

AN OVERVIEW OF THE COVID-19 PANDEMIC ON FOOD SUPPLY CHAIN

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Abstract

The COVID-19 pandemic introduced unexpected stresses on food systems, inducing the rapid response of food supply chains. The range and type of responses varied depending on the stage within the food supply chain, but food safety is a priority in each phase. This paper aims to give an overview of the Covid-19 pandemic on food supply chain. The paper reviewed the concept of Covid-19 pandemic and examined Covid-19 pandemic and food consumption. The paper moreover discussed the effects of Covid-19 on consumer behavior and appraised the effects of Covid-19 pandemic on global food trade as well as the effects of the pandemic on food supply chain.

Keywords: Overview, Covid-19, Pandemic, Food Supply Chain

Introduction

As the COVID-19 disease spread rapidly to six continents by the novel coronavirus SARS-nCoV-2, many countries around the world have declared state of health emergency. On 11 March 2020, the World Health Organization (WHO) declared the rapidly spreading disease as a pandemic and called on countries to plan preparatory and response actions in line with the Global Strategic Preparedness and Response Plan (WHO, 2020a; Vasavada, 2020). WHO explained that a pandemic caused by a coronavirus has not been seen before, and this disease is the first pandemic caused by the coronavirus. COVID-19 is the fifth pandemic, following 1918 influenza virus (H1N1), 1957 influenza virus (H2N2), 1968 influenza virus (H3N2), and 2009 Pandemic flu (H1N1), that resulted in the human deaths of around 50 million, 1.5 million, 1 million, and 300 000, respectively (Liu et al., 2020). WHO indicated that this outbreak is not just a public health crisis, but it is a crisis that will touch every sector. Therefore, every sector and every individual should be involved in this struggle (WHO, 2020c). As of 5 August 2020, the number of cases per 1 million population is given for different regions as follows: 9 613.03 in Americas, 3 694.43 in Europe, 1 136.41 in SouthEast Asia, 2 167.25 in Eastern Mediterranean, 742.75 in Africa, and 176.36 in Western Pacific region. The global total of confirmed cases has reached to 17 528. 223

per 1 million population and 687.64 per 1 million population for corresponding deaths (WHO, 2020b).

The 'Strategic preparedness and response plan' by WHO includes the health measures that all countries had to prepare for and respond to this pandemic. This plan covers what we have learned about the virus so far and aims to transform this information into strategic action that can guide all national and international partners while developing national and regional operational plans. According to this plan, priority steps and actions are outlined in eight main topics which includes coordination, planning, and monitoring at the country level; risk communication and community participation; surveillance, quick response teams, and case investigation; entry points; national laboratories; prevention and control of infection; situation management; and operational support and logistics (WHO, 2020a).

The implementation of these measures caused the closure of workplaces and educational institutions, and temporary restrictions in travels and social meetings. Flexible working from home and online meetings have become standard practices nowadays. However, people who work in the food industry do not have work from home option hence they need to keep their typical office routines (Nicola et al., 2020; FAO and WHO, 2020).

As a consequence of the COVID-19 crisis, response plans for food workers were developed to provide guidance for continuity of operations in the food processing facilities and manage coronavirus in the food industry. Especially meat and poultry processing industries can be defined as the critical infrastructure in food and agriculture. The plan includes a hierarchy of control requirements for cleaning, sanitation, disinfection of facilities, screening, and monitoring of workers for COVID-19, managing the sick employees and education programs for workers and supervisors to prevent the spread of coronavirus (CDC, 2020b).

