THE IMPACT OF THE COVID-19 PANDEMIC ON GLOBAL FOOD SECURITY

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ÖZET

COVID-19 salgını, ulusal gıda güvenliği kontrol sistemlerinin işletilmesinden sorumlu olan yetkili makamlar için istisnai ve benzeri görülmemiş bir zorluk teşkil etmekte olup, bu da ulusal düzenlemeler ve uluslararası tavsiyelere uygun olarak standart işlevlerin ve faaliyetlerin daha fazla uygulanmasını engeller oluşturdu. Birçok ülkede, yetkili makamlar çoğunlukla evden çalışmak mecburiyyetinde kaldı ve tüm yüz yüze toplantılar iptal edildi veya telekonferans olarak yapılandırıldı.

COVID-19 pandemisinin gıda güvenliği üzerindeki etkisini kısa ve uzun vadede tahmin etmek zor olsa da, özellikle bu erken aşamada bazı risk faktörleri şimdiden belirlenebilir. Önceki pandemilerden ve küresel krizlerden öğrenildiği gibi, gıda güvensizliği, özellikle en savunmasız nüfuslara yönelik kayıpların şiddetli olabileceği kırılgan ülkelerde hızla ve büyük ölçüde kötüleşmiştir. COVID-19 salgını dünya çapında yaşamlar, sağlık sistemleri, geçim kaynakları ve ekonomiler üzerinde yıkıcı bir etkiye sahip, ancak gıda krizlerinde yaşayan nüfuslar, etkilerine karşı özellikle savunmasız durumda kalmışdır. Makalede, COVID-19 pandemisinin oluşturmuş olduğu gıda krizi ve yaranmış koşullar analiz edilmişdir.

Anahtar kelimeler: Koronavirüs, pandemi, gıda, güvenlik, global, etki

ABSTRACT

The COVID-19 pandemic is posing an exceptional and unprecedented challenge for the competent authorities responsible for operating national food safety control systems, which has created barriers to the further implementation of standard functions and activities in accordance with national regulations and international recommendations. In many countries, authorities have often had to work from home, and all face-to-face meetings have been canceled or structured as teleconferences.

While it is difficult to predict the impact of the COVID-19 pandemic on food safety in the short and long term, some risk factors can already be identified, especially at this early stage. As learned from previous pandemics and global crises, food insecurity has worsened rapidly and drastically, especially in fragile countries where losses to the most vulnerable populations can be severe. The COVID-19 pandemic has had a devastating impact on lives, health systems, livelihoods and economies worldwide, but populations living in food crises have been particularly vulnerable to its effects. In the article, the food crisis and the conditions created by the COVID-19 pandemic were analyzed.

Keywords: Coronavirus, pandemic, food, security, global, impact

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INTRODUCTION

The world is facing an unprecedented threat from the COVID-19 outbreak caused by the SARS-CoV-2 virus. Many countries are following the World Health Organization (WHO) recommendations on the implementation of physical distancing measures as one of the ways in which transmission of the disease can be reduced. The implementation of these measures has led to the closure of many businesses, schools and educational institutions, and restrictions on travel and social gatherings. However, food industry personnel do not have a chance to work from home. They must continue to work at their place of business as usual. Keeping all workers in food production and supply chains healthy and safe is crucial to surviving the current pandemic. Maintaining food movement in the food chain is a fundamental function that all stakeholders along the food chain must contribute to. Although it is not possible to predict the consequences yet, it is a common belief that the epidemic will be a turning point for the international system (Jawed et al., 2020; WHO, 2020a).

In late December 2019, multiple cases of pneumonia of unknown cause emerged in China and spread rapidly within a month (Bin Salem et al., 2020). The World Health Organization announced on January 12, 2020 that the cause of these complaints was a new type of coronavirus (2019-nCoV). WHO declared this epidemic an international public health status on January 30, 2020, and on February 11, 2020, this new virus was named SARS-CoV-2. The whole world is following the recommendations of the World Health Organization regarding physical distancing measures as one of the ways in which transmission of the disease can be reduced.

Although there is no evidence yet that Coronavirus is transmitted by food and causes infection when taken, it is emphasized that this virus can be transmitted to food by porters, which take place in the production processes from field to table and without showing any symptoms. Careful implementation of hygiene-sanitation practices in food businesses appears as the basic measures to be taken to prevent the virus from entering the food chain and spreading through this way. Proper cleaning, disinfection and prevention of cross-contamination are important in the control of foodborne diseases.

