



## The Impacts of Pandemic on Food Security and Food Inflation

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### ABSTRACT

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One of the most important impacts of the Covid 19 pandemic that broke out in China in the last months of 2019 was on the agricultural sector and, consequently, on the food supply. This situation manifested itself in an increase in food insecurity and food prices in countries around the world, and rising food prices highlighted the risk of undernourishment. The study attempted to statistically represent the impact of the pandemic on food security and food price increases in countries around the world. The study first compared the pre-pandemic and pandemic periods in terms of three basic indicators, such as food security, food prices, and undernourishment rates, and examined whether there was a significant difference between the two periods. Within the context of these three indicators, an attempt was then made to determine whether the negative impact of the pandemic was more severe in low-income countries. The results of the analysis showed that food prices, food insecurity, and undernourishment increased during the pandemic and that these impacts were relatively greater in developing countries. Therefore, the financial burden of these negative impacts associated with food supply was greater in developing countries.

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## Introduction

In recent years, the agricultural sector and access to food have become major issues. According to the UN, over 2 billion people, including 156 million children, lack access to adequate food. While obesity is a problem in developed countries, access to food is a major issue in developing and underdeveloped countries. While about 3 million children die each year due to difficulties in accessing food, nearly 600 million obese patients struggle with various diseases. Countries have had to take strict measures on this issue for reasons such as the Covid 19 pandemic, which plunged many sectors, especially logistics, into crisis, and the increase in stockpiling (İstikbal, 2022). These measures taken by the states are expected to have two important effects on global trade. The contraction in supply, which started in China, will spread to the whole world, and accordingly, there will be decreases in production and export supply will decrease. The second major impact will be on the demand side. Accordingly, the closure of retail stores will cause a decrease in income and a decrease in demand (Uysal and Veziroğlu, 2020).

Today, a strategic importance is attached to the agricultural sector. The food needs of the growing population and ensuring food security are effective in it. For these reasons, the agricultural sector is accepted by the state as a priority sector and supported by appropriate policies (Tokatlıoğlu et al., 2018). There are many areas in which the agricultural sector contributes to the national economy. For example, the agricultural sector has a positive impact on foreign trade, especially in developing countries, contributes to the development of agriculture-based industries, feeds society and increases GDP, and is the most important employment sector (Uzundumlu, 2012). The agricultural sector provides not only the food necessary for people's lives but also most of the raw materials used in industry. When studying the development processes of countries, it is found that there is a close relationship between the agricultural sector and the industrial sector and the resources obtained from the agricultural sector contribute to the development of the industrial sector (Doğan et al., 2015). Despite these contributions of the agricultural sector to national economies, its crucial importance is evident because it meets the nutritional needs of people (Akin et al., 2020).

However, the Covid 19 pandemic negatively impacted the agricultural sector, and the negative consequences were quickly reflected in food prices. Restrictions imposed to mitigate the effects of the pandemic resulted in slower harvests of agricultural products in many parts of the world, seasonal workers became unemployed, and food could not be transported to markets. Due to the deterioration of supply chains, farmers buried their perishable produce and even had to spill their milk. These constraints have caused some difficulties not only in the food production phase but also in the processing phase. For example, many meat processing plants around the world had to close down because of the outbreak of Covid-19 among workers. For all these reasons, it has been observed that people living in the city center have difficulty accessing fresh fruits, vegetables, meat, and dairy products (UN, 2020). Reasons such as the closure of the country's borders and the restriction of mobility led to the inability to meet demand, especially for fast perishable products. During this period, people panicked for reasons such as the increase in the number of cases and deaths due to Covid-19 and stocked up on the food they might need for the future. Since this situation leads to an imbalance in both food supply and demand, it is only natural that there was a rapid increase in food prices (Akm et al., 2020). In this context, this study aims to show the negative impact of the pandemic on the countries of the world, both in terms of food access and food prices. In the context of this main objective, the questions to be answered in the study (sub-objectives) are;

- Has the pandemic increased rates of food inflation, food insecurity, and undernourishment in countries around the world?
- Are these negative impacts more severe in low-income countries?

### Global Food Security Indicators and Trend of Food Prices

Looking at the historical course, the provision of sufficient food has been an important goal for countries at all times. For this reason, human history is full of wars over the lands where food is produced or over the food itself. It can be assumed that the reason for this situation is the fears and anxieties caused by the lack of food (Kıymaz and Şahinöz, 2010). Moreover, the fact that food is the most important basic need leads to the fact that food production has strategic importance (Eştürk and Ören, 2014). Food and food production are also directly related to issues such as human health, the economy, and the environment. In the study of food and food production issues, various concepts have emerged over time. The most common of these concepts are “food safety” and “food security.” Food security and safety is important both because it is critical to human life to provide food under appropriate conditions and because it affects the health of the environment. At the micro level, food security refers to the ability of households to eat healthy and adequate food, while at the macro level it includes ensuring adequate food supplies in all countries and establishing national and international collaborations, regulations, policies, and action plans to do so. Therefore, food security also includes food safety (Koç and Uzmay, 2015). The concept of food safety can be defined as all activities and strategies aimed at protecting food from physical, chemical, and biological spoilage that may occur

in the process from production to consumption. In particular, the increasing amount of data and information on food borne illness has raised public awareness of food safety (Paparella, 2020).

Food security, on the other hand, refers more to food availability. According to the report announced by FAO et al. (2021), food security refers to the situation in which all people have social, physical, and economic access to nutritious, safe, and sufficient food to lead healthy and active lives. According to this definition, the concept of food security is examined in four different dimensions. These dimensions are food availability, physical and economic access to food, food use, and food stability over time. Food availability examines the physical presence and potential of food, including wild food. The food access dimension is the next step after the food availability dimension. If food is physically available, it examines whether people have physical and economic access to food. If food availability and access to food are present, the food use dimension is examined. Here, the focus is on whether households maximize adequate nutrition and energy consumption. The fourth dimension, which is the stability dimension, looks at whether this situation is stable when the requirements established in other dimensions are met. Therefore, it is important to ensure household food security at all times (FAO et al., 2021).

Food security issues have caused global food prices to increase by nearly 45 percent over the past two years. The Ukraine war has exacerbated this negative price increase. Food inflation, which has increased in many countries that import food from abroad, is the most important problem in the post-pandemic period. Especially in underdeveloped and developing countries, the increase in food expenditure, which is a large part of household expenditure, forces the government to take additional measures (İstikbal, 2022).

Looking at Table 1, it is clear that both food prices in general and staple food prices generally show an increasing trend with the pandemic. The level of the food price index, which was 95.1 in 2019, increased to 125.7 in 2021.

When examining the possible causes of food price increases, reasons such as drought and climate change, upward movements in oil prices, stockpiling, and high-profit margins of intermediary service providers can be cited. Especially during the pandemic, consumers grabbed food in panic and it was observed that sellers, using this situation as an opportunity, increased prices excessively (Cavlak and Selvi, 2022). In Table 2, which is organized according to FAO data, it can be seen that both the rates of undernourishment and food insecurity increased significantly with the pandemic after 2019.

