

AN OVERVIEW OF POTENTIAL HAZARDS AND CONTROL MEASURES OF FOOD DELIVERY SERVICE ACTIVITIES

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Abstract. Food delivery services have revolutionized the way we consumed our daily meal. The easiness, speed and convenience provided by the business have attracted many customers. However, the question here is whether the food delivery services may have posed any sort of hazards to its customers. This paper briefly explains the types of hazard associated with foods and identify the potential source of hazards that may occur during food delivery activities. Two hazard control points are identified from the activities, at the receiving stage of the ordered food, and during the delivery (storage conditions and duration of transport). Some control measures are suggested in order to reduce or to prevent the hazard. It is hoped that this overview will become a source of information for the delivery service providers in order to deliver safe and quality food to their customers.

Keywords: biological hazards, chemical hazards, physical hazards, food delivery, control measures

Introduction

Food delivery services have started since 1995 which deliver on-demand and ready-to-eat meals. A couple of years back shows the bloom of food delivering market for the exchange of services and goods as the internet was developed into a massive global marketplace (Arji *et al.*, 2019). With the advancement of recent technologies especially mobile devices, it made food ordering via online applications and its delivery services become more popular (Shahirah *et al.*, 2019). In 2016, it was reported internet access were made using mobile phones by 17.9 million Malaysians. It is expected this figure will reach 21.1 million mobile phone Internet users by 2020 (Lau & David, 2019). Food delivery market in Southeast Asia is huge and expected to have a big opportunity for future growth. It was forecasted that by the year 2022, the food delivery business will grow and become one of the fastest-growing sectors in the food market (Lau & David, 2019). On the larger scope, the online food delivery market worldwide is worth more than US\$35 billion annually, and it is forecasted to reach US\$365 billion by 2030 (The ASEAN, 2020a). The region's food delivery market is expected to grow from US\$2 billion in 2018 to an estimated US\$8 billion in 2025 (The ASEAN, 2020b).

On March 8, 2018, The Center for Disease Control and Prevention of Guangzhou (GZCDC) received a report regarding an outbreak of foodborne illness of students at a school in Guangzhou City. The students show symptom such as diarrhoea and vomiting then later confirmed to be caused by Norovirus-related acute gastroenteritis associated with delivery food (Lu *et al.*, 2020). Based on the study reported by Jiang *et al.* (2020), 10 diarrheal cases were reported at two hospitals in the Nanshan District of Shenzhen, China which was then confirmed to be an outbreak of *Salmonella enteritidis* associated to food ordered through an online food delivery platform. According to Lu *et al.* (2020), there were multiple outbreaks in four schools from 2015 to 2017 in Guangzhou as indicated by the National Public Health Emergency Event Surveillance System (PHEESS). Announced outbreaks prevalently occur in schools, kid care focuses, medicinal services offices and other swarmed settings. Recently, non-essential services had been shut down to contain the spreading of coronavirus disease and restaurants only allow takeout service, in response, food delivery services became public choice during lockdown period to avoid getting out and to practice social distancing. As stated by Nguyen & Vu (2020b), more than 65% of infected cases reported in a public hospital in Hanoi, Vietnam

spread by nonclinical staff working in the hospital canteen. These workers used to prepare meals and deliver food and hot water to patients and visitors across the hospital. This has alarmed the public that food delivery services have the greatest potential for spreading this novel coronavirus and other types of diseases (Nguyen & Vu, 2020a).

This paper will focus on the delivery of ready-to-eat meals only. Delivery of fresh vegetables and other grocery items, as well as non-food items, are not covered. The overview includes a description of the types of food hazards which affect the safety and quality of the food. Potential hazards were identified based on the delivery service activities. Several preventive and control measures are suggested in order to reduce or eliminate the identified potential hazards.

Types of food hazards

A food safety hazard refers to any agent present in the food that causes adverse health consequences for consumers. Hazard has been categorized as biological, chemical and physical agent in, or, condition of, food with the potential to cause a food-borne illness (Olsen, 1998).

Biological hazards are characterized by the contamination of food by microorganisms that are found in the air, food, water, animals, and in the human body. Biological hazard poses the biggest instant food safety risk to consumers that cause a large outbreak in short of time. Technically, the biological hazard also includes organisms such as insects and rodent other than parasite, bacteria and viruses (Lawley, Curtis & Davis, 2012). The viruses such as Norovirus, Hepatitis A virus and Rotavirus are the common viruses that can be transmitted to others even if an infected person shows no symptoms of foodborne illness. Food handler that contributes from “farm to fork” play a crucial role in spreading the harm.