Only when used correctly, personal protective equipment (PPE) such as masks and gloves can be effective in reducing the spread of viruses and diseases in the food industry. Applying sound principles of environmental sanitation, personal hygiene and food safety practices will reduce the likelihood that harmful pathogens will threaten the security of the food supply.

In this review, food safety is discussed in terms of COVID-19.

1. COVID-19 AND IT'S EFFECTS

1.1. COVID-19 Factor

Coronaviruses are single-stranded RNA viruses that can infect animals and humans. That is, their genetic material consists of a strand of RNA and each viral particle is wrapped in a protein envelope (Shariatifar et al.).

Coronaviruses are generally not very resistant to the external environment. There is a durability period that varies depending on factors such as the humidity and temperature of the environment and the texture of the contaminated surface. A coronavirus consists of four structural proteins: nucleocapsid, membrane, and rod-like protrusions (thorns). Since these protrusions are called "corona", which means crown in Latin, these viruses are called coronavirus (crown virus) (Sheeren et al., 2020). The nucleocapsid contains the genetic material in a spherical structure formed by membrane proteins. The spiny ridges identify the cells that the virus can infect and attach to the receptors on the cells.

According to the genotypic and serological characteristics of the coronavirus belonging to the Coronaviridae family; There are four different subgroups: alpha, beta, gamma and delta. Alpha and beta coronaviruses can infect humans, while gamma and delta coronaviruses can only infect animals (Wu et al., 2020). However, some animal coronaviruses can be transmitted to humans and cause epidemics. Intermediate hosts of SARS-CoV and MERS-CoV viruses, whose reservoir is bat, are civet and camel (Bin Salem et al., 2020).

The international virus taxonomy committee named this virus as SARS-CoV-2 and the disease caused by the virus as COVID-19. While deciding on the name Covid-19, the world health organization experts focused only on the type of virus that caused the disease. Co and Vi come from coronavirus, "d" comes from the English word "disease" meaning disease, and 19 comes from 2019, the year the cases started to appear (Sun et al., 2020). The incubation period of COVID-19 varies between 2-14 days. Symptoms that vary according to the age of the patient, such as fever, dry cough, myalgia, fatigue and diarrhea, are observed in patients (Li et al., 2020; Wu et al., 2020).

1.2. COVID-19 and Food Sector

Most viruses that cause disease in humans are of animal origin. Zoonotic viruses have a wide spectrum of spread. These viruses can be transmitted to humans through direct or indirect mediators (Rodriguez-Lazaro et al., 2012).

Records of previous coronavirus outbreaks, such as SARS and MERS, related to the transmission of the coronavirus through food or water, indicate that people are not infected with the coronavirus through food. Although the well-known coronaviruses that cause the common cold are transmitted from person to person, it has been seen that the virus is zoonotic with the emergence of the SARS factor. The food industry takes the necessary precautions

against this group of viruses and implements practices that minimize the risk of contamination through food (Sun et al., 2020; WHO, 2020a).

The transmission of COVID-19 through food, food packages and food handlers has not been identified as a risk factor for the disease. However, based on the available evidence and the persistence of the virus on surfaces for several hours to several days, cleaning and then disinfection is recommended as the best way to control this virus.

Control measures to control the pH, water activity, and thermal applications of foods are used to keep foods microbiologically safe by preventing bacterial growth in foods. Coronaviruses cannot reproduce in food; In order to reproduce, an animal or human must host (Shariatifar et al., 2019). In the case of viral diseases, the goal is not "development", but the protection of food from contamination (Bosch et al., 2018).

While there is no evidence that the coronavirus is transmitted through food, more attention than ever to food safety practices should be taken to reduce the risk. It is important to follow hygienic rules such as washing hands regularly, separating raw and cooked foods, cooking at high temperatures, and storing foods in the refrigerator (Eslami et al., 2020; Seymour et al., 2020). In addition, multiple points for hand washing and disinfection in the workplace should be defined (WHO, 2020).