While the prevalence of undernourishment is higher in low-income economies, it decreases as income levels increase. While the pandemic does not affect undernourishment rates in high-income economies, significant increases are observed in other income groups, especially in 2020. Moderate to severe food insecurity, already high in low- and lower-middle-income countries, has been exacerbated by the pandemic, as has the prevalence rate of undernourishment. In low- and lower-middle-income countries, government-imposed closures during the pandemic and freezes on food transfer programs such as school nutrition for students, supply restrictions, and demand shocks can be said to be effective (Headey and Ruel, 2020).

Table 1. Annual FAO Food Price Indices (2014-2016=100)

Year	Food Price Index	Meat Price Index	Dairy Price Index	Cereals Price Index	Oils Price Index	Sugar Price Index
2016	91.9	91.0	82.6	88.3	99.4	111.6
2017	98.0	97.7	108.0	91.0	101.9	99.1
2018	95.9	94.9	107.3	100.8	87.8	77.4
2019	95.1	100.0	102.8	96.6	83.2	78.6
2020	98.1	95.5	101.8	103.1	99.4	79.5
2021	125.7	107.7	119.1	131.2	164.9	109.3
2022	151.2	119.0	143.4	160.9	219,7	116.7

Source: FAO, <https://www.fao.org/worldfoodsituation/foodpricesindex/en/>, Date: 04.08.2022.

Table 2. Prominent Indicators of Food Security (World) (%)

Year	Prevalence of undernourishment (percent) (annual value)	Prevalence of moderate or severe food insecurity in the total population (percent) (annual value)
2017	7.6	23.9
2018	7.7	25
2019	8	25.4
2020	9.3	29.5
2021	9.8	29.3

Source: FAO, <https://www.fao.org/faostat/en/#data/FS>, Date: 04.08.2022.

Table 3. Prevalence of undernourishment (%) (annual value)

Year	Low income economies	Lower-middle-income economies	Upper-middle-income economies	High-income economies
2017	25.5	10.9	<2.5	<2.5
2018	26.5	10.9	<2.5	<2.5
2019	27.3	11.2	<2.5	<2.5
2020	30	13.1	2.6	<2.5

Source: FAO, <https://www.fao.org/faostat/en/#data/FS>, Date: 04.08.2022

Table 4. Prevalence of moderate or severe food insecurity in the total population (percent) (annual value)

Year	Low income economies	Lower-middle-income economies	Upper-middle-income economies	High-income economies
2017	59	28.2	16.9	7.8
2018	58.1	31.5	16.2	7.3
2019	58.9	33.1	14.9	7.1
2020	61.7	39.8	17.5	7.6

Source: FAO, <https://www.fao.org/faostat/en/#data/FS>, Date: 04.08.2022.

## Literature

The pandemic period has once again demonstrated the importance of agricultural production and food security. This situation has recently led to greater interest in these topics in the literature. This section summarizes studies on the impact of the pandemic period on food security and food prices. Zurayk (2020) highlighted in his study that there were disruptions in food supply chains during the pandemic period. Producers of key food commodities such as rice and wheat have imposed global trade restrictions on these commodities, and countries with high food imports have sought to supplement their food reserves with imports. As a result of the combination of these two situations, pressure on markets has increased. On the other hand, the restriction of movement due to the pandemic has made it more difficult for seasonal agricultural workers to reach their farmlands. Thus, not only is the harvest of existing acreage at risk but so is the product that will be planted in the new season.

According to Lugo-Morin (2020), supply chains in food production and distribution should be structured to represent optimal and safe systems. The restriction of people's movement caused by the pandemic has had a negative impact, especially on smallholder farmers.

In general, this situation is leading to a decline in agricultural food stocks and shortages of some agricultural products. The pandemic is not expected to produce the same results in all countries. The populations of countries experiencing economic downturns are more affected by pandemic containment measures and their side effects. In these countries, where poverty and hunger are high, the increase in food insecurity is felt more acutely.

The study conducted by Varlık (2021) examined the food price bubbles that occurred during the 2008 global crisis and the Covid-19 period in countries defined as the Fragile Eight. According to the empirical results of the study, price bubbles occurred in the Fragile Eight countries during both the 2008 global crisis and the Covid-19 pandemic. However, the price bubbles that formed during the Covid-19 pandemic are expected to propagate over longer periods. The countries with the largest food price bubble during the Covid-19 period are Turkey and Chile. The reason that the price bubbles that formed during the Covid-19 period lasted longer than the 2008 global crisis is because of the supply and demand shocks caused by the pandemic and the droughts that occurred around the world.

The study by Akter (2020) examined the impact of the Covid 19 pandemic on food prices in European countries. The study considered the months of January, February, and March of 2020. According to the empirical results, prices in March 2020 increased by 1% on average compared to prices in January and February. The study highlighted that as curfews increased, general food prices increased in parallel.

Bairagi, Mishra, and Mottaleb (2022) assessed the impact of the Covid -19 pandemic on food prices in India in the context of storable and perishable foods. The results showed that the prices of staple foods such as wheat flour and rice increased significantly during the pandemic compared to the pre-pandemic period, while the price of onions decreased. The reason was explained by the panic buying and storage of staple foods.

The study conducted by Agyei et al. (2021) examined the impact of the Covid 19 pandemic on food prices in sub-Saharan African countries. The study found that the increase in Covid-19 cases led to an increase in food prices. This is because the deaths caused by Covid-19 and the fear of contracting Covid-19 constrained the labor force, leading to an increase in labor costs. The increase in labor costs increased the cost of food and food prices. The study suggested that governments should invest in infrastructures that increase efficiency in the food supply chain, and even emphasized that adequate support to industry in this regard would also improve food availability and food price stability, in the post- Covid-19 period.

Espitia, Rocha, and Ruta (2020) analyzed the impact of Covid-19 and non-cooperative trade policies on global food markets in their study. They emphasized that increasing export restrictions in the wake of the pandemic will significantly increase world food prices. It was found that countries dependent on food imports, most of which are developing or underdeveloped countries, will be more affected by this situation. Cariappa et al. (2021) examined the impact of closure measures due to Covid-19 on food wastage, food losses, and food prices in a study of India. The study, conducted with 729 consumers and 225 farmers, found that access to food is difficult for consumers for reasons such as prevention of access to food markets, deterioration of food supply chains, increase in food prices, and decrease in consumer incomes. The study highlighted that the increase in retail food prices was generally higher than the increase in wholesale food prices. It was also highlighted that the reason for this situation was the increase in retail costs and the transportation problem, especially in the initial phase of Covid-19. Measures such as contract farming, farmer-producer organizations, the establishment of social safety nets to overcome income, production, and price shocks, and access to digital national markets were mentioned to address food supply shortages.

Another study examining the impact of closures due to Covid-19 and measures to prevent the spread of the pandemic on food prices was conducted by Adewopo et al. (2021). The study examined the price changes of rice and maize, the major consumer commodities, during the Covid-19 period in the context of data obtained from a pilot project in Nigeria. It was found that in 2020, when Covid-19 became noticeable in the region, the prices of maize and rice increased by 26% and 44%, respectively, compared to 2019. It was highlighted that consumers were prevented from reaching large markets where cheaper products were available due to the restrictions that were in place during the pandemic period.

