



Review

Food safety requirements for the COVID-19 pandemic in bakery manufacturing: a review

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ABSTRACT

The World Health Organization has published a guide for manufacturers on continuing production during the coronavirus pandemic that should be considered in the regulation of public health and social measures within the scope of COVID-19. Requirements intended by other government agencies or regulatory agencies should be included in the hygiene control applications. This will facilitate both food safety and control of pandemic measures and administrative sanctions. As far as seen that food business has not yet adopted completely the new control measures involving COVID-19 requirements. It is thought that there is an urgent need for management of safety manufacture conditions taking into account pandemic rules and also official controls of the food manufacturers should be evaluated both food safety and COVID-19 pandemic conditions. Provided that all legislative conditions regarding food safety are valid, additional measures to be taken in Bakery Manufacturing against COVID-19 will be specified in this review. This study is a guide that will contribute to the bakery business operators by revealing which conditions should be included in the Prerequisite Program which was set out general measures and procedures by governments to ensure safe food production chains during the COVID-19 pandemic.

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1. Introduction

To combat the coronavirus disease of the 2019 (COVID-19) epidemic, which has turned into a global crisis, several measures have been taken against the coronavirus pandemic to protect public health all over

the world. The World Health Organization (WHO) has issued general advice for the public to prevent the transmission and spread of the coronavirus disease. Most rules are based on general hygiene principles.

The COVID-19 agent is a zoonotic virus. It is transmitted from person to person by droplets, contact, and in some cases aerosol.

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Therefore, protective measures should be taken, especially against contamination by droplets and contact (1,2).

Food managers must obey food hygiene regulations and follow additional preventative measures required by COVID-19 protection procedures during the pandemic. The WHO has published a guide (updated according to the pandemic actions) that should be considered in the regulation of public health and social measures in food plants within the scope of COVID-19. In the guide, general information, public health and social measures, knowledge of pandemic dynamics according to the contagion scenario, and Guiding Principles in Risk Assessment are stated. The Food managers and food employees are responsible for ensuring sustainable good hygiene practices and taking preventive measures to reduce the risk of infection and must comply with the measures announced by the public authority (Ministry of Health, General Directorate of Occupational Health and Safety, Ministry of Environment and Urbanization, etc.) to effectively fight against the coronavirus pandemic in their workplaces during the continued production of food (3-5). This paper aims to present good hygiene practices, including requirements for the COVID-19 pandemic, in bakery manufacturing.

2. Post-COVID-19 precautions for bakery manufacturing area

The COVID-19 virus is transmitted by breathing in droplets produced by an infected person coughing or sneezing or contact with contaminated surfaces.

In terms of surface contamination, it is only necessary to clean surfaces that have been touched. Three important rules apply to all businesses in terms of ways to fight the coronavirus and the measures to be taken- wearing a mask, physical distancing, and handwashing. Other simple precautions are keeping rooms well ventilated, avoiding crowds, and coughing into a bent elbow or tissue. For bakeries and pastry producers, pre-planning should be done; first, suitable social distancing should be maintained, and operating capacity should be brought in accordance with the pandemic rules (maximum 1 person per 4 m²). Because of the necessity of handwashing in food-related businesses, it should be ensured that there are sinks in accessible places. Customers and personnel should use medical masks.

Maximum hygiene conditions to prevent COVID-19 infection should be maintained by food manufacturers. Prerequisite Programs (PRPs) are basic conditions and activities to sustain a hygienic environment throughout the food chain that is suitable for the production, handling, and provision of safe end products and safe food for human consumption. Food-borne infections can be prevented to a great extent by fulfilling the PRPs. The basis of sustainable food safety is the basic principle required for PRPs. Many infectious diseases can be prevented with standard infection control precautions (3,6). The food manager is responsible for ensuring sustainable good hygiene practices and taking preventive measures to reduce the risk of contamination from an infection.

Aiming to reduce the risk of general infection transmission, the requirements for precautions and protection are associated with general and special hygiene practices.

2.1. Airflow

The main mode of transmission of COVID-19 are droplets, which occur when people who are carrying the virus talk, cough, or sneeze. The disease can also be transmitted by touching the mouth, nose, or eyes with hands that have come into contact with surfaces contaminated with droplets. Since there will be pollination from flour in the production area, airflow is more important in areas that process bakery products. Fresh airflow should be provided to prevent dust accumulation. Airflow inside the manufacturing area during the pandemic period is a critical issue. Unventilated areas can increase the spread of infection. The airflow generated by unsuitable air conditioning units can even increase the spread of droplets secreted by COVID-19-infected persons over longer distances in enclosed spaces, and many more people can be infected. If an air conditioning system is used for heating or cooling in a closed environment, serious airflow will occur. For this reason, an air conditioning system cannot completely control or prevent the risk of contamination because of air currents even when operating optimally. If an air conditioning system were to operate based on 100% fresh air, possible virus particles suspended in the air indoors are absorbed and thrown out.

