



Among the first people infected with the virus, it was found that two-thirds of infectious people were linked to the wholesale seafood market in Havana, where live animals are also sold (6, 7). The exact origin source of this virus is not yet known. Some researchers have suggested the Huanan Seafood Wholesale Market may not be the original source of viral transmission to humans (8). However, regardless of the primary source of the disease, people are concerned about the virus being transmitted through food (5). Studies have shown that corona viruses are not water and food borne. There is currently no scientific evidence to suggest that the virus can infect us through the digestive system (7, 8). But it is possible for food-related staff to transmit the virus to the food by coughing or sneezing, or transmitting the virus to food through contaminated hands (9). So the main risk of transmission is from close contact with infected people. In this regard, in order to prevent any kind of contamination and quality assurance of food in food production and distribution units, Prerequisite Hygiene Requirements such as good manufacturing practice (GMP) and good hygiene practice (GHP) principles can be effective.

It is noteworthy that the new coronavirus is a respiratory virus which spreads primarily through droplets generated when an infected person coughs or sneezes, or through droplets of saliva or discharge from the nose. Therefore, the virus can survive on surfaces and foods. However, it is not certain how long the virus that causes COVID-19 survives on foods (10). So food hygiene is very important in this regard. This article refers to food safety and hygiene factors during the covid-19 epidemic.

### A. 1. Food of animal origin

According to the classifications of the World Health Organization, covid-19 is a zoonotic disease. Therefore, food hygiene of animal origin such as meat, poultry, fish, milk and egg will be important.

"Cross-contamination" is the term used to describe the transmission of microorganism from raw food to cooked food (11). In order to prevent cross-contamination, the following steps should be taken:

- Hand washing before food preparing and cooking for at least 20 seconds

- Washing and disinfection of surfaces and equipment

It is important to distinguish between "cleaning" and "disinfecting". "Cleaning" is the physical process of removing food particles. "Disinfecting" is the process of disinfecting or destroying germs / viruses (12). Regardless, it's always critical to follow the four key

steps of food safety (clean, separate, cook, and chill) to prevent foodborne illness (13). It's also important to washing hands frequently with soap and water before preparing, cooking and eating food.

- Face masks are essential for people who may experience sneezing or coughing during food processing.

- Separate raw foods from cooked foods

- Avoid buying bulk or unpackaged foods

It is possible to transmit coronavirus through food packages. It is recommended to be washed and disinfected before consuming a variety of dairy products, canned food and prepared foods, drinking water bottles, beverages and other packaged food products (14).

- Avoid eggs, meat, poultry and raw fish that are not fully cooked. And boil the milk before consumption.

Favorable cooking of foods can destroy almost all dangerous microorganisms. Thorough cooking to a core temperature of 70°C is recommended for inactivating pathogenic microorganisms. 70°C is critical temperature limit for cooking. Cooking food up to 70°C ensures that the food is safe to eat. Covid-19 virus is sensitive to temperature of 70°C for 5 min, or 56°C for 30 min (15). In another research, it is reported that the virus is killed at temperature and time of 56°C and 70°C after 10 and 5 min, respectively (16). It is expected that the cooking process will kill the virus completely.

- Store foods at a temperature near or above 60°C

COVID-19, SARS- CoV and MERS-CoV have different durability based on different conditions such as temperature, humidity and light. The Coronaviruses are active and stable even at -20°C or less for 2 years. Therefore storing foods in the refrigerator (4-8°C) will not disable the coronavirus (17).

### A.2. Vegetables and fruits

There are some recommendations for consuming vegetables and fruits at the following.

- Choose the vegetable and fruits with desirable appearance

- Washing thoroughly fruits and vegetables after purchase, or before eating and cooking.

- peeling the fruits before using

- As far as possible, eat cooked vegetables.

Possible contamination of the coronavirus in cooked vegetables is eliminated by heat [18]. Also, the some vegetables are more nutritious when cooked. Such as Tomatoes, Asparagus, Spinach, Mushrooms, Celery and Green Beans (19).

