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SARS-CoV-2 and food hygiene

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ABSTRACT

The coronavirus disease (COVID-19), caused by SARS-CoV-2, is an acute respiratory syndrome and is easily transmitted between people. The disease first started in Wuhan, Hubei Province, China, and then quickly spread to more than 200 countries. In March 2020, the World Health Organization announced the outbreak of the disease as a global epidemic, and it is a great challenge that has affected all nations. Initially, governments in various countries, to prevent the spread of this disease, took stubborn measures, including complete lockdown. It seems that little attention has been paid to food hygiene and its association with the coronavirus disease (COVID-19) pandemic. Transmission risk of SARS-CoV-2 is possible through food department staff to food products and food contact surfaces. Recently, cases of survival of SARS-CoV-2 through various surfaces have been reported. The possibility of transmission and survival of SARS-CoV2 via food is discussed based on previous information for other respiratory viruses such as MERS-CoV and SARS-CoV. Nevertheless, studies are needed to survey the possibility of its transmission and survival via food. In the face of challenges such as the current epidemic, the flexibility of a system such as the food industry is critical to protecting producers' and consumers' health to reduce the risk of outbreaks by implementing new approaches.

1. Introduction

Humans have faced a multitude of health problems caused by microbial infections from time immemorial, i.e., bacteria and viruses. Studies focus mainly on bacterial spoilage in food and foodborne disease because foodborne pathogens are more bacterial, so less attention is paid to viruses in this area. Viruses contain DNA or RNA and require a living host cell, including humans, animals, bacteria, and plants, to multiply (1). Viral diseases, including acquired Immune Deficiency Syndrome and Avian Influenza Diseases, happen worldwide. A new virus that has spread worldwide in December 2019 is called the coronavirus (CoVs), which are members of the subfamily *Orthocoronavirinae* in *Coronaviridae*. The World Health Organization (WHO) named the novel virus SARS-CoV-2 because of its 86.9% similarity to the SARS-CoV genome (2, 3). SARS-CoV-2, which is broadcast from China, has unique characteristics such as a high diffusion rate and lack of primary scientific data and is characterized by respiratory illness and symptoms ranging from mild flu (such as the flu) to severe pneumonia and acute respiratory distress syndrome (4). The clinical manifestations of COVID-19 in patients are variable and nonspecific. A significant proportion of patients with clear evidence of clinical infection have severe disease. The most common side effects include productive or non-productive fever and cough, muscle aches, and fatigue blood sputum has been presented in a small percentage of patients with upper respiratory tract symptoms such as sneezing, runny nose, and sore throat, and gastrointestinal symptoms such as nausea, vomiting, diarrhea, headaches are not expected. It's still unclear exactly how a loss of smell and taste happens with COVID-19, but there are some theories (5-7). The overall mortality rate among diagnosed cases is about 2%. Our knowledge of this disease is incomplete and evolving. Coronavirus is a common virus between humans and animals (zoonotic) and circulates among animals and may be transferred to humans. This transmission occurs when infected animals are slaughtered for consumption (8, 9). SARS-CoV2 has been identified in horseshoe bats, cattle, cats, chickens, swine, rats, dogs, horses, turkeys, rabbits (10-13). The first SARS-CoV2 infections were related to Wuhan's Huanan seafood wholesale market (14) because the COVID-19

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epidemic started in Wuhan, Hubei Province, China (15, 16). Given the accelerated extension of this virus and its high prevalence globally, the scientific community is urgently looking for a plan to control and precaution the disease and understand its transmission routes. This review article examines the probability of Coronavirus transmission through food products.

2. The possibility of transmitting viruses via food products

As mentioned, viruses cannot multiply in food because they need a human or an animal host to grow. However, as a carrier, food products can transmit viruses to humans, such as enterovirus, adenovirus, rotavirus, astrovirus, sapovirus, and hepatitis E virus transmitted via contaminated water and food (17). Hepatitis A virus and Norovirus are two viruses transmitted by foods (18, 19). Hepatitis A belongs to the genus Hepatovirus within the family *Picornaviridae*. Utilization of pork pies, undercooked deer, raw pork, wild boar, homemade sausages, shellfish, unpasteurized milk, fruit, and vegetable pose a risk of Hepatitis A infection. Norovirus belongs to the family *Caliciviridae*. Shellfish, berry fruits, deli meat, oyster, and green vegetables are significant Norovirus infection sources (19, 20). Food can be contaminated in three main ways, the first being contamination during the food production process. The second way is done by infected food handlers who do not observe personal hygiene, such as hand washing (18), and the last way is to consume animal products that contain a common human-animal virus (19). Animals can act as intermediate hosts in viral diseases, such as Ebola, Nipah virus, SARS-CoV, and SARS-CoV-2. Studies have shown that in all of these diseases, bats act as intermediate hosts (21).