However, since air conditioners operating with 100% indoor air (e.g. Variable Refrigerant Flow (VRF), fan coil unit, split air conditioner) constantly circulate the same air, they will increase the density of virus particles. These types of air conditioner machines should not be used during pandemic periods. Moreover, contaminated mechanical airflow should be prevented from entering the production area. Ventilation should be provided in a way that ensures the circulation of 100% clean air, and the air conditioner's filters, tools, and equipment should be cleaned and disinfected periodically. Ventilators should not be opened in the working area (6,7).

2.2. Drainage system

The correct installation and maintenance of drainage are critical to prevent contamination. A COVID-19 outbreak case linked to the drainage system in one apartment block in Hong Kong was associated with a contaminated draining system (8). Drainage systems should be designed, constructed, and installed in such a way as to prevent the risk of contamination, and they should not harm the environment. A sufficient number and size of drainage channels should be established. Pipe sizing should maintain an average flow velocity of at least 1 m/s, which prevents stagnation of solid matter in the pipe. The wastewater channels should be safe, cleanable, and disinfected. The wastewater must be disinfected before the discharge point. Leakage, cracks, and other defects in wastewater pipes should be repaired periodically.

In brief, a well-designed, installed and maintained drainage system will not create any source of contamination for food manufacturers (6,7).

2.3. Training for the pandemic management plan

Operating food businesses should create a checklist form that will cover their food hygiene conditions and COVID-19 measures, and they should develop evaluation and action plans according to the situations. Under the pandemic context, prerequisite programs (PRPs) should be revised. A Crisis Management Team should be assembled, and the team must organize education and training programs for employees. PRP training by the Crisis Management Team should be provided with guidance on hygiene and sanitation practices and epidemic management that will prevent exposure to or transmission of COVID-19. All food staff should be trained in personal hygiene and good hygiene practices by trained supervisors (6,7).

2.4. Precautions to be taken in the packaging area

Although it has been shown that the COVID-19 virus can be found on inanimate surfaces, and it can be transmitted by package or cargo, such transmission is not in the amount that will cause disease. According to the WHO and European Centre for Disease Prevention and Control, there are no restrictions on cargo, etc., because they do not carry enough viruses to make people ill. The spread of COVID-19 can be prevented by social distancing, disinfection, personal hygiene practices, and the use of masks.

Staff's working times should be recorded for contact tracing purposes in case there is an infection in the workplace. A person who should be in quarantine must comply with the rule mandating 14 days of isolation. Any risk to staff in terms of COVID-19 disease during the beginning and exit working times to determine whether health information should be checked. With social distancing rules, disinfection, personal hygiene practices, and the use of masks, the prevalence of COVID-19 can be minimized.

In terms of the sale of bread and bread varieties offered to the market, the direct selling of products to consumers should be prevented. Bread, bread varieties, and other Bakery Manufacturing products should be sold with suitable packaging materials. Given the adhesion times of the new type of coronavirus to surfaces (between 3 h and 5 days), it is necessary to ensure that the packaging and the material used in the packaging are not a source of contamination, and these measures should be applied sensitively (3,9).

2.5. Operating vehicles

COVID-19 control plans should be developed for transportation vehicles. The aim of the Epidemic Precaution Plan in food plants should reduce and control risks associated with the virus as much as possible. Precautions must be taken to minimize the risk of spreading COVID-19, such as by cleaning and disinfecting surfaces before and after transport, reducing germs on surfaces, and inhibiting microbial contaminants. Transportation vehicles must be cleaned and disinfected.

Hygiene programs to decrease the risk of infection from vehicle surfaces must be obeyed by all food staff. If possible, vehicles and the contact surfaces of the vehicle (door handles, window controls, steering wheels, gearshifts, radios, etc.) should always be used by the same personnel. After each contact, disinfection should be carried out with a product containing a minimum alcohol concentration of 70%. These measures should be updated over time depending on the process (9).