### A.3. Bread

Bread is one of the most widely used staple foods that almost all people consume daily. In Iran, the bread supply process is often traditional (20), so the possibility of bread contamination with the coronavirus is very high. Traditional breads, which are baked in traditional bakeries, can transmit the virus and cause disease if health tips are not followed. Fortunately, due to the use of high baking temperatures in the preparation of bread, all traces of viruses will be eliminated. But, when safety and hygiene rules have not been followed in the bakery, Bread will be virus transmission agent. Also, bread cannot be washed or disinfected. So in order to cross-contamination prevention, it is necessary to reheat bread in home (21).

### B. Food contact surfaces, kitchen and food packaging

Food contact surfaces are defined as any surface that touches food such as knives, pans, cutting boards and etc (22). Cleaning, sanitizing and disinfecting of food contact surfaces is very important to prevent possible contamination caused by microorganisms such as coronavirus. Recent laboratory researches, have shown that the covid-19 virus can remain infectious on different surfaces (23). Chin *et al.* (2020) reported the stability of SARS-CoV-2 in different environmental conditions (16). This virus is removed on tissue paper, cloth and stainless steel after 3 h, 2 days and 7 days, respectively. They reported that the virus can remain viable for up to 72 h on plastic and stainless steel, up to four hours on copper, and up to 24 h on cardboard.

Therefore, the contamination of foods and hands will be possible both in stores and at home. Also, food packaging may have been contaminated when handled by an infected person. This is why it is important to follow these rules:

- cleaning and drying the food packaging with disinfectant Wipes or a damp single-use paper towel
- Using the latex gloves when removing food packages from store shelves
- Do not touch your face while shopping
- Washing your hands when you return home after putting away your groceries.
- Cleaning and disinfecting of high touch surfaces daily in kitchen

Chin *et al.* (2020) reported that household bleach (1:49), ethanol (70%), povidone-iodine (7.5%), chloroxylenol (0.05%), chlorhexidine (0.05), and Benzalkonium chloride (0.1%) can remove virus for 5 min

. In order to disinfecting surfaces can be used ether, 75% ethanol, chlorine disinfectant, peracetic acid, and chloroform, except for chlorhexidine (23).

### C. Covid-19 and Nutrition advices

Well-balance and variety diet boosted the human immune system. Therefore, in order to reduce the risk of chronic and infectious diseases during the outbreak, proper nutrition is essential (24). According to the World Health Organization you should eat a variety of fresh and unprocessed foods every day to get the vitamins, minerals, dietary fiber, protein and antioxidants. To reduce the risk of overweight, obesity, heart disease, stroke, diabetes and certain types of cancer, drink enough water and avoid sugar, fat and salt (25).

Recently, studies have shown that vitamin D supplementation could prevent and treat several infections including influenza, coronavirus, and pneumonia.. In a study, Grant *et al.* (2020) have mentioned to the mechanism and role of vitamin D in reducing the risk of respiratory infections. They have reported that vitamin D can be reduced risk of Influenza and COVID-19 Infections through reducing concentrations of pro inflammatory cytokines, and increasing concentrations of anti-inflammatory cytokines. Also, they recommended that the consumption of vitamin D3 might be useful for treatment of people who become infected with COVID-19 (26). In other research, Zhang and Liu (2020) also have been proposed significant nutritional interventions to prevention and treatment of covid-19. They have suggested taking vitamins (A, B complex, C, D, and E), minerals (selenium, zinc, iron) and omega-3 to preventing and treatment of infectious (27).

In another study, Dayrit and Newport (2020) suggested the coconut oil as an effective antiviral agent against the Novel Coronavirus. The antiviral properties of coconut oil is due to its compounds such as Lauric acid, monolaurin, and sodium lauryl sulfate (28).

Also, Dushianthan *et al.* (2011) emphasized the consumption of omega-3 supplements and foods containing antioxidants in patients with acute respiratory distress syndrome (ARDS) (29). Because the coronaviruses involved most the patients with poor immune system, the use of foods containing high antioxidants can be effective in controlling and preventing of infectious.