## Material and Method

The study compared the pre-pandemic period with the pandemic period to determine whether the pandemic, which is the first sub-objective, increased the rates of food inflation, food insecurity, and undernourishment in countries around the world. In this context, the paired-samples t-test was applied because the values of the same group of countries in different periods were compared. The paired samples t-test can be applied to the same sample group. This test can be used to measure the differences between different values such as expectation, success, etc. indifferent periods of the sample group in question (Ak, 2016). When two different data sets are obtained as a result of two different applications from a group consisting of  $n$  units, these sequences are interdependent. The results of pre-and post-tests can be analyzed using the paired samples t-test (Özdamar, 1999). This analysis can be used in social sciences to test whether the difference between the means of the measurements of a particular variable at two different time points in a group is significant at a certain level of significance (Gürbüz and Şahin, 2017). In the study, paired samples t-test was applied as food price inflation (percentage), the prevalence of moderate or severe food insecurity in total population (percentage), and the prevalence of undernourishment (percentage) of countries in the world were compared before the pandemic and during the pandemic.

To test whether these adverse effects on food supply, which are the second sub-objective of the study, are more severe in underdeveloped, low-income countries, an independent-samples t-test was conducted. For this comparison, the countries of the world are divided into two groups. The first of these groups consists of high-income and upper-middle-income countries (Group 1), and the second consists of low-income and lower-middle-income countries (Group 2). The independent samples t-test is used in social science studies where the difference between two groups is examined concerning a particular variable is investigated (Gürbüz and Şahin, 2017). This test helps us to determine whether there is a significant difference between the means of two different groups (Ak, 2016). Since the number of samples used in the study was large ( $n > 30$ ), it was assumed that the data were in normal distribution according to the central limit theorem (Çakır and Sesli, 2013).

Countries' food price inflation (%), the prevalence of moderate or severe food insecurity in the total population (%), and the prevalence of undernourishment (%) were taken from the FAO database and the countries whose data could be accessed were included in the analysis. The countries included in the analysis are listed in the following tables. Because FAO data on the prevalence of moderate or severe food insecurity in the total population (%) and the prevalence of undernourishment (%) are accessible as a three-year average, the analyzes had to assume a three-year average for 2018-2020 as the pandemic period. Although this is a limitation of the study, the fact that it took place in mid-2020, when the impact of the pandemic was felt intensely, makes the results of the analysis an important indicator of the pandemic period. SPSS package program was used in the analysis. The variables used in the analysis, the years they cover, and their accession addresses can be found in Tables 5 and 6 below.

Table 5. Variables used in the paired samples T-test

Variables	Number of countries	Pre-pandemic period	Pandemic period	Access address and date
Prevalence of moderate or severe food insecurity in the total population (%) (3-year average)	101 (Table 7)	2016-2018	2018-2020	<a href="https://www.fao.org/faostat/en/#data/FS">https://www.fao.org/faostat/en/#data/FS</a> , Date: 11.04.2022
Food price inflation (%)	199 (Table 8)	2018/December	2020/December	<a href="https://www.fao.org/faostat/en/#data/CP">https://www.fao.org/faostat/en/#data/CP</a> , Date: 11.04.2022
Prevalence of undernourishment (%) (3-year average)	163 (Table 9)	2016-2018	2018-2020	<a href="https://www.fao.org/faostat/en/#data/FS">https://www.fao.org/faostat/en/#data/FS</a> , Date: 11.04.2022

Table 6. Variables used in the independent samples T-test

Variables	Number of countries	Pandemic period	Access address and date
Prevalence of moderate or severe food insecurity in the total population (%) (3-year average)	120 (Table 10) (Group 1:70; Group 2:50)	2018-2020	<a href="https://www.fao.org/faostat/en/#data/FS">https://www.fao.org/faostat/en/#data/FS</a> , Date: 20.04.2022
Food price inflation (%)	186 (Table 11) (Group 1:110; Group 2:76)	2020/December	<a href="https://www.fao.org/faostat/en/#data/CP">https://www.fao.org/faostat/en/#data/CP</a> , Date: 20.04.2022
Prevalence of undernourishment (%) (3-year average)	162 (Table 12) (Group 1:98; Group 2:64)	2018-2020	<a href="https://www.fao.org/faostat/en/#data/FS">https://www.fao.org/faostat/en/#data/FS</a> , Date: 27.04.2022

Tables 7. Countries-Prevalence of moderate or severe food insecurity in the total population (%)

1	Afghanistan	35	Greece	69	Norway
2	Albania	36	Guatemala	70	Palestine
3	Algeria	37	Guinea	71	Peru
4	Argentina	38	Honduras	72	Poland
5	Armenia	39	Hungary	73	Portugal
6	Australia	40	Iceland	74	Republic of Korea
7	Austria	41	Indonesia	75	Republic of Moldova
8	Azerbaijan	42	Iran (Islamic Republic of)	76	Romania
9	Bangladesh	43	Ireland	77	Russian Federation
10	Bosnia and Herzegovina	44	Israel	78	Samoa
11	Bots wana	45	Italy	79	Senegal
12	Brazil	46	Japan	80	Serbia
13	Bulgaria	47	Kazakhstan	81	Seychelles
14	Burkina Faso	48	Kenya	82	Sierra Leone
15	Cambodia	49	Kuwait	83	Singapore
16	Canada	50	Kyrgyzstan	84	Slovakia
17	Chile	51	Latvia	85	Slovenia
18	Congo	52	Libya	86	South Sudan
19	Costa Rica	53	Lithuania	87	Spain
20	Croatia	54	Luxembourg	88	Sudan
21	Czechia	55	Malawi	89	Sweden
22	Denmark	56	Malaysia	90	Switzerland
23	Ecuador	57	Malta	91	Thailand
24	Egypt	58	Mauritania	92	Tunisia
25	El Salvador	59	Mauritius	93	Uganda
26	Estonia	60	Mexico	94	United Kingdom*
27	Eswatini	61	Mongolia	95	United Republic of Tanzania
28	Ethiopia	62	Montenegro	96	United States of America
29	Finland	63	Namibia	97	Uruguay
30	France	64	Nepal	98	Uzbekistan
31	Gambia	65	Netherlands	99	Viet Nam
32	Georgia	66	New Zealand	100	Zambia
33	Germany	67	Nigeria	101	Zimbabwe
34	Ghana	68	North Macedonia		

\*United Kingdom of Great Britain and Northern Ireland

Tables 8. Countries-Food price inflation (%)