A physical hazard is any foreign matter inadvertently presented in food or a naturally occurring object which can cause illness or harm to the consumers. The foreign materials are associated with unsanitary conditions during production, storage and distribution of food. These materials are considered as hazardous due to its sharpness, hardness, size or shape which may cause lacerations, perforations and wounds or may become choking hazard (Singh *et al.*, 2019). Materials such as glass fragments, pieces of plastics, remnants of insect fragments, and stones are some examples of physical hazard.

Chemical contaminants show rarely in the food-borne outbreak in developed countries. However, there is the potential of a chemical hazard to enter the food chain at the primary stage of food production, for instance, the use of herbicides and insecticides that contained toxic residues to the consumers (Lawley, Curtis & Davis, 2012).

The aforementioned hazards are identified from the time the food is received, the packaging used, storage conditions of food during delivery, and the duration of transport before it reaches the customers. Personal hygiene of the delivery crew or known as rider is also considered as a source of hazards.

Food delivery activities

In general, the food delivery service begins with the customer choosing the order using their mobile phone, payment or confirmation of the order, preparation of the ordered food, delivery service pick-up and delivery to the customer. Based on the flow-chart of the service (Figure 1), two locations of the hazard critical control points (HCCP) are identified.

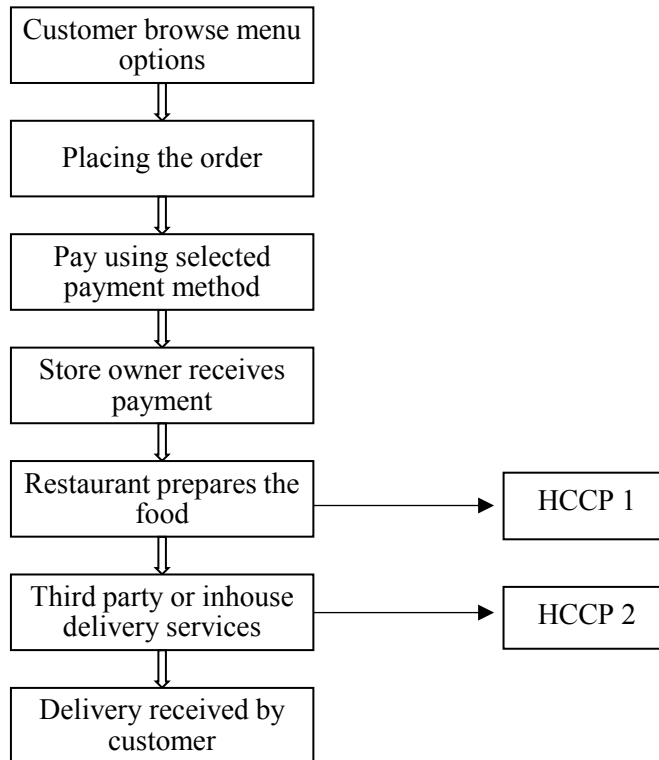


Figure 1. General flowchart on food delivery process and possible hazard control points

HCCP 1: Preparation, Receiving and Packaging of food

The food preparation itself possesses the risk of a hazard in which Norovirus and Shigella can contaminate the food during processing. The food also can be contaminated by cross-contamination that can occur between cooked and raw food. Moreover, inadequate cooking and improper holding temperatures can allow the growth of pathogenic bacteria. Adequate cooking temperatures are necessary, the internal temperature must reach at least 70°C in order to kill most of the bacteria. In general, although varies by strains, the growth of bacteria populations can double every 9-20 minutes during log phase (FAO, 2008). Notably, chilling and freezing do not kill pathogens, the bacteria will become dormant thus slows down their growth. However, they will grow rapidly once the temperature reaches their ideal condition.

For delivery service, how the food or meal was prepared by the supplier either a restaurant, fast-food facility or home-cooked are not part of their activity scope. However, if the foods delivered to the customers are already spoiled or contaminated, the blame may fall to the delivery company. Ensuring that the food is freshly made, cooked properly, not prepared too early prior to pick-up and packed in a suitable container should be included in the checklist of the delivery rider.