### D. foodborne viruses and covid-19

Norovirus and hepatitis A are the most important foodborne viruses. As they originate within the intestines of humans and animals, these viruses are mainly spread and transmitted through fecal oral route (30, 31). Therefore, these viruses, as food pathogens, have the ability to survive in food. According to WHO

guidance, Coronaviruses cannot multiply in food; they need an animal or human host to multiply (7).

COVID-19 is a respiratory pathogen. Its main transmission route is through person to person contact and through direct contact with respiratory droplets generated when an infected person coughs or sneezes. [32]. recently, new researches from China showed that the novel coronavirus is also spread by fecal-oral transmission.

Xiao *et al.* (2020) reported that out of a total of 73 patients tested, 53 patients were positive for fecal SARS-CoV-2 RNA (33). Also, Jin *et al.* (2020) have shown that among 651 patients tested, 74 (11.4%) patients were presented with at least one GI symptom (nausea, vomiting or diarrhoea) (34). Fortunately, CDC (Center for Diseases Control) has reported that the risk of transmission of COVID-19 from the feces of an infected person is low based on data from previous outbreaks of related coronaviruses. However, according to these findings, it is very important to observe and implement food hygiene in order to prevent fecal contamination in food. Also, many efforts should be made to detection and diagnosis of viruses in foods.

### Conclusion

Until this date no evidence of food transmission of covid-19 has been reported. Coronaviruses cannot grow and multiply in external environment (such as foods, food packaging and Food contact surfaces), they need a live host (animal or human) to multiply. But, there is possibility of transmitting of virus in to foods by touching contaminated surface, object, or the hand of an infected persons. Therefore, Observing hygienic tips such as frequent hand washing, separating raw materials from cooked ones, cleaning food contact surfaces and not using raw foods, can play a preventive role in transmitting the virus through food. Also, due to the diagnosis of the virus in the feces of patients, there is also the possibility of fecal contamination. Therefore, more attention should be paid to disposal of sanitary sewage. Finally, it can be concluded that in order to prevent food contamination with coronavirus, personal hygiene and food hygiene are vital during the epidemic period.

### Conflict of interest

The authors declared that they have no conflict of interest.

### Acknowledgements

None

### References

1. Dhama K, Sharun K, Tiwari R, *et al.*, Coronavirus disease 2019–COVID-19. 2020. doi: 10.20944/preprints202003.0001.v1
2. Paules CI, Marston HD, Fauci AS., Coronavirus infections—more than just the common cold. *Jama* 2020; 323: 707-708.
3. Huang C, Wang Y, Li X, *et al.* Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet* 2020; 395 (10223): p. 497-506.
4. Jalava K. First respiratory transmitted food borne outbreak? *Int J Hyg & Env Health* 2020; 226: 113490.
5. Malik YS, Sircar S, Bhat S, *et al.* Emerging Coronavirus Disease (COVID-19), a pandemic public health emergency with animal linkages: Current status update. 2020.
6. Cohen J, Wuhan seafood market may not be source of novel virus spreading globally. *Science* 2020; 10.
7. Yuan J, Lu Y, Cao X. Regulating wildlife conservation and food safety to prevent human exposure to novel virus. *Ecosystem Health & Sustain* 2020; 6: 1741325.
8. World Health Organization (W.H.O), COVID-19 and food safety: guidance for food businesses. Interim guidance, 7 April 2020.
9. Wang L, Wang Y, Ye D, *et al.* A review of the 2019 Novel Coronavirus (COVID-19) based on current evidence. *Int J Antimicrob Agents* 2020; 105948.
10. Yi Y, Philip NP, Sen Y, *et al.* COVID-19: what has been learned and to be learned about the novel coronavirus disease. *Int J Biologic Sci* 2020; 16: 1753.
11. World Health Organization (WHO), Foodborne disease outbreaks: guidelines for investigation and control. 2008.
12. Chang A, Schnall AH, Law R, *et al.* leaning and Disinfectant Chemical Exposures and Temporal Associations with COVID-19 — National Poison Data System, United States, January 1, 2020–March 31, 2020.
13. 4 Steps to Food Safety. 2019. Available at: [www.foodsafety.gov](http://www.foodsafety.gov).
14. COVID-19 - ANSES's recommendations on food, shopping and cleaning, French Agency for Food, Environmental and Occupational Health & Safety, Available at: <https://www.anses.fr/en>.
15. Deng SQ, Peng HJ. Characteristics of and public health responses to the coronavirus disease 2019 outbreak in China. *J Clinic Med* 2020; 9: 575.
16. Chin A, Chu J, Perera M, *et al.* Stability of SARS-CoV-2 in different environmental conditions. *MedRxiv*, 2020.
17. Hirneisen KA, Black EP, Cascarino JL, *et al.* Viral inactivation in foods: a review of traditional and novel food-processing technologies. *Comprehen Rev in Food Sci & Food Safe* 2010; 9: 3-20.
18. Lake R, Kingsbur J. Potential for foodborne transmission of Covid-19: literature review update. Update, 2020.