2. IMPACT OF COVID 19 ON THE FOOD AND BEVERAGE INDUSTRY

2.1. Overview of the COVID-19 Pandemic Situation for the Food and Beverage Industry

Today, the sector that interacts most with the agricultural sector is the food sector. The main function of the food sector is to obtain high quality food and beverage products by processing agricultural raw materials. In this process, which starts from production and ends with the consumer, there are many different components from raw material supply to energy use, from resource use to waste management, from packaging to distribution channels. It is unlikely that a sector with such different components will not be affected by a global epidemic.

Demand Side Shocks: Effects of Change in Consumer Habits: The continued spread of COVID-19 still threatens the food supply chain and triggers consumer concerns about food safety. In the event of a global epidemic such as COVID-19 or a natural disaster such as a devastating earthquake, food consumers change their habits. For example, when Hurricane Sandy hit New York City in 2012, consumers exhibited food storage, hoarding or storage behavior. Similarly, food consumers have started to stock up on food and beverages with the COVID-19 outbreak, which has caused many food products to be unavailable in markets (Wang et al., 2020). In addition to basic food and beverage items such as pasta, rice, canned goods, flour, frozen products, and bottled water, products such as hand sanitizers, soap and

toilet paper were also sold out in markets due to panic buying behavior or hoarding (Hobbs, 2020).

The closure of businesses such as cafes, bars and restaurants in order to reduce the spread of the epidemic can be shown as another reason why the market shelves are empty. While consumption at home increased, consumption abroad decreased a lot and even ended due to curfews in some countries. For example, more than a third of food expenditures in Canada are made in restaurants. The shift in spending to the food retail sector has created additional supply pressure on a functioning food system (Hobbs, 2020). Of course, this situation had rapid effects. Although some suppliers direct certain products to retail outlets, the supply chain has been disrupted by the change in consumer habits (Pieter, 2020).

2.2. Macroeconomic Impacts of COVID-19 on Food Demand

Although the predictions made by the IMF at the beginning of the COVID-19 outbreak have many uncertainties, they can be useful for giving an idea. Projected food demand is determined by two main factors: low economic growth trend, reducing food demand; lower product prices tend to increase demand. The output of these two factors may vary according to countries and food products. However, staple foods such as rice and wheat will be less affected by COVID-19, while the price of higher-value commodities such as vegetable oil and animal products will drop significantly (Gay et al., 2020).

2.3. Supply Side Shocks

The reason for supply-side shocks in the supply chain, especially at the point of fresh food, is the reduction in the workforce and disruptions in transportation services, depending on the current restrictions (Hobbs, 2020). If large numbers of workers in the food industry become ill due to COVID-19, this will adversely affect food producers, distributors and sellers. It is known that in some countries slaughterhouses are closed or temporarily reduced their capacity (Larue, 2020). Transport and distribution links were directly affected by the restriction of movement and loss of workforce, especially cross-border trade.

Especially the danger of the production of labor-intensive food products and the disruptions in the supply chain, food safety brings the subject to the fore. Moreover, the epidemic poses a problem for countries that are heavily dependent on imports for food. As mentioned above, many governments take different measures in order to prevent the negativities that may be experienced in areas such as unemployment, price increase, food safety and food supply in the food sector.

2.4. Short and Long Term Changes

In addition to demand and supply-side shocks, it would be useful to examine the long-term effects of COVID-19 on the food supply chain. The growth of the online grocery/distribution sector and the extent to which consumers will prioritize the "local" food supply chain are two that immediately come to mind. While online food sales or "click and buy" sales were in their normal course before the pandemic, an increase was observed after the pandemic, especially in big cities. It is a fact that online sales are beneficial to old and sick people during the pandemic period. Moreover, such sales also help maintain social distance (Hobbs, 2020).

3. FOOD SAFETY AND COVID-19 VIRUS

3.1. Food Safety and Measures to be Taken in the Supply Chain

Food safety is one of the pillars of the food system most affected by the corona virus epidemic. Table 1 shows the safety measures to be taken during the pandemic in the food industry. Table 2, on the other hand, highlights the most vital measures for each stage of the food supply chain from farm to fork (Rizou et al., 2020).