2.6. Precautions for employees

A responsible officer should be assigned for COVID-19 control in each business. This person should be a workplace doctor or healthcare professional chosen by the Health and Safety Board. In cases where this assignment cannot be made, the staff should be briefed about the COVID-19 disease by a food business operator. Two or three work shifts generally occur in Bakery Manufacturing. The number of Bakery Manufacturing staff members on the same work shifts needs to be restricted as much as possible by food, the business operator while the pandemic is ongoing. The personal restroom should be assigned to a particular area to minimize contact between them, dressing, shower/bath, and social areas should be rearranged in accordance with social distance conditions, and cleaning and disinfection procedures should be carefully applied to these sections. In addition, minimum contact of people who are temporarily admitted to the facility for supply or other reasons (repair, maintenance, etc.) should be maintained.

There must be new control measures because of the COVID-19 pandemic for food suppliers, who should carry out their transactions by maintaining social distancing rules and using protective equipment.

Food suppliers should declare a health-code for COVID-19 before entering the food manufacturing plant. It should be ensured that different personnel exchange the money on the one hand and deliver the Bakery Manufacturing products or bread to customers on the other. Personnel practices to prevent the transmission of the disease during the pandemic period are as follows:

- a. Training should be provided on the transmission routes and prevention measures of COVID-19.
- b. There should be at least 1.5–2 m of social distance between employees.
- c. All personnel should wear masks in accordance with the rules; as the masks become damp or dirty, they should be changed. Care should be taken to use hand sanitizer when putting on a new mask.
- d. Cleaning and disinfection must be applied before and after touching surfaces or the eyes, nose, mouth, or mask. The food staff should also wash their hands with soap and water for at least 20 s or use an alcohol-based hand sanitizer (70% alcohol). Hand hygiene procedures should be established, and a personnel manager should check that they are applied correctly. Wearing gloves can reduce the frequency of handwashing by creating a sense of security, which can increase the risk of

contamination by hands. It should not be forgotten that hand gloves do not replace cleaning.

- e. Personnel should wear suitable clothes before starting work.
- f. Employees should have their temperature taken at the entrance. If they have a fever higher than 38°C, they should not be accessed in the business.
- g. Individual isolation of people showing signs of respiratory tract infection should be ensured. If employees have been in contact with anyone diagnosed with coronavirus in the past 14 days, they should notify the food business, avoid going to the business, and implement quarantine procedures.
- h. Communication and emergency scenarios in case of possible or suspected contamination should be prepared. The emergency contact list and contact information in the business should be kept up to date.
- i. A simple health/travel questionnaire record should be kept for everyone entering the food business, and their temperature should be measured with a digital thermometer.
- j. When the business has an employee diagnosed with COVID-19, the business person in charge of the COVID-19 Provincial/District Health Directorate should be informed for contact tracing. Business's employees should comply with the requests of Provincial Health Directorate personnel.

A decision about returning to work of personnel diagnosed with COVID-19 should be made in accordance with the recommendations of the relevant health institution. Necessary physical and social distancing measures (min. 1.5–2 m) should be maintained in dressing rooms and the dining hall, services area certainly (6,7,10,11).

2.7. Environment cleaning, disinfection, and ventilation of businesses

Cleaning and disinfection are crucial to removing food-borne pathogens and secure food safety and operational efficiency. Good and effective cleaning and disinfection procedures should be carried out with a chemical solution suitable for each type of surface. The possibility of virus transmission by persons, equipment, or surfaces can be reduced or prevented via effective sanitation procedures. Infrastructure and the quality of equipment must be established to prevent cross-contamination. The pre-processing, preparing, cooking, and cooling surfaces; bread cases; shelves; and sales sections should be suitable for food. This area should not absorb water, and it should be easy to clean and disinfect.

All food-contacting surfaces must have corrosive properties and be made of suitable materials to minimize the risk of contamination. For example, if a dough kneading machine is on the floor or its surfaces are open, there will be a high risk of cross-contamination during the process.

For this reason, it is necessary to design the production area in accordance with clean airflow, which plays a major role in the effectiveness and adequacy of food hygiene practices. Cleaning and disinfection processes prevent physical, chemical, and/or microbiological cross-contamination from one product to the next.