HCCP 2: Delivery (Storage conditions and duration of transport)

Prepared foods especially ready-to-eat meals often have limited shelf life and they must be kept at suitable storage conditions. Storing food for a long time at ambient temperature (4.4°C – 60°C) can cause bacteria such as *Staphylococcus aureus*, *Salmonella enteritidis*, *E. coli*, and *Campylobacter* to proliferate at dangerous levels that can cause illness (FAO, 2008). This temperature ranges between 4.4°C to 60°C is known as the danger zone due to the fact that bacteria can grow within this range. As a precaution, since pathogenic bacteria grow rapidly in the middle of the zone, between 21°C and 47°C, any food stored at this range for more than 2

hours should not be consumed (Singh *et al.*, 2019). During the delivery service, this is the common range of temperature the food is exposed to on the way to reach the customer and explained why delivery is indicated as hazard point.

Apart from temperature, duration of transport is also very crucial to ensure food safety. The time the food is stored in the danger zone must be minimized. If the prepared food is hot ($>32^{\circ}\text{C}$), the food should not be at ambient temperature for more than 1 hour. If chilled food is taken out of refrigeration, it should not be left out over than 2 hours (Singh *et al.*, 2019). In other word, food that needs refrigeration must be kept cool while being transported. The food needs to be packed in an insulated box with a coolant gel or in a cool bag with a temperature of 8°C or below. For food that needs to be kept hot, it should be packed in an insulated bag with a temperature of above 60°C (FAO, 2008)

In order to maintain the heat within the food, it is advised to keep the delivery distance short; a maximum of a 30 minutes radius for deliveries is recommended. The person in charge should be capable of keeping the food at the right temperature, keep the transportation bag or tools clean and in good condition, and able to check the food temperature regularly when necessary before handing-over to the customer. The aforementioned points indicated that storage bag and food packaging play an important role to minimize hazards and contamination. Food should be placed in a clean container suitable for food use.

Delivery Personnel

Personal hygiene of the food handlers particularly delivery rider may also be the source of contamination (Todd *et al.*, 2009). The delivery personnel must have basic knowledge regarding food hygiene and safety. Similar to other food handlers at any food premises, the rider must obtain the compulsory food handlers' certificate and vaccinated with typhoid injection (Food Hygiene Regulations, 2009; Rahman, 2019). The rider also should not be allowed to deliver any food if they are unhealthy. Particularly, during COVID-19, hand washing has been a strict standard to meet food safety compliance (WHO, 2020). They need to wash or sanitize their hands before and after collecting food, before and after delivering food (WHO, 2020). Each rider must be supplied with a hand sanitizer with an alcohol content of at least 60%.

Preventive/Control Measures for Delivery Service

There are four major locations that possess the risk of hazards identified in the operation of delivery service which is the food itself, food container, transport duration, and the delivery personnel. The suggested control measures at each of the location are tabulated in Table 1.

Table 1. List of possible hazard arises from food delivery activities.

Sources	Possible hazard	Control measure	Monitoring procedure	Corrective action
Food preparation	Microbial contamination (Mould and bacterial growth)	Temperature and humidity control	Visual inspection checklist	Dispose the food if exceeded stipulated time.
Food container (delivery box or storage bag)	Contaminated packaging material	Removal of packs which do not meet requirements	Visual inspection	Rejection, instruction to supplier

	Microbial spoilage (Mould and bacterial growth)	Temperature and humidity control	Check temperature and humidity between every delivery Use temperature indicator/data logger	Clean and sanitized storage bags. Replace bags if traces of microbes is presence.
	Cleaning agents (soap/ disinfectants)	Wash thoroughly until no residue left	Check presence of chemical agents	Replace bags if the odour or residue persist
Transportation	Duration of delivery	Delivery location less than 30 minute distance	Time indicator	No delivery to customer more than 30 minutes distance
Delivery rider	Microbial contamination (due to improper hygiene and infected food handlers)	Hand sanitizer Handlers strictly follow food handlers' program and constantly educated	Obtain food handlers certificate Vaccinated	Provide training and request rider to vaccinate prior registration as delivery rider

Conclusion

The food delivery service is the last steps of food preparation before it reaches the consumers. It is the final stage of the food supply chain operation that usually receives the least attention. To deliver safe and quality food to customers, knowledge or education on food safety and food handling together with good hygiene practices are important in the delivery activities. HACCPs are identified at the receiving and during transportation of the food. Therefore, preventive measures must be implemented at these hazard points. The fact that the food delivery service is different from food manufacturing and unique in terms of location, logistic and the various types of foods they deliver, efforts in controlling the safety of the food need to be improved and changed to ensure no incidents of foodborne illnesses will occur.

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