1	Afghanistan	67	France	133	Nigeria
2	Åland Islands	68	French Polynesia	134	North Macedonia
3	Albania	69	Gabon	135	Norway
4	Algeria	70	Gambia	136	Oman
5	Andorra	71	Georgia	137	Pakistan
6	Angola	72	Germany	138	Palau
7	Anguilla	73	Ghana	139	Palestine
8	Antigua and Barbuda	74	Greece	140	Panama
9	Argentina	75	Greenland	141	Papua New Guinea
10	Armenia	76	Grenada	142	Paraguay
11	Aruba	77	Guadeloupe	143	Peru
12	Australia	78	Guam	144	Philippines
13	Austria	79	Guatemala	145	Poland
14	Azerbaijan	80	Guinea	146	Portugal
15	Bahamas	81	Guinea-Bissau	147	Puerto Rico
16	Bahrain	82	Haiti	148	Qatar
17	Bangladesh	83	Honduras	149	Republic of Korea
18	Barbados	84	Hungary	150	Republic of Moldova
19	Belarus	85	Iceland	151	Réunion
20	Belgium	86	India	152	Romania
21	Belize	87	Indonesia	153	Russian Federation
22	Benin	88	Iran (Islamic Republic of)	154	Rwanda
23	Bhutan	89	Iraq	155	Saint Kitts and Nevis
24	Bolivia (Plurinational State of)	90	Ireland	156	Saint Lucia
25	Bosnia and Herzegovina	91	Israel	157	Saint Vincent and the Grenadines
26	Botswana	92	Italy	158	Samoa
27	Brazil	93	Jamaica	159	San Marino
28	British Virgin Islands	94	Japan	160	Sao Tome and Principe
29	Brunei Darussalam	95	Jordan	161	Saudi Arabia
30	Bulgaria	96	Kazakhstan	162	Senegal
31	Burkina Faso	97	Kenya	163	Serbia
32	Burundi	98	Kiribati	164	Seychelles
33	Cabo Verde	99	Kuwait	165	Sierra Leone
34	Cambodia	100	Kyrgyzstan	166	Singapore
35	Cameroon	101	Lao People's Democratic Republic	167	Slovakia
36	Canada	102	Latvia	168	Slovenia
37	Cayman Islands	103	Lebanon	169	Solomon Islands
38	Chad	104	Lesotho	170	South Africa
39	Chile	105	Liberia	171	South Sudan
40	China, Hong Kong SAR	106	Libya	172	Spain
41	China, Macao SAR	107	Lithuania	173	Sri Lanka
42	China, mainland	108	Luxembourg	174	Sudan
43	Colombia	109	Madagascar	175	Suriname
44	Comoros	110	Malawi	176	Sweden
45	Congo	111	Malaysia	177	Switzerland
46	Cook Islands	112	Maldives	178	Syrian Arab Republic
47	Costa Rica	113	Mali	179	Tajikistan
48	Côte d'Ivoire	114	Malta	180	Thailand
49	Croatia	115	Martinique	181	Timor-Leste
50	Curaçao	116	Mauritania	182	Togo
51	Cyprus	117	Mauritius	183	Tonga
52	Czechia	118	Mexico	184	Trinidad and Tobago
53	Democratic Republic of the Congo	119	Micronesia (Federated States of)	185	Tunisia
54	Denmark	120	Mongolia	186	Turkey
55	Djibouti	121	Montenegro	187	Uganda
56	Dominica	122	Montserrat	188	Ukraine
57	Dominican Republic	123	Morocco	189	United Arab Emirates
58	Ecuador	124	Mozambique	190	United Kingdom*
59	Egypt	125	Myanmar	191	United Republic of Tanzania
60	El Salvador	126	Namibia	192	United States of America
61	Equatorial Guinea	127	Nepal	193	Uruguay
62	Estonia	128	Netherlands	194	Uzbekistan
63	Eswatini	129	New Caledonia	195	Vanuatu
64	Ethiopia	130	New Zealand	196	Viet Nam
65	Fiji	131	Nicaragua	197	Yemen
66	Finland	132	Niger	198	Zambia
				199	Zimbabwe

\*United Kingdom of Great Britain and Northern Ireland

Tables 9. Countries-Prevalence of undernourishment (%)

1	Afghanistan	55	Fiji	109	New Caledonia
2	Albania	56	Finland	110	New Zealand
3	Algeria	57	France	111	Nicaragua
4	Angola	58	French Polynesia	112	Nigeria
5	Argentina	59	Gabon	113	North Macedonia
6	Armenia	60	Gambia	114	Norway
7	Australia	61	Georgia	115	Oman
8	Austria	62	Germany	116	Pakistan
9	Azerbaijan	63	Ghana	117	Panama
10	Bangladesh	64	Greece	118	Papua New Guinea
11	Barbados	65	Guatemala	119	Paraguay
12	Belarus	66	Guyana	120	Peru
13	Belgium	67	Haiti	121	Philippines
14	Belize	68	Honduras	122	Poland
15	Benin	69	Hungary	123	Portugal
16	Bolivia (Plurinational State of)	70	Iceland	124	Republic of Korea
17	Bosnia and Herzegovina	71	India	125	Romania
18	Botswana	72	Indonesia	126	Russian Federation
19	Brazil	73	Iran (Islamic Republic of)	127	Rwanda
20	Brunei Darussalam	74	Iraq	128	Saint Vincent and the Grenadines
21	Bulgaria	75	Ireland	129	Samoa
22	Burkina Faso	76	Israel	130	Sao Tome and Principe
23	Cabo Verde	77	Italy	131	Saudi Arabia
24	Cambodia	78	Jamaica	132	Senegal
25	Cameroon	79	Japan	133	Serbia
26	Canada	80	Jordan	134	Sierra Leone
27	Central African Republic	81	Kazakhstan	135	Slovakia
28	Chad	82	Kenya	136	Slovenia
29	Chile	83	Kiribati	137	Solomon Islands
30	China	84	Kuwait	138	Somalia
31	China, Hong Kong SAR	85	Kyrgyzstan	139	South Africa
32	China, Macao SAR	86	Lao People's Democratic Republic	140	Spain
33	China, mainland	87	Latvia	141	Sri Lanka
34	China, Taiwan Province of	88	Lebanon	142	Sudan
35	Colombia	89	Lesotho	143	Suriname
36	Congo	90	Liberia	144	Sweden
37	Costa Rica	91	Lithuania	145	Switzerland
38	Côte d'Ivoire	92	Luxembourg	146	Thailand
39	Croatia	93	Madagascar	147	Timor-Leste
40	Cuba	94	Malawi	148	Togo
41	Cyprus	95	Malaysia	149	Trinidad and Tobago
42	Czechia	96	Mali	150	Tunisia
43	Democratic People's Republic of Korea	97	Malta	151	Turkey
44	Democratic Republic of the Congo	98	Mauritania	152	Turkmenistan
45	Denmark	99	Mauritius	153	Ukraine
46	Djibouti	100	Mexico	154	United Arab Emirates
47	Dominica	101	Mongolia	155	United Kingdom*
48	Dominican Republic	102	Montenegro	156	United Republic of Tanzania
49	Ecuador	103	Morocco	157	United States of America
50	Egypt	104	Mozambique	158	Uruguay
51	El Salvador	105	Myanmar	159	Uzbekistan
52	Estonia	106	Namibia	160	Vanuatu
53	Eswatini	107	Nepal	161	Venezuela (Bolivarian Republic of)
54	Ethiopia	108	Netherlands	162	Viet Nam
				163	Yemen

\*United Kingdom of Great Britain and Northern Ireland

Table 10. Countries- Prevalence of moderate or severe food insecurity in the total population (%)