Every industry in the world expects to see how the COVID-19 outbreak will affect the manufacturing industry, and the food industry is no different from other industries. However, the difference in the food industry from other industries is to produce products that are essential for daily life. Everybody knows that if one factory closes, a certain number of people who works at these factories have the potential to starve, but if processors and distributors are infected, all people are at risk (Staniforth, 2020). In addition, the food industry is a very important sector in regard to economy. However, food sector faces different sets of challenges compared with other sectors that are not critical for daily life such as tourism and aviation during a pandemic. Pandemic might lead to a US\$113 billion loss in aviation and US\$80 billion in tourism sector (IATA, 2020; UNTWO, 2020). Some food companies face various challenges due to a drop in income, whereas others are working hard to meet the growing demand of retailers. During the current COVID-19 outbreak, some difficult decisions had to be made, including temporarily shut down of the various businesses. The fact is that this pandemic clearly demonstrated different companies from different industries are closely connected to each other all over the world (Sebastian, 2020; Shahidi, 2020).

To summarize, four major issues have been raised in the food industry and the food supply chain during the COVID-19 outbreak. Firstly, people tend to have follow a healthy diet for protecting themselves and their immune systems (Rodríguez-Pérez et al., 2020). Therefore, the demand for the functional foods which contain bioactive ingredients increased. Secondly, food safety has

gained more attention to prevent the transmission of coronavirus among producers, retailers, and consumers. Thirdly, food security concerns have arisen because of the people on lockdown restrictions. Lastly, food sustainability problems have emerged in the era of pandemic (Galanakis, 2020). In the light of recent challenges in food supply chain, there is now considerable concern about the food supply chain. Therefore, the purpose of this paper is to provide an overview of the covid-19 pandemic on food supply chain.

Concept of COVID-19 Pandemic

The Coronavirus infection (COVID-19) is an emerging infectious illness which broke out during the winter of 2019 (Al-Hanawi et al., 2020; WHO, 2020a). Due to its presentations, it has been declared a public health emergency of international concern by the World Health Organization (WHO) (WHO, 2020a). An alarming response has been introduced across the globe due to its high infectiousness and case fatality rate (Zhong et al., 2020). The identification of the risks and the prevention of infectivity regarding COVID-19 have been stated to depend on human perception (Zhong et al., 2020). Especially in the submergence of an infectious disease such as COVID-19, different thoughts have shaped individuals' views on the illness.

Currently, the Coronavirus disease has spread to 213 countries with nearly 24 million confirmed cases and close to 820,000 recorded deaths (WHO, 2020b, 2020c). Publicly available reports from the Africa Centre for Disease Control (ACDC) states that confirmed cases of COVID-19 had risen to 1,203,769 and 28,289 deaths as of 25 August 2020 (ACDC, 2020). As of 25th August 2020, the West African subregion accounted for a significant proportion of cumulative COVID-19 records in Africa. In Nigeria, there are 52,800 confirmed cases of COVID-19 with a total of 1,007 deaths as of 25 August 2020 (NCDC, 2020a; WHO, 2020b). Oyo State presently holds the third spot on the Nigeria Centre for Disease Control (NCDC) daily COVID-19 updates, with 3058 laboratory-confirmed cases of COVID-19 and 37 deaths (NCDC, 2020b). Urban areas in Ibadan, the capital city of Oyo State frequently present with confirmed cases (Enwongo, 2020).

As a part of the emergency response activities across all States in Nigeria, health education campaigns have been directed at members of the public (NCDC, 2020a, 2020b). These campaigns have been aimed at knowledge improvement and the correction of certain misconceptions that have been widely circulated among community members (NCDC, 2020a). Education on precautionary measures such as wearing of face masks, regular handwashing with soap and water or with alcohol-based hand sanitizers, and social distancing have been done (NCDC, 2020a, 2020b; Gbadamosi, 2020).