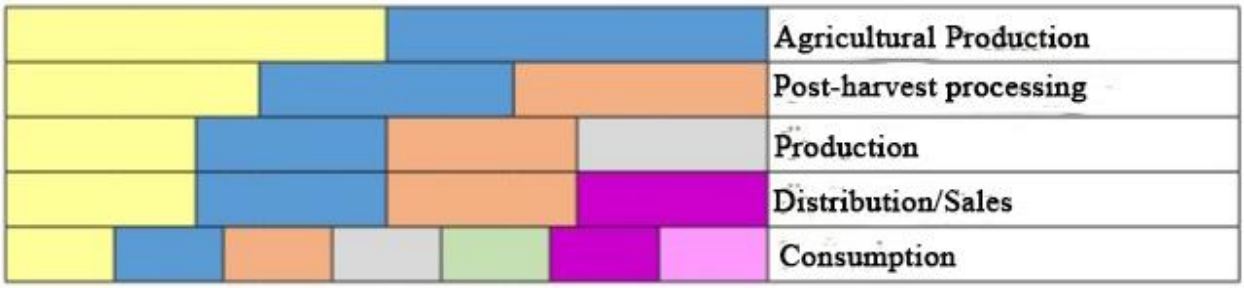
Table 1: Safety measures for the food industry in the COVID-19 global pandemic

Sanitary	Hands	Surfaces	Working environment
If you are sick stay home	Wash your hands frequently with soap and water for at least 20 seconds	Clean frequently touched surfaces with suitable disinfectants.	Clean common areas such as toilets and sinks with appropriate disinfectants.
Watch out for symptoms like fever, cough, and difficulty breathing	Do not touch your mouth, nose and eyes with dirty hands	Read the labels of disinfectants	Create outdoor workspaces
Cover your mouth with a tissue or elbow when sneezing or coughing	Use disinfectant with at least 60% alcohol	Observe protective measures	Ventilate the environment frequently
(FDA, 2020)	(FDA, 2020)	(FDA, 2020)	(Dietz et al., 2020; Liu et al., 2020)

Preparation	Distribution	Social Distance
Separate raw and cooked products	Prefer "contactless" deliveries	Keep at least 2 meters distance between you and people
Wash fruits and vegetables thoroughly before eating	Ensure proper temperature and time conditions are provided	Do not gather in groups

Cook food at the appropriate temperature (>70°C)	Make sure shipping containers are cleaned and disinfected	Do not be in crowded places

Figure 1: The most vital measures for each stage of the food supply chain from farm to fork.



The measures are listed as follows: Health status of employees (eg, stay at home if you are sick), personnel hygiene (eg: wash your hands), disinfection of surfaces, keeping the working environment clean, production or preparation of food, distribution of food and social distancing. preservation. Although these measures are applied at all five stages in the food supply chain (Picture 1), they should be critically used in the final stages (eg consumption). The reason for this is that as the chain progresses to the final stages, more people are involved in the process and therefore the person with the potential to spread the disease. In addition, the sine qua non for the food industry is the safety of the food reaching the consumer, and this food should not put the health of the consumer at risk at any stage of the process, including the distribution stage (Rizou et al., 2020).

In addition to the above, other measures can be taken, especially during the preparation and consumption phases. For example, although there is no scientific evidence that the SARS-CoV-2 virus is transmitted by food, some restaurants and cafes in Europe have removed undercooked meat dishes from their menus at the very beginning of the epidemic (Euractiv, 2020). If a person with the disease sneezes or coughs on products such as fresh fruit and vegetables or packaging material, the corona virus can be transmitted to food. In such a case, it is possible to transmit the virus from the hands that come into contact with the food or directly from the food/package itself. SARS-CoV-2 virus becomes inactive in 5 minutes at 70 °C (Chin et al., 2020), so cooking temperatures (>70 °C) will prevent viral transmission. However, transmission from frozen food is possible. Therefore, it is very important for food handlers to wash their hands and perform the necessary purification before touching raw foods.

3.2. Additional Measures to be Taken Against COVID-19 in Food Businesses

Safety measures and sanitation are not foreign to food industry workers. Many of the measures to be taken against COVID-19 are followed within the enterprise. For example, frequent washing of hands, use of masks, gloves and disinfectants are ordinary practices we see in every food business. However, these may not be enough to prevent the spread of COVID-19 in businesses. In order to keep food businesses away from this disease, it is essential to comply with the precautions that we briefly mentioned below.