19. Jiménez-Monreal AM, García-Diz L, Martínez-Tomé M, *et al.* Influence of cooking methods on antioxidant activity of vegetables. *J Food Sci* 2009. 74: H97-H103.
20. Mohammadbeigi, A, Salehi A, Heidari H, *et al.* Evaluation of the accessible level of iodine in marketed iodised salt in Iran: A comparison with standard recommended values. *Adv in Human Biol* 2019. 9: 42.
21. Shariatifar N, Molaee-aghaee E. A novel coronavirus 2019 (COVID-19): Important tips on food safety. *J Food Safe Hyg* 2019; 5: 58-59.
22. Gould GW. 2012. *New methods of food preservation.* Springer Science & Business Media.
23. Aaron Green CSYBY. *Coronavirus Guidelines for Cleaning and Disinfecting to Prevent COVID-19 Transmission.* 2020, New England Complex Systems Institute.
24. Schmidt MA, Smith LH, Sehnert KW. *Beyond antibiotics: 50 (or so) ways to boost immunity and avoid antibiotics.* 1994: North Atlantic Books.
25. Nutrition advice for adults during the COVID-19 outbreak. 2020. Available at: <http://www.emro.who.int>.
26. Grant WB, Lahore H, McDonnell SL, *et al.* Evidence that vitamin D supplementation could reduce risk of influenza and COVID-19 infections and deaths. *Nutrients*, 2020. 12: 988.
27. Zhang L, Liu Y. Potential interventions for novel coronavirus in China: a systemic review. *J Med Virolog* 2020.
28. Dayrit FM, Newport MT. *The Potential of Coconut Oil as an Effective and Safe Antiviral Agent Against the Novel Coronavirus (nCoV-2019).* 2020.
29. Dushianthan A, Grocott MPW, Postle AD, *et al.* Acute respiratory distress syndrome and acute lung injury. *Postgrad Med J* 2011; 87: 612-622.
30. Woods JW, Burkhardt W. Occurrence of norovirus and hepatitis A virus in US oysters. *Food & Environ Virolog* 2010; 2: 176-182.
31. Koopmans M, Duizer E. Foodborne viruses: an emerging problem. *Int J Food Microbiol* 2004; 90: 23-41.
32. Peeri NC, Shrestha N, Rahman MS, *et al.*, The SARS, MERS and novel coronavirus (COVID-19) epidemics, the newest and biggest global health threats: what lessons have we learned? *Int J Epidemiol* 2020.
33. Xiao F, Tang M, Zheng X, *et al.* Evidence for gastrointestinal infection of SARS-CoV-2. *Gastroenterol* 2020; 158: 1831-1833. e3.
34. Jin X, Lian JS, Hu JH, *et al.* Epidemiological, clinical and virological characteristics of 74 cases of coronavirus-infected disease 2019 (COVID-19) with gastrointestinal symptoms. *Gut* 2020; 69: 1002-1009.