No	Countries	Grup	No	Countries	Grup
1	Albania	1	61	Slovenia	1
2	Algeria	1	62	South Africa	1
3	Argentina	1	63	Spain	1
4	Armenia	1	64	Sweden	1
5	Australia	1	65	Switzerland	1
6	Austria	1	66	Thailand	1
7	Azerbaijan	1	67	Tonga	1
8	Belgium	1	68	United Kingdom of Great Britain and Northern Ireland	1
9	Bosnia and Herzegovina	1	69	United States of America	1
10	Botswana	1	70	Uruguay	1
11	Brazil	1	71	Afghanistan	2
12	Bulgaria	1	72	Angola	2
13	Canada	1	73	Bangladesh	2
14	Chile	1	74	Burkina Faso	2
15	Costa Rica	1	75	Cabo Verde	2
16	Croatia	1	76	Cambodia	2
17	Czechia	1	77	Cameroon	2
18	Denmark	1	78	Central African Republic	2
19	Ecuador	1	79	Congo	2
20	Estonia	1	80	Democratic Republic of the Congo	2
21	Fiji	1	81	Egypt	2
22	Finland	1	82	El Salvador	2
23	France	1	83	Eswatini	2
24	Germany	1	84	Ethiopia	2
25	Greece	1	85	Gambia	2
26	Guatemala	1	86	Georgia	2
27	Hungary	1	87	Ghana	2
28	Iceland	1	88	Guinea	2
29	Iran (Islamic Republic of)	1	89	Honduras	2
30	Ireland	1	90	Indonesia	2
31	Israel	1	91	Kenya	2
32	Italy	1	92	Kiribati	2
33	Japan	1	93	Kyrgyzstan	2
34	Kazakhstan	1	94	Lao People's Democratic Republic	2
35	Kuwait	1	95	Lesotho	2
36	Latvia	1	96	Liberia	2
37	Libya	1	97	Malawi	2
38	Lithuania	1	98	Mauritania	2
39	Luxembourg	1	99	Mongolia	2
40	Malaysia	1	100	Morocco	2
41	Malta	1	101	Mozambique	2
42	Mauritius	1	102	Myanmar	2
43	Mexico	1	103	Nepal	2
44	Montenegro	1	104	Nigeria	2
45	Namibia	1	105	Palestine	2
46	Netherlands	1	106	Philippines	2
47	New Zealand	1	107	Republic of Moldova	2
48	North Macedonia	1	108	Senegal	2
49	Norway	1	109	Sierra Leone	2
50	Peru	1	110	Somalia	2
51	Poland	1	111	South Sudan	2
52	Portugal	1	112	Sudan	2
53	Republic of Korea	1	113	Tunisia	2
54	Romania	1	114	Uganda	2
55	Russian Federation	1	115	United Republic of Tanzania	2
56	Samoa	1	116	Uzbekistan	2
57	Serbia	1	117	Vanuatu	2
58	Seychelles	1	118	Viet Nam	2
59	Singapore	1	119	Zambia	2
60	Slovakia	1	120	Zimbabwe	2

Group 1: High-income and Upper-middle-income economies //Group 2: Low income and Lower-middle-income economies



Table 11. Countries- Food price inflation (%)

No	Countries	Gr	No	Countries	Gr	No	Countries	Gr
1	Albania	1	63	Luxembourg	1	125	Côte d'Ivoire	2
2	Algeria	1	64	Malaysia	1	126	Democratic Republic of the Congo	2
3	Andorra	1	65	Maldives	1	127	Djibouti	2
4	Antigua and Barbuda	1	66	Malta	1	128	Egypt	2
5	Argentina	1	67	Mauritius	1	129	El Salvador	2
6	Armenia	1	68	Mexico	1	130	Eswatini	2
7	Australia	1	69	Montenegro	1	131	Ethiopia	2
8	Austria	1	70	Namibia	1	132	Gambia	2
9	Azerbaijan	1	71	Netherlands	1	133	Georgia	2
10	Bahamas	1	72	New Caledonia	1	134	Ghana	2
11	Bahrain	1	73	New Zealand	1	135	Guinea	2
12	Barbados	1	74	North Macedonia	1	136	Guinea-Bissau	2
13	Belarus	1	75	Norway	1	137	Haiti	2
14	Belgium	1	76	Oman	1	138	Honduras	2
15	Belize	1	77	Palau	1	139	India	2
16	Bosnia and Herzegovina	1	78	Panama	1	140	Indonesia	2
17	Botswana	1	79	Paraguay	1	141	Kenya	2
18	Brazil	1	80	Peru	1	142	Kiribati	2
19	Brunei Darussalam	1	81	Poland	1	143	Kyrgyzstan	2
20	Bulgaria	1	82	Portugal	1	144	Lao People's Democratic Republic	2
21	Canada	1	83	Puerto Rico	1	145	Lesotho	2
22	Chile	1	84	Qatar	1	146	Liberia	2
23	China, Hong Kong SAR	1	85	Republic of Korea	1	147	Madagascar	2
24	China, Macao SAR	1	86	Romania	1	148	Malawi	2
25	China, mainland	1	87	Russian Federation	1	149	Mali	2
26	Colombia	1	88	Saint Kitts and Nevis	1	150	Mauritania	2
27	Costa Rica	1	89	Saint Lucia	1	151	Micronesia (Federated States of)	2
28	Croatia	1	90	Saint Vincent and the Grenadines	1	152	Mongolia	2
29	Cyprus	1	91	Samoa	1	153	Morocco	2
30	Czechia	1	92	Saudi Arabia	1	154	Mozambique	2
31	Denmark	1	93	Serbia	1	155	Myanmar	2
32	Dominica	1	94	Seychelles	1	156	Nepal	2
33	Dominican Republic	1	95	Singapore	1	157	Nicaragua	2
34	Ecuador	1	96	Slovakia	1	158	Niger	2
35	Equatorial Guinea	1	97	Slovenia	1	159	Nigeria	2
36	Estonia	1	98	South Africa	1	160	Pakistan	2
37	Fiji	1	99	Spain	1	161	Palestine	2
38	Finland	1	100	Suriname	1	162	Papua New Guinea	2
39	France	1	101	Sweden	1	163	Philippines	2
40	French Polynesia	1	102	Switzerland	1	164	Republic of Moldova	2
41	Gabon	1	103	Thailand	1	165	Rwanda	2
42	Germany	1	104	Tonga	1	166	Sao Tome and Principe	2
43	Greece	1	105	Trinidad and Tobago	1	167	Senegal	2
44	Greenland	1	106	Türkiye	1	168	Sierra Leone	2
45	Grenada	1	107	United Arab Emirates	1	169	Solomon Islands	2
46	Guatemala	1	108	United Kingdom*	1	170	South Sudan	2
47	Hungary	1	109	United States of America	1	171	Sri Lanka	2
48	Iceland	1	110	Uruguay	1	172	Sudan	2
49	Iran (Islamic Republic of)	1	111	Afghanistan	2	173	Syrian Arab Republic	2
50	Iraq	1	112	Angola	2	174	Tajikistan	2
51	Ireland	1	113	Bangladesh	2	175	Timor-Leste	2
52	Israel	1	114	Benin	2	176	Togo	2
53	Italy	1	115	Bhutan	2	177	Tunisia	2
54	Jamaica	1	116	Bolivia (Plurinational State of)	2	178	Uganda	2
55	Japan	1	117	Burkina Faso	2	179	Ukraine	2
56	Jordan	1	118	Burundi	2	180	United Republic of Tanzania	2
57	Kazakhstan	1	119	Cabo Verde	2	181	Uzbekistan	2
58	Kuwait	1	120	Cambodia	2	182	Vanuatu	2
59	Latvia	1	121	Cameroon	2	183	Viet Nam	2
60	Lebanon	1	122	Chad	2	184	Yemen	2
61	Libya	1	123	Comoros	2	185	Zambia	2
62	Lithuania	1	124	Congo	2	186	Zimbabwe	2