In order to prevent the spread of COVID-19:

- Personnel should be informed about the SARS-CoV-2 virus, the disease caused by this virus, and the symptoms of the disease,

- It should be explained in detail how the personnel will be contacted with competent persons in case of catching the disease,
- Administrative leave should be given to the sick employees and it should be checked whether the isolation conditions are complied with,
- Work in accordance with social distance in the workplace,
- The existing good hygiene practices should be made more stringent,
- Frequently touched surfaces such as door handles, buttons and telephone handset and common areas such as toilets and sinks should be cleaned carefully and with appropriate disinfectants,
- Mask distribution within the enterprise should be done without contact,
- Non-contact hand disinfectants should be available in the establishment,
- Tools used by employees in the production area should be personal, such as personalized knives in meat slaughterhouses.
- Employees should be encouraged to go outside during breaks,
- If possible, flexible working order should be adopted,
- Necessary measures should be taken to maintain social distance in locker rooms, cafeteria and personnel services,
- Entrances and exits to the enterprise should be done in a controlled manner, and additional card reading systems should be installed to reduce clutter at shift entries/exits.

4. STRONG GENERATIONS WITH IMMUNITY WITH SUSTAINABLE AND FLEXIBLE FOOD SYSTEM

COVID-19 is a health crisis affecting the most vulnerable segments of societies. The majority of those who lost their lives are over the age of 65 and have chronic diseases. Children appear to be least affected by the disease. However, children are also indirectly affected by the crisis. As UN Secretary General Antonio Guterres stated, measures to control the disease, especially the interruption of education, prevented 310 million children in the world from reaching their school meal, which is their only daily food. This figure is equal to half of the world's school-age children. Food problems experienced during the pandemic affect not only children but also millions of people. According to the UN Food Programme, the food crisis is growing due to the problems caused by COVID-19. While 821 million people are starving all over the world, 130 million more are at risk of starvation by the end of 2020 (Jawed I, Tareen FR, Cauhan K, Nayeem M, 2020).

Opinions are often expressed that the COVID-19 outbreak may lead to a food crisis. It is stated that the problems in the global food system make many countries more vulnerable to possible shocks. Another view that has been increasingly voiced is that industrial livestock farming leads to the emergence of epidemics such as COVID-19. A third view that focuses on the connection between food and COVID-19 is that common dietary habits weaken the immune systems, causing chronic diseases and increasing the effects of epidemics. In this section, the mutual relationship between the food system and epidemic diseases will be examined under three headings in the light of the views put forward:

4.1. Industrial Agriculture and Livestock Trigger Epidemics

It is unclear how the SARS-COV-2 virus that caused the COVID-19 outbreak emerged. According to one claim, it spread from the fish market in Wuhan, China. In the market, which was closed when the epidemic started, not only seafood but also wild animal meats were sold.

It is estimated that the SARS-COV-2 virus, like other coronaviruses, originated in bats. Scientists estimate that the bat virus was transmitted to humans through another carrier animal, possibly an anteater or the meat of another animal sold in the Wuhan Fish Market.

It has long been suggested that industrial livestock practices cause zoonoses. Industrial livestock farming is a rapidly developing field, especially in Asian countries. According to the data of the UN Food and Agriculture Organization (FAO), industrial livestock enterprises meet 74 percent of poultry products, 40 percent of pork and 68 percent of eggs. In 2050, when the world population is estimated to reach 10 billion, urbanization and increasing welfare are expected to increase the demand for protein (meat, poultry, dairy products and eggs).

In order to meet the increasing demand, industrial livestock applications are becoming widespread. These applications provide an increase in productivity and bring about a great increase in production (Li Q, Guan X, Wu P, et al, 2020). However, it is frequently stated that the methods used to increase yield trigger zoonoses. It is stated that these practices affect biological diversity and that the genetics of animals become copies of each other. Pathogenic viruses can spread rapidly among animals that are genetically similar and confined to narrow spaces, and the virus can also be transmitted to humans. In addition, antibiotics are used to support the growth of animals, and it is stated that this situation increases the treatment resistance of animal diseases transmitted to humans. Stress in animals raised in crowded farms suppresses the immune system of animals and facilitates infections.

It is stated that industrial stockbreeding abuses agricultural lands, animals and natural resources, especially water, causes environmental pollution and is unsustainable. It is argued that such facilities should be strictly controlled or even banned.

4.2. The Elasticity of the Global Food System Should Be Increased

It is possible with sustainable food production to strengthen the food systems in a way that will prevent the emergence of epidemics and the immune systems will be least affected by the diseases.