A Bakery Manufacturing business operator should have good planning, with well-designed and organized operations that include all the required measures for thorough cleaning. Potential safety risks for the food Bakery Manufacturing business must be determined, and cleaning and disinfection of food contact surfaces of equipment should be conducted effectively. Except for hand dryers working with High-Efficiency Particulate Air (HEPA) filter airflow, hand dryers should not be used during the ongoing COVID-19 pandemic. Equipment used frequently in the transportation of bread and other products should be kept cleaned and sanitized. Considering the adhesion times of COVID-19 on the surface, cleaning and disinfection processes should be applied. Floors, walls, and surfaces in contact with food should be solid and made of materials suitable for cleaning and disinfection. In particular, floors should be washable and have a suitable slope for water to flow. Food contact surfaces should be selected from suitable materials to protect against dirt accumulation, oxidation, and mold. Ceilings and installations located on the ceiling should be designed in such a way that they do not allow the accumulation of dirt, oxidation, or mold growth on the surfaces, and they should be easily cleanable.

Contamination that may occur in foodstuffs because of evaporation and dripping during production should be prevented (6).

2.8. Waste management

A plan associated with COVID-19 waste management should be generated by the food business. All waste should be removed from the environment in a hygienic and environmentally friendly way, following the related legislation. Waste should be prevented from being a direct or indirect source of contamination, separated infectious waste (contaminated mix waste) including masks, gloves, and tissues, awareness outreach for generators, *used* double bagged for potentially infectious waste, refused/reduced single-use plastic and plastic products, prepared to use colored containers and/or proper labeling according to the waste categories in each ward. Contaminated wastes should be collected in containers that can be covered, with a disinfectant containing 500 mg/L of chlorine. After treatment, it should be disposed of as hazardous waste in a sealed bag. When employees are diagnosed with COVID-19 in business, his/her wastes should be double-bagged and covered with sodium hypochlorite. Personal protective equipment used by employees in enterprises should be disposed of in household waste (3,6,12).

2.9. A safe water supply

Some bacterial diseases, such as cholera, spread through contaminated water. If a safe water system and waste management practices in the food business are well-designed to prevent microbial pathogens, it will help prevent pathogens, including COVID-19, from being transmitted in this way. When water quality, sanitation, and hygiene conditions are good, this can prevent infection and protect human health during all infectious disease outbreaks (13). The water used in the food manufacture should be potable water quality, chemical, and microbiological analyzes should be carried out routinely, the lines of potable and non-potable water should be marked, and there should be no mixing between them. Centralized drinking water sanitation methods should inactivate the COVID-19 virus. The most commonly used water disinfection practices against COVID-19 include chlorination and ultraviolet (UV) treatment (9).

The information about guidance on the management of COVID-19 published by the health government should be carried out sensitively during all production stages. The recommended pandemic precautions as explained in the section (including a pandemic management plan, airflow conditions, a drainage system, cleaning and disinfection rules for manufacturing area, operating vehicles, environment and packing area, precautions for employees, ventilation conditions, waste management, water safety, etc.) should be applied in Bakery Manufacturing. PRPs to prevent contamination from food processing areas, such as washing and sanitizing of all the food contacted surfaces, as well as the implementation of good personal hygiene and practices among workers, will reduce the risk of virus transmission. A combination of cleaning and

methods will be the most effective way to remove the food-borne pathogens and COVID-19 virus from food manufactures. During the pandemic situation, food business operators should consider implementing pandemic measure plans in order to guarantee a healthy working area.

3. Discussion

Reason of increasing the number of positive cases of COVID-19 between workers in producing area indicate that the managing outbreak is not enough to prevent transmission. Although, the auditing of bakeries against COVID-19 disease is vital, it is reported that few Bakery Manufacturing could obey the rules. The weak pandemic management system provides lower control of the transmission. Post-COVID-19 Precautions for Bakery Manufacturing Area is not just general hygiene rules. Although processing area must be adopted social distancing procedures, healthy staff plan, physical barriers to remain at least 6 feet apart, modified hygiene procedures for employers, these considerations are insufficiently established in accordance with laws, rules, and regulations by businesses.

4. Conclusion

To effectively fight against the COVID-19 epidemic in the manufacturing area, the "Intra-Company Pandemic Measure Plan" should be implemented effectively and sustainably. Combining food hygiene conditions with COVID-19 control measurements from entering to the exit point of the manufacture is important in enhancing the precautions. Manufacturing controls to prevent contamination of food, such as washing and sanitizing of produce surfaces, as well as the implementation of good personal hygiene and practices among workers, will reduce the risk of virus transmission. A food business needs much more information for applying the risk of COVID-19 spread associated with food and food manufacturing areas. It is suggested that food businesses should be educated about the current guidelines issued by public health authorities and procedures for PRPs must be revised in accordance with the directives of the Ministry of Health.

Conflict of interest

The authors declare to have no conflict of interest.

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