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Editorial

Food Safety Practices in COVID-19 Pandemic

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The super-spread of COVID-19 not only has led to many deaths and disabilities, but has brought social and economic downturn. Coronaviruses are a large family of viruses and a subset of Coronaviridae and include a group of viruses which are capable to induce disease in humans and animals, and consist of common cold virus up to more severe pathogens such as SARS-CoV, MERS-CoV, and SARS-CoV-2. Coronaviruses are classified into four groups, including alpha, beta, delta, and gamma coronavirus, 22 subclasses and 40 species. Out of 40 species of family coronavirus, seven species are reported to transmit to human, so far. HCoV-E229, HCoV-OC43, HCoV-NL63, and HCoV-HKU1 are the most common species known in humans. The SARS-CoV-2 contains a single stranded, non-segmented, positive sense RNA with 29891 nucleotides which encodes 9860 amino acids. Nucleolus of this virus is constructed from the genetic substance which includes RNA with the diameter of 120 nanometers. The 2/3 of RNA of SARS-CoV-2 encodes RdRp, ORF1a-ORF1b, and RNA synthesis materials and 1/3 encodes the four structural proteins of membrane, envelope, spike and nucleocapsid (Adhikari et al., 2020). In addition, this virus consists of 4 types of protein (protein spike, envelope, membrane, and nucleocapsid) and an outer layer of lipid (Chatterjee, 2020). At the first contact of virus with the cell, spike protein is connected to cell membrane. This connection is mediated by a protein named ACE-2 in outer layer of some body cells (e.g. cells of respiratory system; Abere, 2020). When the virus attaches the cell, one protease at cell surface is activated named TMPRSS-2 and causes hydrolysis of proteins; and finally, the virus is entered into cells and infused into the host cell and causes symptoms of disease (Abere, 2020).

Transmission into food and survival of SARS-CoV-2

Until now, transmission of SARS-CoV-2 by food or food services has not been approved. Therefore, by attention to food hygiene practices, virus transmission through food could be prevented. Little evidence was obtained about survival of this virus at open food surface. Working with similar viruses have shown that some food surfaces do not let virus to survive, however, the virus stayed alive on some of them (WHO, 2020a). There is the probable that the food-related staff transmit virus through coughing and sneezing, or transmit it through touching food with contaminated hand and utensil (Adams and Walls, 2020).

The method of shopping and transporting food to home

In order to prevent transmission of coronavirus during shopping of food, a distance of 1 to 2 m should be established from other people, and it is recommended to use mask to prevent disease transmission. After buying food packages, it is better to disinfect all items with alcohol and then put them in a warm place. All the purchased foods such as cans, oils, snacks, and legumes which might be contaminated with the virus should be washed with water and soap or dish washing liquid. Fruits and vegetables should be washed by dish washing liquid and should be thoroughly dried before placement in the

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fridge, and then placed in the fridge with a special container. After purchasing meat and poultry, firstly they should be washed and disinfected thoroughly and disinfect all the surfaces which were in touch with it such as knife, butcher block and etc. Separating the place of raw meat and cooked food and using closed containers for keeping each of the materials, and finally thorough cooking of the meat at the temperature of 70 °C and higher is recommended (Shariatifar and Molaee-Aghaee, 2019). The main transmission route of SARS-CoV-2 is through direct contact with infected people and not from food and food packaging. However, there is an urgent need for implementation of food hygiene practices to prevent transmission of SARS-CoV-2 from foods and to protect food workers' health. Precautions in food production sites for raw materials, processing, packaging, and distribution practices should be considered and be trained to food workers. The COVID-19 disease can be transmitted from infected asymptomatic people; therefore, food workers should be carefully monitored for their health status. The current pandemic has enforced food processors to shift from foodservice to retail channels. For example, the Canadian Cargill meat processing plant has switched from 60% of retail to 85% due to COVID-19 pandemic (Wang et al., 2020). In food industry, the food contamination can be prevented by Food Safety Management Systems (FSMS) on the basis of the Hazard Analysis and Critical Control Point (HACCP) principles. The procedures on the basis of HACCP and the Prerequisite Programs (PRPs) such as Good Hygiene Practices (GHP), Good Manufacturing Practices (GMP), and etc. are necessary to maintain a hygienic environment for food processing. Disinfection of working surfaces, hand hygiene practices and use of Personal Protective Equipment (PPE) by food workers, including cleaners, managers, food inspectors, and delivery workers can prevent the transmission of SARS-CoV-2 (WHO, 2020a).

The stability of SARS-CoV-2 in different processing condition is almost similar to SARS-CoV and cannot be multiplied in foods. The 6.8 log $TCID_{50}$/ml of SARS-CoV-2 is reduced to 0.7 log after two weeks at 4 °C, while this viral load is inactivated after 5 min at 70 °C (Chin et al., 2020). In controlled temperature and humidity, SARS-CoV-2 is not affected by pH values ranging from 3-10 and is more stable on plastic than stainless steel and cardboard (Van Doremalen et al., 2020). However, all these experiments were conducted *in vitro* and should be interpreted *in vivo*.

Initial preparation and proper washing at home

Although, coronavirus cannot be transmitted through food, it can be alive for several hours or days on materials which are used for packaging. Preliminary studies showed that the virus could be alive on carton, glass, and on plastic and metal cans. However, the quantity of the virus is reduced over this time rapidly (Chin et al., 2020). Nowadays, there is no evidence on transmission of virus from packaging so far. It is suggested that buyers should wash their hand thoroughly after handling each item which is probably touched by others. However, some scientists insist on disinfecting food packages. Therefore, food packages need to be disinfected, and individuals should avoid buying bulk food. Since usual temperature of cooking (70 °C) was effective in killing SARS-CoV, it is expected that coronaviruses are killed by cooking. Therefore, raw and not fully cooked animal products (milk, red meat, poultry, and fish) should be avoided as a general principle. The food should be consumed well-cooked as much as possible (Bertrand et al., 2012). Foods should be placed in fridge in closed containers. Foods that are purchased for long-term use need freezing, especially meat products should be thoroughly cooked (WHO, 2020c).

It can be claimed that these viruses are psychrophilic and dry and cold weather enhances the probable of floating of virus-infected droplets into air and infecting individuals. In addition, coronaviruses need humidity to continue their activities. In contrast, thermal process (temperatures higher than 70 °C) and using sanitizing solutions, due to that coronavirus cover is made from lipids, can deactivate the viruses (Shariatifar and Molaee-Aghaee, 2019). Using fat solvents such as soap changes the active shape of the virus. Ethyl alcohol 70%, alcohol-based materials containing quaternary ammonium and bleaching compounds which consist of active sodium hypochlorite were also used as an effective substance to eliminate viruses (WHO, 2020b). Household bleaching disinfectants in 1:49 and 1:99 ratios can reduce the viral load of SARS-CoV-2 (Log $TCID_{50}$/ml) to below detectable levels in 5, 15, and 30 min (Chin et al., 2020). According to studies on other coronaviruses, this virus is stable at freezing state and could be survived up to two years at -20 °C (Chin et al., 2020). Therefore, freezing has no effect on it, and healthy food should be used for freezing. In addition, freezing should be done by adhering to hygiene principles. Hands should be washed carefully before freezing and also the packaging containers should be washed and disinfected.

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