It is evident that perception shapes one's knowledge and the adoption of safety measures concerning the transmission of an infection. Data obtained from the perception of community members regarding COVID-19 could help target interventions needed to improve the knowledge of community members regarding Coronavirus. Superstitious beliefs have largely shaped the perception of most Nigerians regarding the source and cause of COVID-19 (Chukwuorji and Iorfa, 2020). At the onset of the COVID-19 outbreak in Nigeria, infected persons belonged to either the political class or high socioeconomic cadre (Chukwuorji & Iorfa, 2020). The characteristic prevalence of COVID-19 infection among this group of persons accorded COVID-19 the name, 'a disease of the rich and mighty' (Nwaubani, 2020). Few months into the COVID-19 outbreak in Nigeria, perceptions revolved around "immunity" to COVID-19 among the religious folks with a

disregard of bans on religious gatherings (Lichtenstein, Ajayi & Egbunike, 2020). Such perceptions could have been influenced by several factors. Social media platforms such as WhatsApp, Facebook and Twitter have been used to spread false news on COVID-19, resulting to panic disorder and anxiety among some persons and shunning of safety measures among others (Aluh & Onu, 2020; Olapegba et al., 2020). Among many persons, physical distancing, social isolations, restriction of religious and social gatherings etc. have been opined as alien solutions in overcoming the COVID-19 pandemic in Nigeria and Africa at large (Olapegba et al., 2020). Literatures have reported the existence of knowledge relating to COVID-19 among Nigerians, and it is expected that this would influence precautionary behavior among them. However, inherent wrong perceptions may contribute to COVID-19 risk aversion measures (Iorfa et al., 2020). Perceptions of COVID-19 has been influenced by age and gender. Due to their increased vulnerability to illnesses, older persons have been predicted to increasingly adopt COVID-19 precautionary behavior compared to other population groups (Iorfa et al., 2020). Females have been identified as models in the adoption of precautionary health behavior. In the COVID-19 context, the practice of handwashing, hygiene, and use of face masks occur more frequently among females than males (Iorfa et al., 2020). Such an occurrence could be due to the perceived susceptibility to illnesses among females as well as their health-conscious nature.

Covid-19 Pandemic and Food Consumption

A major concern shared by all food companies is preserving the employee's health and the provision of sufficient workforce due to those who do not want to work because of sickness or coronavirus fear. It is very important to protect and maintain the health of people working in the food supply chain during this time of crisis (FAO and WHO, 2020). However, keeping the distribution chain alive by the supply management strategies is also important to meet the consumer demands (De Sousa Jabbour et al., 2020). Maintaining the flow of food and commodities throughout the supply chain should be ensured with the contribution of all stakeholders. Ensuring the confidence of consumers is also essential for food safety and security (FAO and WHO, 2020). At this time of crisis, food security is associated with consumers' access to food rather than food availability (OECD, 2020b).

Consumers generally do not think much about how the food on their tables is produced. However, concerns about food safety in the midst of the global pandemic have drawn attention to the enormous infrastructure and workforce responsible for creating a safe and reliable food supply worldwide. Especially at the beginning of this global crisis, consumer demand for food has increased and some store shelves have been temporarily emptied and resulted in excess purchases of essential products. However, despite this unprecedented demand, the food supply chain remained strong, since many supply chain actors, including farmers, producers, distributors, and retailers, have worked hard to renew shelves (Nicola et al., 2020; Watts, 2020).

Despite the large scale of the pandemic, there is no report that COVID-19 has been transmitted through food consumption to date. Therefore, as stated by the European Food Safety Authority, there is no evidence that food poses a risk to public health in relation to COVID-19. However, after the latest infections have been seen in Xinfandi market due to salmon processing, it can be concluded that the risk of the virus that transmitted through foods is lower than the perceived risk. Considering the survival time of SARS-CoV-2 in different environments such as plastic, steel, or cardboard, it is possible that animal tissues (meat, fish, or poultry) might be a serious source for

foodborne transmission. Hygiene controls by food business operators are designed to prevent contamination of food by any pathogen and will therefore aim to prevent contamination of foods by the virus responsible for COVID-19 too (Arellano, 2020; Dalton, 2020; EC, 2020; Pressman et al., 2020). It was reported that foods were not a source of spread of coronaviruses including MERS and SARS-CoV due to the acidic environments of the stomach ($\text{pH} < 3.5$) in previous outbreaks. However, some cooking and eating habits may lead to the reappearance of the coronavirus from animals to humans (Rizou et al., 2020).