Due to the coronavirus pandemic, the world has faced a food shock that is rarely seen in history. The 2002-2003 SARS outbreak or the 2012 MERS outbreaks had limited impact on the food supply. Food prices rose sharply in West Africa during the Ebola epidemic in 2014 but the global food crisis did not arise. In the COVID-19 crisis, food production is in a triple shock [48]. There are problems in the production, distribution and access of food products. COVID-19 also reveals how vulnerable the global food system is to shocks. For this reason, the need for a more flexible and sustainable food system is frequently mentioned (Lodder W, de Roda Husman AM, 2020: 533).

There has yet to be any indication of a problem with the food supply since the COVID-19 outbreak began. The crisis broke out at a time when global food stocks were high. Apart from a few items, food prices also show a downward trend rather than an increase. It has been reported that wheat prices have increased by 8 percent and rice prices by 25 percent in global markets since the onset of the COVID-19 crisis. Food prices have reacted differently in local markets. For example, rice prices in Nigeria, which has the largest economy in Africa, increased by 30 percent in March. It is stated that the price of rice exported by Thailand has reached the highest level of the last six years. Despite these negative developments, according to the World Bank, although there are some jumps in some items, there is a 4 percent decrease in food prices in global markets, not an increase.

However, there are increasing concerns that there may be problems in the coming months due to the countries' starting to impose export bans and the disruptions in the international supply chain. For example, Russia, the world's largest grain exporter, restricted its wheat export to 7 million tons between April and June of 2020. Russia, Kyrgyzstan and Armenia have imposed quotas on the export of some vegetables such as soybeans and onions. Ukraine has banned buckwheat exports until 1 July. Major rice producers such as Vietnam, Cambodia and India have placed temporary export bans. Egypt announced that it stopped its pulses exports until the end of June. On the other hand, it is stated that Egypt and Iraq, the world's largest grain importers, increased their imports due to increasing concerns about the epidemic. On the increasing trade restrictions, FAO made a statement on March 26 and warned that food shortages could occur all over the world. A hunger warning came from FAO in the following weeks.

The reason for concern is that COVID-19 measures are affecting access to inputs and workforce vital to agriculture. The World Bank has warned that access to fertilizers, pesticides and labor may be disrupted next year, if not this year, due to trade restrictions and disruptions in the international supply chain. Farmers whose access to markets are restricted and demand for their products falls bankrupt, the next year's production decreases, thus food security is endangered.

It is estimated that the agricultural input problems predicted by the World Bank will be felt most in developing countries. The COVID-19 crisis is troubling developing countries in many ways (Shereen MA, Khan S, Kazmi A, Bashir N, Siddique R, 2020: 92). The first of these is the trade restrictions of developed countries. While these restrictions reduce the incomes of agricultural exporting developing countries to a great extent, disruptions in the global food chain increase the expenditures of agricultural input imports. Developments that erode agricultural incomes increase the risk of malnutrition and hunger in developing countries, and have the potential to create social confusion. In the light of these developments, the World Bank called on the G-20 countries, which are also the world's largest food producers and exporters, to keep their trade channels open with developing countries.

One of the methods used to control the COVID-19 epidemic is to restrict freedom of movement. Measures to contain the epidemic also have a negative impact on food production. In March, Argentina's grain, especially soybean exports, fell by half due to strict quarantine measures by local governments. Farmers in India had to use perishable products such as lettuce and strawberries that they harvested as animal feed because they could not reach the markets due to travel bans.

Travel bans also prevented temporary agricultural workers from reaching the fields. Epidemics can cause farmers to leave their lands or miss planting, planting and harvesting times. These restrictions may affect not only basic production activities but also the entire agricultural supply chain. For example, it is stated that billions of bees have died in China due to the inability of beekeepers to reach pets. Breeders and fishermen may not be able to reach the markets or extended border crossing times increase product losses. This reduces agricultural incomes and increases poverty. African countries, where millions of families spend half of their income on food, are the countries most vulnerable to disruptions in food supply.