\*United Kingdom of Great Britain and Northern Ireland; Gr: Group

Table 12. Countries- Prevalence of undernourishment (%)

No	Countries	Gr	No	Countries	Gr	No	Countries	Gr
1	Afghanistan	2	55	Sudan	2	109	Iran (Islamic Republic of)	1
2	Angola	2	56	Timor-Leste	2	110	Iraq	1
3	Bangladesh	2	57	Togo	2	111	Ireland	1
4	Benin	2	58	Tunisia	2	112	Israel	1
5	Bolivia (Plurinational State of)	2	59	Ukraine	2	113	Italy	1
6	Burkina Faso	2	60	United Republic of Tanzania	2	114	Jamaica	1
7	Cabo Verde	2	61	Uzbekistan	2	115	Japan	1
8	Cambodia	2	62	Vanuatu	2	116	Jordan	1
9	Cameroon	2	63	Viet Nam	2	117	Kazakhstan	1
10	Central African Republic	2	64	Yemen	2	118	Kuwait	1
11	Chad	2	65	Albania	1	119	Latvia	1
12	Congo	2	66	Algeria	1	120	Lebanon	1
13	Côte d'Ivoire	2	67	Argentina	1	121	Lithuania	1
14	Korea**	2	68	Armenia	1	122	Luxembourg	1
15	Congo***	2	69	Australia	1	123	Malaysia	1
16	Djibouti	2	70	Austria	1	124	Malta	1
17	Egypt	2	71	Azerbaijan	1	125	Mauritius	1
18	El Salvador	2	72	Barbados	1	126	Mexico	1
19	Eswatini	2	73	Belarus	1	127	Montenegro	1
20	Ethiopia	2	74	Belgium	1	128	Namibia	1
21	Gambia	2	75	Belize	1	129	Netherlands	1
22	Georgia	2	76	Bosnia and Herzegovina	1	130	New Caledonia	1
23	Ghana	2	77	Botswana	1	131	New Zealand	1
24	Haiti	2	78	Brazil	1	132	North Macedonia	1
25	Honduras	2	79	Brunei Darussalam	1	133	Norway	1
26	India	2	80	Bulgaria	1	134	Oman	1
27	Indonesia	2	81	Canada	1	135	Panama	1
28	Kenya	2	82	Chile	1	136	Paraguay	1
29	Kiribati	2	83	China, Hong Kong SAR	1	137	Peru	1
30	Kyrgyzstan	2	84	China, Macao SAR	1	138	Poland	1
31	Lao People's DR	2	85	China, mainland	1	139	Portugal	1
32	Lesotho	2	86	China, Taiwan Province of	1	140	Republic of Korea	1
33	Liberia	2	87	Colombia	1	141	Romania	1
34	Madagascar	2	88	Costa Rica	1	142	Russian Federation	1
35	Malawi	2	89	Croatia	1	143	Saint Vincent and the Grenadines	1
36	Mali	2	90	Cuba	1	144	Samoa	1
37	Mauritania	2	91	Cyprus	1	145	Saudi Arabia	1
38	Mongolia	2	92	Czechia	1	146	Serbia	1
39	Morocco	2	93	Denmark	1	147	Slovakia	1
40	Mozambique	2	94	Dominica	1	148	Slovenia	1
41	Myanmar	2	95	Dominican Republic	1	149	South Africa	1
42	Nepal	2	96	Ecuador	1	150	Spain	1
43	Nicaragua	2	97	Estonia	1	151	Suriname	1
44	Nigeria	2	98	Fiji	1	152	Sweden	1
45	Pakistan	2	99	Finland	1	153	Switzerland	1
46	Papua New Guinea	2	100	France	1	154	Thailand	1
47	Philippines	2	101	French Polynesia	1	155	Trinidad and Tobago	1
48	Rwanda	2	102	Gabon	1	156	Turkey	1
49	Sao Tome and Principe	2	103	Germany	1	157	Turkmenistan	1
50	Senegal	2	104	Greece	1	158	United Arab Emirates	1
51	Sierra Leone	2	105	Guatemala	1	159	United Kingdom*	1
52	Solomon Islands	2	106	Guyana	1	160	United States of America	1
53	Somalia	2	107	Hungary	1	161	Uruguay	1
54	Sri Lanka	2	108	Iceland	1	162	Venezuela (Bolivarian Republic of)	1

\*United Kingdom of Great Britain and Northern Ireland; \*\*Democratic People's Republic of Korea; \*\*\* Democratic Republic of the Congo; Gr: Group; Group 1: High-income and Upper-middle-income economies //Group 2: Low income and Lower-middle-income economies

## Findings

Tables 13, 14, and 15 include the results of paired-samples t-tests to determine the difference between the rates of food price inflation (%), the prevalence of moderate or severe food insecurity in the total population (%), and the prevalence of undernourishment (%) before the pandemic and during the pandemic period.

As can be seen in Table 13, there is a significant ( $P < 0.05$ ) difference in food price inflation between the pre-pandemic and pandemic periods for 199 countries in the world. Between these two periods with a significant difference, the average food price inflation is higher in the pandemic period (2020/December) than in the pre-pandemic period (2018/December), as expected (3.8859

<10.5480). The difference of about 2.7 times between the two periods suggests that the pandemic has pushed food prices to very high levels. The results of the analysis are consistent with many studies (Akter, 2020; Bairagi, Mishra and Mottaleb, 2022; Agyei et al., 2021; Adewopo et al., 2021; Espitia, Rocha and Ruta, 2020, etc.) that found that the restrictions and panic that increased with the pandemic significantly increased food prices.

As can be seen in Table 14, there is a significant (P<0.05) difference in the rate of food insecurity between the pre-pandemic period and the pandemic period for 101 countries in the world. Between these two periods with a significant difference, it can be seen that the average rate of food insecurity is higher in the pandemic period (2018-2020) than in the pre-pandemic period (2016-2018). As can be seen in Table 15, there is a significant (P<0.05) difference in the percent prevalence of undernourishment between the pre-pandemic period and the pandemic period for 163 countries in the world. Between these two periods with a significant difference, the average prevalence of percent undernourishment during the pandemic period (2018-2020) is higher than in the pre-pandemic period (2016-2018), as expected (9.8663<10.0945).

Tables 16, 17, and 18 include the results of independent samples t-tests to test whether there is a significant difference between “high- and upper-middle-income countries” and “low- and lower-middle-income countries” in terms of the prevalence of moderate or severe food insecurity in the total population (%), food price inflation (%), and prevalence of undernourishment (%) during the pandemic period. As can be seen in Table 16, there is a significant (P<0.05) difference between high-income and upper-middle-income economies and low-income and lower-middle-income economies in the prevalence of moderate or severe food insecurity in the total population (percent). Looking at the averages (15.3510 < 49.0600), we find that food insecurity is almost three times higher in low-income and lower-middle-income economies.