3. SARS-CoV-2 and food products

The risk of foodborne transmission of SARS-CoV-2 is the most critical issue for food consumers in pandemic conditions. The transition of SARS-CoV-2 is monitored closely by the European Food Safety Authority (EFSA), United States Food and Drug Administration (FDA), World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), and other food safety authorities all over the world and they agree that up to now, there is no evidence that SARS-CoV-2 spreads via food products. However, the possibility of SARS-CoV-2 surviving on the food's surface or in contact with contaminated food should be investigated. As studies have shown, some viruses can survive in food products (22, 23). A study showed that respiratory viruses, including SARS-CoV-1 and influenza, can transfer from food products (24). The possibility of contamination of food packaging with SARS-CoV-2 is also a significant risk for the consumer. Therefore, the oral transmission of SARS-CoV-2 should be studied (10, 13). However, SARS-CoV transmission through food intake has not yet occurred (25). Some studies have shown that SARS-CoV-2 can remain in environmental samples for some days because this virus can survive on the level and be transmitted to humans through contact levels (26). Also, findings have shown that SARS-CoV-2 survived on plastic for 3 days and on stainless steel 2 days at 21-23°C and 40% relative humidity, but the virus was not indicated after 4 and 24 hours on copper and cardboard, respectively (27). Similarly, human coronavirus 229E (HuCoV-229E) was found on polyfluorotetraethylene (Teflon, PTFE), stainless steel, polyvinyl chloride (PVC), and ceramic tile surfaces for at least 5 days at 21°C with relative humidity of 30-40٪ (28). Studies have shown that SARS-CoV-2 was inactivated after 5 minutes of incubation at 70°C (29). Therefore, an average cooking temperature (>70°C) is sufficient to inactivate the infectious agent. However, the virus is very stable at 4°C and remains at -20°C for up to 2 years (30). Therefore transfer from refrigerated temperatures and frozen food is still possible. Hence, thorough hand washing after handling frozen and non-frozen raw foods is essential to prevent cross-contamination. Water is also virus-free with typical water treatment methods (31, 32). The Food and Agriculture Organization (FAO) and the World Health Organization (WHO) also stated that touching contaminated food packages is an acceptable way to transmit SARS-CoV-2 to the hands, mouth, eyes, and nose (30). However, this is not the primary way for the virus to spread because it usually does not survive long on the surfaces, as mentioned above.

4. Detection of SARS-CoV-2 on the food industry

To detect coronavirus in food, various methods have been suggested, such as molecular detection assays based on RT-qPCR (17), nano-ELISA (33), and enzyme-free immunosorbent assay (34). Nevertheless, so far, no studies and tests have been performed to detect the virus in foods because there is no document of the transition of coronavirus through foods. On the other hand, due to the low viral load and inhomogeneous distribution of viral particles in food products, reliable identification of viruses remains a significant challenge for experts (17). As mentioned above, the transmission of the coronavirus through contaminated workers, contaminated food handlers through the food supply chain, through surfaces and environments around the food industry may occur. Numerous studies have been performed to identify SARS-CoV-2 by RT-qPCR in environmental samples (35). Because sample kits are expensive and require many kits for use in large food industry centers, experts have adopted another method for detecting the coronavirus in food industry environments, and that is wastewater-based epidemiology (WBE). Because live SARS-CoV-2 has been isolated from the urine and feces of infected individuals (36), it is believed that sewer testing with paper kits could identify potential coronavirus carriers, even if they are asymptomatic. Therefore, using this method, rapid screening can be performed in food environments, and subsequently, the necessary measures can be taken to prohibit the extension of viruses and diseases (37).

5. Conclusion

Among the challenges that food professionals and relevant government agencies face when increasing the risk of viral outbreaks and infections are: (a) ongoing testing of food industry personnel for SARS-CoV-2; (b) tracking SARS-CoV-2 in environments where food is produced and delivered; (c), assessing critical control points during food processing; (d) using the appropriate disinfectant frequently to decontaminate surfaces and the work environment; (e) and how to get healthy food to the end consumer. In the current epidemic, new approaches in the food industry should be used instead of conventional methods. In this regard, more public health surveillance and the development of related bioanalytical tools could be utilized to improve food hygiene. Although the potential for COVID-19 transmission through the food industry is negligible, food sector precautions need to be taken internationally, and their results should be published worldwide.

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