The year 2020 has not started easily for most of the world. Millions of people in the world are malnourished due to internal conflicts, economic problems and disasters caused by extreme climate events due to global climate change. In addition, locust invasions in 23 countries in recent months pose a great danger to food security. It is stated that the fight against COVID-19 also hinders the fight against locust invasions. But the food crisis in the world has not emerged in recent months. As mentioned above, according to a report released by FAO in July

2019, 821.6 million people in the world, that is, one out of every nine people, are undernourished. The number of people deprived of food security reaches two billion. 5 percent of children under the age of five (148.9 million children) have growth retardation due to malnutrition (Sun J, He WT, Wang L, et.al, 2020: 484). 135 million people in the world suffer from acute malnutrition due to reasons such as conflicts, migrations, major macroeconomic shocks and income inequality. One third of them are children. According to the 2020 Global Report on Food Crises, published in April, the measures taken to control the COVID-19 outbreak and the pandemic are such that a large number of people may "starve to death".

It is unclear when the COVID-19 pandemic will end. Almost all sectors suffered from the crisis. In this period, there are things to be done at the global and national level to ensure food safety. Various ways are proposed to increase the elasticity of the global food system. Some of these views are summarized below:

4.2.1. A Shorter and Faster Food Supply Chain Should Be Created

Since the pandemic broke out, it has been observed that people shop for food in a panic. Consumers tend to hoard. These images actually showed how fragile the food supply chain is and that the links of the chain can easily break. The food system must be flexible and capable of producing surpluses.

Much of the world has highly centralized food systems. Whereas locally distributed food systems are more resistant to shocks. A resilient and sustainable food system with strong local and regional food subsystems creates economic opportunity for a significant proportion of the population and accelerates the economy's return to normalcy.

Cities with 1.2 billion of the world's population are particularly in need of food security. For this reason, while the COVID-19 epidemic continued, measures were taken to increase food safety in many cities from Wuhan to New York. Agriculture was encouraged in the lands close to the city. Action has been taken to create short and fast food chains (Wang, E., An, N., Gao, Z, et.aı, 2020: 740).

In order to increase the initiatives cited by FAO as an example, it is recommended that especially local governments create "short food supply chains", that is, encourage the consumption of food products produced in rural areas close to the city, in order to ensure food safety in cities. It is stated that in order to create local production chains that are not wasted and maintain a reasonable price level, technological applications such as "mobile wholesale food sales" should be increased, as is done in Thailand or Peru, and distribution optimization should be ensured with modern logistics methods.

4.2.2. Disruption of the Global and National Food Supply Chain Must Be Prevented

Food production, storage, distribution, processing, packaging, retail sales and marketing activities should not be stopped. On the other hand, infection of food workers should be prevented. In order to improve these processes, it is necessary to be open to innovation and technologies (Bin Salem S, Jagadeesan P, 2020: 1).

Localization will increase the elasticity of the food system. However, the food supply chain should not be closed within national borders. All countries are in the global food system and this should not be expected to change. As the OECD underlines, food trade is essential for global food security and the situation will not change in the future. Because, in terms of

geographical location, climate and population density, some regions of the world are more advantageous for certain food, agricultural and fishery products.

In turn, the global food system can be redesigned to provide local and regional food elasticity. For example, subsidy mechanisms that have been removed or reduced by pressures in international trade can be reinstated and productions that will provide healthy eating habits can be supported.

4.2.3. Sectors Most Affected by the Food Crisis Should Be Protected

The coronavirus poses a threat in countries that do not have strong social safety nets. 20 percent of the world's population does not have any social security. It is necessary to ensure that these segments are provided with social security and their access to food is continuous. These social safety nets should include direct cash benefits. It should not be forgotten that there is a correlation between nutritional level and mortality rates. Social safety nets will also be vital in the post-pandemic rebuilding period (WHO, 2020).

In addition, epidemics are most effective on the urban poor, the elderly, those living in remote areas, the disabled, pregnant women, women who have just given birth, and prisoners. When the epidemic begins, states should take measures to ensure that these people can reach adequate nutrition.

4.2.4. Sustainable Ecological Agriculture Practices Should Be Supported

Industrial farming practices have ensured the delivery of high amounts of food to global markets. However, this mode of production has negative consequences. The productivity of agricultural lands decreases, fresh water resources are wasted, ecosystems are damaged, greenhouse gas emissions are increased and biodiversity is reduced. Industrial agriculture is also input-intensive; It is dependent on the prices of energy, fertilizers and pesticides. In many countries these inputs are imported. Therefore, resorting to industrial agriculture practices less will increase both the sustainability of food systems and their flexibility by reducing their dependence on foreign trade and supply chain shocks (Henwood A.F, 2020: 103).