Both the increase in food insecurity and the increase in undernourishment rates are expected to be felt more acutely in underdeveloped low-income countries during the pandemic period. This is consistent with the findings of previous studies (such as Lugo-Morin, 2020; Espitia, Rocha, and Ruta, 2020).

Table 13. Paired samples t-test tables with food price inflation (%) difference for the pre-pandemic period (2018/December) and the pandemic period (2020/December)

Variables	Period	N	Mean	Std. Deviation	t	df	Sig.(P)
Food price inflation (%)	Pre-pandemic period (2018/ December)	199	3.885877	9.8707190	-2,530	198	0.012
	Pandemic period (2020/ December)	199	10.548037	41.4000174			
	Paired Samples Correlations	0.528 (p=0.000)					

Table 14. Paired samples t-test tables with prevalence of moderate or severe food insecurity in the total population (%) difference for the pre-pandemic period (2016-2018) and the pandemic period (2018-2020)

Variables	Period	N	Mean	Std. Deviation	t	df	Sig.(P)
Prevalence of moderate or severe food insecurity in the total population (%) (3-year average)	Pre-pandemic period (2016-2018)	101	25.059	21.8511	-4.121	100	.000
	Pandemic period (2018-2020)	101	26.333	23.0257			
	(Paired Samples Correlations)	0.992 (p=0.000)					

Table 15. Paired samples t-test tables with prevalence of undernourishment (%) difference for the pre-pandemic period (2016-2018) and pandemic period (2018-2020)

Variables	Period	N	Mean	Std. Deviation	t	df	Sig.(P)
Prevalence of undernourishment (%) (3-year average)	Pre-pandemic period (2016-2018)	163	9.8663	11.14818	-2.772	162	0.006
	Pandemic period (2018-2020)	163	10.0945	11.34211			
	Paired Samples Correlations	0.996 (p=0.000)					

\*In the calculations, this rate is taken as 2.5% for the countries with a prevalence of undernourishment below 2.5%

Table 16. Independent samples t-test: Differences between “high-income and upper-middle-income economies” and “low income and lower-middle-income economies” in terms of prevalence of moderate or severe food insecurity in the total population (%) during the pandemic period (2018-2020)

Variables	Countries	N	Mean	Std. Deviation	t	df	Sig.(P)
Prevalence of moderate or severe food insecurity in the total population (%) (3-year average)	Group 1: High-income and upper-middle-income economies	70	15.351	13.4294	-9.560	74.360	.000
	Group 2: Low income and lower-middle-income economies	50	49.060	22.1980			

Table 17. Independent samples t-test: Differences between “high-income and upper-middle-income economies” and “low income and lower-middle-income economies” in terms of food price inflation (%) during the pandemic period (2020/December)

Variables	Countries	N	Mean	Std. Deviation	t	df	Sig.(P)
Food price inflation (%)	Group 1: High-income and upper-middle-income economies	110	7.9236	39.13964	-1.244	184	.215
	Group 2: Low income and lower-middle-income economies	76	15.8483	47.38759			

Table 18. Independent samples t-test: Differences between “high-income and upper-middle-income economies” and “low income and lower-middle-income economies” in terms of prevalence of undernourishment (%) during the pandemic period (2018-2020)

Variable	Countries	N	Mean	Std. Deviation	t	df	Sig.(P)
Prevalence of undernourishment (%) (3-year average)	Group 1: High-income and Upper-middle-income economies	98	5.2418	5.72997	-6.909	77.787	.000
	Group 2: Low income and Lower-middle-income economies	64	17.6438	13.59426			

\*In the calculations, this rate is taken as 2.5% for the countries with a prevalence of undernourishment below 2.5%

As can be seen in Table 17, there is no statistically significant difference between the high and upper-middle-income economies and the low and lower-middle-income economies in terms of food price inflation (percent), since  $P < 0.05$  is not present. This situation shows that food price inflation is a major problem for all countries during the pandemic period. As can be seen from Table 18, there is a statistically significant ( $P < 0.05$ ) difference in the prevalence of undernourishment (percent) between the high and upper-middle-income economies and the low and lower-middle-income economies. Looking at the averages (5.2418 < 17.6438), we find that the rate of undernourishment is about three times higher in the low-income and lower-middle-income economies.

## Conclusion and Suggestions

The epidemic that occurred in China in the last months of 2019 had a negative impact on the food supply and therefore on food prices. The measures and restrictions taken to mitigate the impact of the pandemic resulted in the inability to harvest agricultural products in many regions of the world and the deterioration of supply chains (UN, 2020). In addition, the masses, panicked by the increase in deaths resulting from the pandemic and the intense restriction measures, tended to stock up on food for the following times. This situation endangered the food supply and led to a rapid increase in food prices (Akin et al., 2020: 904-908; Bairagi, Mishra and Mottaleb, 2022). In this study, which was conducted to show the threats of the pandemic in the context of food supply and food prices, it was found that food price inflation, food insecurity, and the risk of undernourishment increased significantly, especially during the pandemic period. In addition, the risk of undernourishment due to food insecurity and rising prices was found to be about three times higher in low-income countries. This finding is consistent with the findings obtained in the study by Lugo-Morin (2020). According to Lugo-Morin (2020), the pandemic should not be expected to produce the same results for all countries. Populations of countries experiencing economic slowdown are more affected by the measures to contain the pandemic and its side effects. The increase in food insecurity is more clearly felt in these countries where poverty and hunger are high.

This situation poses a new problem area for many countries that import food from abroad. Especially in underdeveloped and developing countries, the increase in food expenditures, which constitute a large part of household expenditures, leads the public to take additional measures, creating additional financial burdens (İstikbal, 2022). Rising food prices, while increasing inflation rates, especially in the context of consumer prices, also play an important role in increasing macroeconomic instability. This is because developing measures to combat inflation and prevent food prices from rising is of great importance in ensuring long-term and sustainable price stability (Eştürk and Albayrak, 2018). Considering the fact that most of the increase in inflation is due to the increase in food prices, central banks should prioritize the necessary measures to prevent the growth of food price bubbles in the current period (Varlık, 2021). These increases in the prices of foods that are vital to consumers cause consumers to become victims and their quality of life to decrease (Cavlak and Selvi, 2022). For this reason, it has become even more important to take permanent measures such as increasing support for direct production to increase agricultural and livestock production (Kandemir, 2011), strengthening producer organizations and producer cooperatives by reducing middlemen in agricultural product markets (Kıymaz and Saçlı, 2008), contract farming, creating social safety nets to cushion income, production and price shocks, and access to digital national markets (Cariappa et al., 2021).