Effects of Covid-19 Pandemic on Consumer Behaviour

When the issue of how the COVID-19 pandemic affects consumers' food demand is examined, it is seen that the demand varies depending on the price of foodstuffs, income level of consumers, sociodemographic situation, consumption, and shopping preferences and time constraints. In addition, the number of visits to food store and spending money on food in per visit changed (Bakalis et al., 2020; Cranfield, 2020).

COVID-19 outbreak interrupted the daily routine and resulted in boredom which can be defined as high energy intake by the consumption of high amount of fat, carbohydrate, and proteins. In addition, quarantine caused stress in people and pushed them toward sugary foods for feeling positive, because carbohydrate-rich foods can be used as self-medicating components due to their ability to encourage serotonin production. However, these unhealthy eating habits may contribute to the development of obesity linked to the chronic inflammation and serious complications of COVID-19 (Muscogiuri et al., 2020).

The closure of restaurants and limited service eating places affected the eating/purchasing habits and resulted in an unusual demand shift from food service to retail. Reports showed that purchasing food from supermarkets and using food services had the same ratio as 50% before the outbreak; however, it is almost 100% for supermarkets. The number of visits to food store was decreased whilst spending money on food was raised per visit. Consumers experienced reduced availability of certain types of foods during the COVID-19 lockdown. In European countries, flour which is a staple product received more attention and not found on food store shelves due to the interest in home-baking as a family activity. Interestingly, bread and baked products kept their place on the supermarket shelves. Consumers have focused on the products with long shelf life such as dried or canned foods, pasta, milk, or milk substitutes, and frozen foods due to convenience and daily cooking at home. People stocked these foods at home because of the turn to home baking and believing rumours or getting false information. Consumers preferred takeaway and home delivery options as a result of social distance and closure of restaurants (Bakalis et al., 2020; Shahidi, 2020).

Indeed, it was interesting to note that the shortage of eggs was not only due to increased demand but also lack of packaging for retail. Household egg consumption increased 40% since March 20 in Argentina and sales of eggs rose by 44% compared to last year in the USA. The U.S. Food and Drug Administration provided flexibility related to the packaging and labelling of eggs due to the insufficient availability of appropriately labelled retail packages to fulfill the demand and facilitate the distribution of eggs during COVID-19 pandemic (FDA, 2020; Mazili, 2020; Reiley, 2020).

Global events such as COVID-19 increase the demand for food worldwide. In a study, demand data in European countries due to COVID-19 were evaluated. Accordingly, although the demand

for fresh bread increased by 76% and frozen vegetables by 52% in the week when the pandemic was announced, the demand for alcoholic beverages did not increase. However, the demand for alcoholic beverages increased about twice, one month after pandemic announcement (Crisp, 2020).

Effects of Pandemic on Global Food Trade

Although the current conditions seem exceptional, the vulnerability of food systems to problems related to climate and diseases has been experienced long before the COVID-19 crisis. Food systems have been unstable from various events and shocks previously such as the oil crisis in the 1970s, the SARS and Ebola outbreaks, and the 2006–2008 food crisis. Africa Swine Fever disease made the global commodity markets upset just a year ago and became a progressive epidemic in Eastern Europe and Asia. The world's largest swine producer (has 1/3 of the global market) and biggest exporter, China, lost 37% of its pigs by the end of 2019 (IPES, 2020). Ebola had a great negative impact on agricultural production, marketing, and trade economies of some African countries. On the production side, due to road constraints, farmers had limited access to inputs such as seeds, fertilizers, and pesticides, and most regions faced labour shortages. For this reason, more than 40% of agricultural land has not been cultivated. However, pandemic did not severely affect the production because agricultural areas were often in the geographic areas which are far away from urban densities (Agrilinks, 2020; Shahidi, 2020).

