



## COVID-19 Outbreak and Impact on Food Safety

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We have observed the emergence of different infectious diseases during the last years posing a crucial threat to public health. Coronaviruses have a broad range of clinical manifestations from typical flu-like disease and gastrointestinal symptoms to severe acute respiratory syndrome (SARS). Without any doubt, the novel coronavirus SARS-CoV-2 has spread rapidly from China all across the world and has been declared a pan-demic by the World Health Organization (1). The disease called COVID-19 mainly affects the elderly, the immunocompromised people and other clinical states. The virus is transmitted through small droplets between people in close proximity during coughing, sneezing and talking. However, people may become infected also by touching contaminated surfaces and objects and then touch their mouth, face and eyes (2).

Physical distance measures, restriction of social gathering and systematic disinfection of hands and touching surfaces seem to protect us and reduce the risk of transmission of the disease (3). These practices have been applied by many professionals in workplaces and schools. Many companies and industries have tried to limit the physical presence of their staff and offer the possibility of telecommuting (4). This possibility is not practically feasible for all food industry workers. Administrative staff could be limited in an industrial food plant but not workers on the chain production. The survival of SARS-CoV-2 in the environment depends on multiple factors, such as air humidity, temperature, the involved surface, as well as the virus concentration. The virus's genetic material (RNA) can be detected for up to three days, depending on the surface background but also the viral charge (5). However, SARS-CoV-2 is not usually stable on inert dry surfaces, and viral concentration is dropping gradually within a few hours to a couple of days. We should note that in most cases, it is not sure whether the RNA detected is still viable as viral cultures are needed to prove that (5).

Strict guidelines and regulations are applied in the food industry under the HACCP (Hazard Analysis and Critical Control Points) management system for food safety (6). HACCP is applied in all different parts of the chain in food industry and even starts from growing, harvesting and collecting the raw material following Good Manufacturing Practices (cGMPs) plans. However, as stated, HACCP is also applied to the processing, manufacturing, distribution and even marketing for a food product (6). The HACCP system is based on seven principles, and it is adopted universally by governments, trade firms, as well as the food industry all over the world. The application of the HACCP system is based on the systematic analysis of physicochemical and biological hazards in the food chain from raw material collection to the food processing and distribution of the final product (6).

Without any doubt, the successful implementation and success of a HACCP program depends on the thorough and systematic education and training the staff for producing safe foods. Food workers should be instructed to apply specific manipulations to minimize major hazards to the food chain (6). In all cases, the staff should acquire a deep knowledge of good hygiene practices, sanitation and cleaning procedures in the food plant as well as personnel hygiene rules to work in the plant. The HACCP team of the food industry should be in close relation with governmental authorities to ensure compliance of the staff to the regulations.

Actually, heavy sanitation measures must be applied for the protection of the staff from SARS-CoV-2 but also to avoid the spreading of the virus in the food chain (7). Those measures are in compliance with the aforementioned general practice for SARS-CoV-2, which are the social distancing, wear of masks and hands and personal hygiene (8). Reshaping of the food premises is necessary to respect the correct distance of at least 1.5 m between the working staff (9, 10).

People that are feeling ill should stay home following WHO instructions (1). Moreover, food workers touch raw, open food and packages during the processing and manufacture. It is imperative that social distancing is kept as much as possible in the industry workplace, and workers suspected of being ill should be excluded from work (10). Despite that, asymptomatic people are the major hazard in the food workplace as they cannot be detected (10).

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Following HACCP regulations, food workers should wear masks and gloves to protect food from any eventual contamination. However, systematic hand washing is required together with hand sanitizer agents. Moreover, frequently touched surfaces as switches, handrails, handles and doorknobs must be disinfected systematically (6).

There is currently no evidence of SARS-CoV-2 in foods (11, 12). However, it is stated that transmission is possible if food is touched by a diseased or asymptomatic carrier person and comes in close contact with another person eventually through touching or ingestion.

Open and fresh foods may be exposed to SARS-CoV-2 before packaging or frozen procedures. To date, we have evidence that MERS and SARS-CoV-1 can be infectious for up to two years in a frozen product (2). Additionally, several countries, as is the example of Belgium, have cancelled serving of rare and uncooked foods in restaurants under the regulations of national health authorities (5).

Adjusting for the COVID-19 crisis (13), it is requisite to work together across governmental authorities, food producers and industries to alleviate the direct impacts of the virus and eventually improve and reorganize the food systems in general so they could offer even safer food to the consumer. Border restrictions and more systematic controls should be necessary in the country borders.

Many meat industrial plants and open food markets are had to close due to severe COVID-19 outbreaks among staff workers. However, multiple consumers used to buy their food from open food markets where food security is uncertain (14).

From another point of view, global food supplies should be affected by the COVID-19 pandemic as it is a major health and human crisis compromising food safety, security and nutrition of people all over the world (14). There is a global food emergency, as food security is currently suspended due to the increasing prices of several foods (14). Economic crisis associated with COVID-19 will influence the agricultural business and the producers because of the limited production and limited buying capacity of consumers, lack of employment, cost of purchasing hygienic protective equipment and eventual medical costs (14).

In this vein, precautionary measures (8) and tactics and policy (14) should be applied to the whole food chain to control the spread of coronavirus at the foods and retail sector. Working personnel in the food domain should be educated to apply the necessary measures of personnel, hand hygiene and social distancing.

Notwithstanding, according to our current knowledge, there have not been reported cases of humans infected via food consumption probably due to the low environmental stability of the SARS-CoV-2 (2).

As stated previously, food globally involves many stakeholders, governmental authorities, health issues and regulations and socio-economic environments, altogether ensuring its safety and security (15).

In conclusion, COVID-19 is a severe human crisis menacing food safety, food security and nutrition all across the globe. Precautions to the correct functioning of food systems are necessary to ensure their sustainability, which could poise the impact of food production, food processing, food safety and human health.

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