There is a trend towards transition from industrial agricultural practices to precision farming practices in the world. precision agriculture; It refers to agricultural management that aims to protect soil and other natural resources while increasing productivity by using advanced technologies and using the most suitable inputs (water, fertilizer, pesticide, etc.) for the needs of soil and plants. In this method, more economical and environmentally friendly production is provided by using data provided by satellite technologies, small, cheap but capable sensors, cameras, unmanned aerial vehicles and robotic agricultural vehicles. Precision farming practices are increasing rapidly in the world. It is possible to reach the analysis titled Food Safety as Global Threats Increase, which touches on this subject, from the pages of STM ThinkTech.

4.2.5. Food Safety Should Be Followed By Utilizing Digital Technologies

In other words, technologies can be used not only in the spread of precision farming practices, but also in the elimination of other problems in the food system. Thanks to digital tracking systems, the food supply chain can be closely monitored and bottlenecks can be overcome with possible time and resource losses (Jawed I, Tareen FR, 2020: 1).

Mobile networks, earth observation satellites, big data and artificial intelligence applications can offer governments the opportunity to measure the results of their food policies. For example, thanks to digital technologies, food prices can be followed closely. As stated above, jumps in food prices can be seen in the COVID-19 crisis. Ensuring the transparent dissemination of information will make it easier for states to manage food markets. This control can prevent people from panic shopping and enable farmers to make sensible production decisions (Shariatifar N, Molaee-aghaee E. 2019: 59).

Thanks to new technologies, food producers can be guided in accordance with policies and programs. In addition, digital technologies can make it easier for manufacturers to deliver their products to the most suitable markets in a timely manner.

CONCLUSION

As in other crisis situations, different opinions and discussions are encountered in the current COVID-19 process. In this process, it is vital for humanity to ensure that the process is carried out correctly by taking the necessary precautions in line with scientific data.

In the COVID-19 pandemic, food safety from farm to fork has become more important than ever, and it is extremely important not to break this chain and to prevent the viral factor that caused the epidemic from entering this chain. The way the virus is transmitted to foods is in the form of contamination of food by porter workers working in food businesses who do not show any signs of illness but carry the virus.

The COVID-19 pandemic has marked the beginning of a new era in the food supply chain and in the food industry. We are still trying to understand the effects of this epidemic on humanity, economy and food security. Experts and researchers working in the field of food are faced with some challenges, such as ensuring food safety, detection of SARS-CoV-2 virus in places where food is produced, processed and distributed, and proper cleaning of surfaces and work areas. As we go to the last steps of the supply chain, more and more strict measures are needed because more people are involved in these steps. However, transmission of COVID-19 through a component of the food industry seems unlikely.

Evidence hasn’t been presented so far of the transmission of COVID-19 through food packaging. However, the virus that causes COVID-19 can survive on different surfaces for a certain period of time. Therefore, transmission can occur through people touching these virus-contaminated surfaces and then bringing their hands to their mouth, nose and eyes. In food outlets, the highest contamination is due to contact with surfaces. Proper cleaning and disinfection of these surfaces is important. In order to prevent contact with people in market and market-like environments, the social distance rule must be followed and a mask must be worn.

In this process, consumers as well as producers have a great responsibility. Maintaining food movement in the food chain is a key function that all stakeholders along the chain must contribute to. This is also necessary to maintain confidence in food safety and availability, and consumer confidence. Keeping all workers in food production and supply chains healthy and safe is crucial to surviving the current pandemic. Therefore, it is important to comply with the hygiene rules from farm to table. Prevention is easier, cheaper and safer than treatment.

It is very important to stay away from information pollution in the prevention of the disease and the fight against the epidemic. Incomplete or purposeful information causes more harm than good in society. In this context, non-experts in the media should be prevented from

making statements. It should not be forgotten that it is important to apply the right measures against the disease.

The COVID-19 outbreak has also revealed the disruptions in the existing food system. It appears that HACCP-based food systems are not as effective as desired in reducing the risk associated with unidentified hazards. While HACCP only deals with food safety, the current scenario requires tools that address the five elements of food protection, namely food safety, food quality, food defence, food security and food fraud. These elements can be defined and understood as separate concepts. However, overlapping interactions are observed. The need to develop a stronger food preservation system for the food industry has also emerged. Also, in addition to using technological progress for food preservation, behavioral sciences need to be used, especially in food safety enforcement and communication systems processes.

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