The current COVID-19 crisis has changed the food trade policies of some governments, moving towards restricting exports and facilitating imports. The main reason that countries impose export restrictions is to ensure the maintenance of the number of products in the domestic market. Although the export restriction typically produces this result in the short term, it also has some negative effects. First, export restrictions cause domestic prices to drop, which will hurt farmers financially resulting in the decrease in crop production and reduced incentives in the industry. Second, countries will lose their competitive advantage by losing their place in international markets. Third, export restrictions undermine exporter's reputation and encourage importers to reduce confidence in the world market, thereby reducing trust in international trade and destroying future business opportunities for exporters (Espitia et al., 2020; FAO, 2020).

In 2008 food crisis, although domestic food prices increased greatly, some big countries that could isolate themselves from world markets were not affected. Compared with 2004, rice prices increased by 224%, wheat prices by 108%, and corn prices by 89% (FAO, 2011). In general, prices increased due to trade constraints, risks, and uncertainties in international markets leading to an increase in prices in the import-dependent countries higher than they should be. Because of the export restrictions enforced by major exporting countries, panic-buying behaviour has been observed in importing countries and prices have been elevated due to more demand for products (DOS, 2011).

Although world food stocks are currently high, a prolonged pandemic crisis can cause problems in the food supply chain, as well as export-restricted policies, which can trigger the domino effect. According to the FAO 2019 grain production estimates, it was reported that there had been around 2.721 billion tonnes of production consisting of 1.44 billion tonnes for coarse grains, 763 million tonnes for wheat, and 512 million tonnes for rice. According to FAO's 2020 estimates, wheat and

coarse grain production is expected to be similar to 2019. For this reason, global grain markets are expected to follow a balanced situation despite the concern of COVID-19 (FAO, 2020b).

A total of 19 countries have taken measures to restrict exports, which are related to 27 food products due to COVID-19 outbreak. Some of these restrictions are inactive and currently a total of 8 countries are continuing their measures on 11 food. When the effects of restrictions on importing countries are evaluated (expressed as Kcal unit), it is seen that Tajikistan, Uzbekistan, Afghanistan, and Azerbaijan were negatively affected by 79%, 70%, 61%, and 54%, respectively (IFPRI, 2020).

Effects of Pandemic on Food Supply Chain

The Food supply chain can be divided into five stages, including agricultural production, postharvest handling, processing, distribution/ retail/service, and consumption. Two systems are being used in the food supply chain regarding food quality and safety. The First one is based on regulations and laws that use mandatory standards which are inspected by state agencies. The Second one is relying on voluntary standards which are defined by market laws or international associations (Bendekovic et al., 2015). Safety measures to ensure the continuity of food flow in each stage can be grouped as food employee's health issues, personal hygiene, using personal protective equipments such as helmets and glove, sanitization of surfaces and working environments, safe handling/preparation/delivery of food, and maintenance of social distance. Protective measures in the last stages of the food supply chain are critical since more people can be potentially affected as moved towards the last stages (Rizou et al., 2020).

Unlike foot and mouth disease, bird flu, Escherichia coli (E. coli), or Listeria, the COVID-19 pandemic does not directly affect production, as it does not spread directly through livestock or agricultural products (FAO, 2020a). However, due to the pandemic, governments around the world have made significant restrictions in the transportation (land, water, and air transport) of goods, as well as in the migration of labour. Reports showed that using the trucks for food distribution was declined to 60% since the restrictions in France which was 30% before the pandemic (FAO, 2020j; Bakalis et al., 2020).

