune system and those over 65 years of age should be evaluated and act according to legal guidelines. These people should be planned to work

remotely if possible when legal permission is given (Turkish Food Safety Association, 2020). Washing hands offers higher prevention of the infection than wearing gloves. Therefore, food industry workers wash their hands frequently to ensure sufficient sanitation. A regular soap and tap water are sufficient to make hands virus-free. Hand sanitizers or cologne could also be used to clean the hands, but they could not replace washing (WHO, 2020b). Various studies (Sun *et al*., 2020; Zhu *et al*., 2019) indicated that coronavirus could also be transmitted through aerosols and droplets, thus hand washing may not be sufficient and barrier masks were required to prevent SARS-CoV-2 infection. Ma *et al.* (2020) indicated that N95 masks provided 100%, regular medical masks provided 97% and homemade masks provided 95% blockage of the virus and recommended individuals to use medical masks throughout the day. Also, physical distance is crucial in preventing or slowing the spread of coronavirus. The contact between healthy and infected individuals should be minimized. Food industry and service providers must obey the rule of physical distance (WHO, 2020b). WHO guidelines (2020c) state that a minimum distance of 1 meter (3 feet) should be maintained between employees.

Since coronavirus could survive over the package surfaces, recent research mostly focused on antiviral packages made of polymers or biopolymers (Olaimat *et al*., 2020). For instance, Sportelli *et al.* (2020) indicated that nanomaterial (silver, copper, zinc nanoparticles) films and coatings may prevent virus contamination on packages of foodstuff and transmission of virus through touching.

Washing fruits and vegetables with plenty of water before processing and consumption in food production areas, continuous cleaning of tools-equipment, tables, cutting boards, kitchen tools and other food-contact surfaces and disinfection using appropriate disinfectants, heat treatment at temperatures suitable for food safety and hygiene practices in salad service cabinets, fresh products and bakery products, the correct use of personal protective equipment and a small number of employees in production areas are required (Yucel Sengun *et al*., 2020).

All objects and surfaces contaminated with respiratory secretions/body fluids, frequently contacted surfaces including door handles, toilets and telephones should frequently be cleaned (WHO, 2020b). Alcohol-based disinfectants (ethanol, propane-2-ol, propane-1-ol) should be used in cleaning of such surfaces to reduce virus concentrations (70-80%) and thus prevent potential transmission of virus from these surfaces. Regular disinfectants with quaternary ammonium compounds and chlorine-based active ingredients will also have virucidal properties (WHO, 2020b; FAO, 2021).

CONCLUSION

The COVID-19 epidemic, which has affected the whole world, continues. Efforts to prevent this epidemic, which causes death and economic losses along with the loss of health, are of great importance. COVID-19 does not cause a foodborne illness, but foodstuffs poses a risk to their role in the transmission of this virus. Therefore, to protect food and food workers against COVID-19, firstly, employees should be trained at regular intervals. In addition, it is necessary to take various measures such as ensuring hygiene and sanitation practices in production and sales areas in food production workplaces, paying attention to personnel hygiene, keeping fewer employees in production areas, providing informative brochures in workplaces, using masks and complying with the social distance rule. In addition, the role of daily intake of foods containing vitamins, minerals, bioactive components and probiotics in boosting the immune system and fighting infections is well-known. Also, all food handlers and people who come into contact with food should be vaccinated. In places such as restaurants, cafes, kitchens; the food that needs to be cooked should be consumed after being cooked thoroughly and after washing the raw fruits and vegetables with plenty of water. Because SARS-CoV-2 survives on the surface of the food packages, further studies are needed to produce packaging with antiviral properties. In addition, for SARS-CoV-2 to shed light on the exact sources of transmission, it is suggested that more studies are needed, considering foods as a possible tool.

Conflict of interest: None.

REFERENCES

Abu-Farha, M., Thanaraj, T.A., Qaddoumi, M.G., Hashem, A., Abubaker, J. and Al-Mulla, F. (2020). The role of lipid metabolism in COVID-19 virus infection and as a drug target. International Journal of Molecular Sciences. 21(10): 3544, 10.3390/ijms21103544.

Barman, A., Das, R. and De, P.K., (2021). Impact of COVID-19 in food supply chain: Disruptions and recovery strategy. Current Research in Behavioral Sciences. 2: 100017.

Bucak, T. and Yigit, S. (2021). The future of the chef occupation and the food and beverage sector after the COVID-19 outbreak: Opinions of Turkish chefs. International Journal of Hospitality Management. 92: 102682. https://doi.org/10.1016/j.ijhm.2020.102682.

Ceylan, Z., Meral, R., Cetinkaya, T. (2020). Relevance of SARS-CoV-2 in food safety and food hygiene: potential preventive measures, suggestions and nanotechnological approaches. Virus Disease. 31(2): 154-160.

Chhikara, B.S., Rathi, B., Singh, J. and Poonam, F.N.U. (2020). Corona virüs SARS-CoV-2 disease COVID-19: Infection, prevention and clinical advances of the prospective chemical drug therapeutics. Chemical Biology Letters. 7(1): 63-72. http://pubs.iscience.in/journal/index.php/cbl/article/view/995.

Desai, A.N. and Aronoff, D.M. (2020). Food safety and COVID-19. JAMA. 323(19). doi:10.1001/jama.2020.5877.

Duda-Chodak, A., Lukasiewicz, M., Ziec, G., Florkiewicz, A. and Filipiak-Florkiewicz, A. (2020). Covid-19 pandemic and food: Present knowledge, risks, consumers fears and safety. Trends in Food Science and Technology. 105: 145-160.