In developing and underdeveloped countries, temporary or seasonal employment is common, especially for planting, sorting, harvesting, processing, or transporting crops to markets. Therefore, the supply chain is significantly affected as a result of the absence of local or migrant workers due to sickness or travel restrictions imposed by lockdown. It also weakens not only production abilities for others, but also their own food safety, in cases where the disease directly affects their health or movement (FAO, 2020k). Especially, labour shortage due to COVID-19 crisis caused severe disruptions in some sectors such as livestock production, horticulture, planting, harvesting, and crop processing which are relatively labour intensive (Stephens et al., 2020). However, shortage of farmworkers was a major issue well before the COVID-19 outbreak, too (Richards and Rickard, 2020).

Due to the fact that many skilled workers in the harvest could not access various countries because of the border controls, a call has been made to the unemployed persons to work in the fields in France. In Britain, 'Pick for Britain' campaign was aimed to find 70 000 British to work in the field and during the harvest (Nature Plants, 2020). However, due to the shortage of workforce as

a result of illness and physical distance to be maintained during production, the crisis undermines the ability of farms and agricultural businesses to work. These conditions retarded the delivery of food and agricultural inputs and created problems in providing continuous food supply to markets (ILO, 2020). Although many manufacturers rely on their core inputs, most are more susceptible to disruptions, as they must obtain their requirements from domestic markets. Logistics barriers that disrupt food supply chains further weaken high-value goods due to their short shelf life (Shahidi, 2020; FAO, 2020j, FAO, 2020k).

Most agricultural activities depend on the season and weather, and therefore, activities need to follow a fine-tuned schedule with flexibility so that immediate actions can be performed when needed. Since all processes and stages in a supply chain are strongly connected to each other, a slight delay or glitch can trigger a butterfly effect resulting in a big loss in the yield and output (FAO, 2020k). Actually, there are many reports that farmers were forced to destroy their products by burning or leaving them to spoil because of the restrictions. Dairy Farmers in America Co-operative consider 14 million litres of milk are being dumped every day due to interrupted supply chain. In England, chair of dairy farmers reported that approximately 5 million litres of milk are at risk in one week. Also, It was reported that tea plants were being lost because of the logistical challenges in India (BBC, 2020a). Therefore, maintaining logistical efficiency is a key factor for the food industry, especially in global crisis.

The biggest issues in the food supply chain are obtaining raw materials from suppliers and ensuring the continuity of food flow from manufacturers to end users (Alonso et al., 2007). The problems are jeopardizing the ability of agricultural businesses to continue their business as usual, and may have negative effects on food quality, freshness, and food safety, and hinder access to markets and affordability (FAO, 2020k). As countries struggle with that pandemic, they must make every effort to move the gears of the food supply chains. The impact of pandemic problems on agricultural systems largely depends on the intensity and composition of agricultural inputs and varies depending on the product produced and the country. Capital intensive techniques are usually used in high-income countries for agricultural production, whereas production is mostly labour dependent in low-income countries. Thus, the supply chain should be kept running with a particular focus on the basics of logistic challenges (FAO, 2020j).

Conclusion

The COVID-19 pandemic introduced unexpected stresses on food systems, inducing the rapid response of food supply chains. Food processing industries are especially vulnerable, as they have an intensive number of production staff in the facilities' limited closed space. During this period of pandemic, continuing the flow of the supply in agriculture and food sector, which is one of the most important sectors together with health, is vital to prevent the food crisis and reducing the negative impact on the global economy. Although no major problems have been observed in the food supply chains so far it remains unclear in the face of an uncertain future. As a result, each country has to realize the severity of the situation and sometimes should tighten or loosen the measures according to the spread of the pandemic. The supply chain also should be flexible enough to respond to the challenges in the food supply chain. The COVID-19 outbreak seriously threatens food safety, security, and nutrition. The economic chaos due to the pandemic threatens economic access and physical availability of food. Disruptions and possible problems in marketing, logistics, and trade systems may restrict access to food in some places and times, therefore, hunger and

malnutrition problems may appear. Governments also should establish and operate emergency provisioning strategies to support production. The regions most affected by the outbreak should be protected by temporary input subsidies programs.

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