## References

- Aker S. 2020. The impact of covid-19 related ‘stay-at-home’ restrictions on food prices in Europe: Findings from a preliminary analysis. *Food Security*, 12(4), 719-725. <https://doi.org/10.1007/s12571-020-01082-3>
- Ak B. 2016. Parametrik hipotez testleri (4. Bölüm). SPSS Uygulamalı Çok Değişkenli İstatistik Teknikleri (Ed. Şeref Kalaycı) içinde, Asil Yayın Dağıtım: Ankara, 73-82.
- Akin Y, Çelen B, Çelen MF, Karagöz A. 2020. Tarım ve pandemi: Covid-19 sonrası Türk Tarımı nasıl değişmeli? *EJONS International Journal of Mathematic Engineering and Natural Sciences*, 4(16), 904-914. <https://doi.org/10.38063/ejons.353>
- Agyei SK, Isshaq Z, Frimpong S, Adam AM, Bossman A, Asiamah, O. 2021. Covid-19 and food prices in Sub-Saharan Africa. *African Development Review*, 33, 102-113. <https://doi.org/10.1111/1467-8268.12525>

- Adewopo JB, Solano-Hermosilla G, Colen L, Micale F. 2021. Using crowd-sourced data for real-time monitoring of food prices during the covid-19 pandemic: Insights from a pilot project in northern Nigeria. *Global Food Security*, 29, <https://doi.org/10.1016/j.gfs.2021.100523>
- Bairagi S, Mishra AK, Mottaleb KA. 2022. Impacts of the COVID-19 pandemic on food prices: Evidence from storable and perishable commodities in India. *PLoS ONE* 17(3): e0264355. <https://doi.org/10.1371/journal.pone.0264355>
- Cavlak N, Selvi MS. 2022. Gıda fiyatlarındaki aşırı artışların olası nedenleri ve Covid-19'un etkisi. *Gıda/The Journal of Food*, 47(1), 42-54.
- Cariappa AGA, Acharya KK, Adhav CA, Sendhil R, Ramasundaram P. 2021. Covid-19 induced lock down effects on agricultural commodity prices and consumer behaviour in India—Implications for food loss and waste management. *Socio-Economic Planning Sciences*, <https://doi.org/10.1016/j.seps.2021.101160>
- Çakır P, Sesli F.A. 2013. Determination of factors affecting the real estate value of land property and the rank of importance of these factors. *Electronic Journal of Map Technologies*, 5 (13) 1-16.
- Doğan Z, Arslan S, Berkman A. 2015. Türkiye’de tarım sektörünün iktisadi gelişimi ve sorunları: Tarihsel bir bakış. *Niğde Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 8(1), 29-41.
- Espitia A, Rocha N, Ruta M. 2020. Covid-19 and food protectionism: The impact of the pandemic and export restrictions on world food markets (May 19, 2020). *World Bank Policy Research Working Paper No. 9253*.
- Eştürk Ö, Ören MN. 2014. Türkiye’de tarım politikaları ve gıda güvenesi. *Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi*, 24(2), 193-200.
- Eştürk Ö, Albayrak N. 2018. Tarım ürünleri-gıda fiyat artışları ve enflasyon arasındaki ilişkinin incelenmesi. *Uluslararası İktisadi ve İdari İncelemeler Dergisi (UIİD-IJEAS)*, 18. EYİ Özel Sayısı, 147-158. <https://doi.org/10.18092/ulikidince.353991>
- FAO. *FAO Food Price Index*. <https://www.fao.org/worldfoodsituation/foodpricesindex/en/> [Accessed 4 August 2022]
- FAO. *FAOSTAT*. <https://www.fao.org/faostat/en/#data>
- FAO, IFAD, UNICEF, WFP & WHO. 2021. *The state of food security and nutrition in the world 2021. Transforming food systems for food security, improved nutrition and affordable healthy diets for all*. Rome, FAO. <https://doi.org/10.4060/cb4474en>
- Headey DD, Ruel MT. 2020. The COVID-19 nutrition crisis: What to expect and how to protect. In *COVID-19 and global food security*. eds. Johan Swinnen and John McDermott. Part Two: Diets and nutrition, Chapter 8, pp. 38-41. Washington, DC: International Food Policy Research Institute (IFPRI). [https://doi.org/10.2499/p15738coll2.133762\\_08](https://doi.org/10.2499/p15738coll2.133762_08)
- Gürbüz S, Şahin F. 2017. Sosyal bilimlerde araştırma yöntemleri: Felsefe-yöntem-analiz. 4. Baskı, Seçkin Yayınevi: Ankara.
- İstikbal D. 2022. Gıda fiyatları neden artıyor? <https://www.sabah.com.tr/yazarlar/perspektif/deniz-istikbal/2022/04/02/gida-fiyatlari-neden-artiyor>, [Accessed 28 May 2022]
- Kandemir O. 2011. Tarımsal destekleme politikalarının kırsal kalkınmaya etkisi, *Ekonomi Bilimleri Dergisi*, 3 (1), 103-113.
- Kıymaz T, Saçlı Y. 2008. Tarım ve gıda ürünleri fiyatlarında yaşanan sorunlar ve Öneriler. DPT, Yayın No: 2767, [https://www.sbb.gov.tr/wp-content/uploads/2018/11/Tarim\\_ve\\_Gida\\_Urunleri\\_Fiyatlari\\_nda\\_Yasanan\\_Sonunlar\\_ve\\_Oneriler.pdf](https://www.sbb.gov.tr/wp-content/uploads/2018/11/Tarim_ve_Gida_Urunleri_Fiyatlari_nda_Yasanan_Sonunlar_ve_Oneriler.pdf) [Accessed 30 May 2022]
- Kıymaz T, Şahinöz A. 2010. Dünya ve Türkiye-gıda güvenesi durumu. *Ekonomik Yaklaşım Dergisi*, 21(76): 1-30.
- Koç G, Uzmay A. 2015. Gıda güvenesi ve gıda güvenliği: Kavramsal çerçeve, gelişmeler ve Türkiye. *Tarım Ekonomisi Dergisi*, 21(1): 39-48.
- Lugo-Morin DR. 2020. Global food security in a pandemic: The case of the new coronavirus (COVID-19). *World*, 1(2), 171-190, <https://doi.org/10.3390/world1020013>
- Özdamar K. 1999. Paket programlar ile istatistiksel veri analizi, 2. Baskı, Kaan Kitabevi: Eskişehir.
- Paparella A. 2020. Food Safety: Definitions and Aspects. In: Al-Rub FA, Shibhab P, Al-Rub SA, Pittia P, Paparella A (editors), *Food Safety Hazards*, (Chapter 1, pp.1-4), Published by GAVIN eBooks, USA.
- Tokatlıoğlu M, Selen U, Leba R. 2018. Küreselleşme sürecinde tarımın stratejik önemi ve tarımsal arz güvenliğinin sağlanmasında devletin rolü. *Journal of Life Economics*, 5 (4), 151-176.
- Uysal, O, Veziroğlu, P. 2020. Overview of Turkish agriculture and future prospects in the COVID-19 pandemic, *Turkish Journal of Agriculture -Food Science and Technology*, 8(12): 2643-2650. <https://doi.org/10.24925/turjaf.v8i12.2643-2650.3849>
- Uzundumlu AS. 2012. Tarım sektörünün ülke ekonomisindeki yeri ve önemi. *Alinteri Journal of Agriculture Science*, 22(1), 34-44.
- UN 2020. Policy brief: The impact of COVID-19 on food security and nutrition (June 2020), <https://reliefweb.int/report/world/policy-brief-impact-covid-19-food-security-and-nutrition-june-2020> [Accessed 28 April 2022]
- Varlık N. 2021. Kırılgan Sekizli’de gıda fiyat balonlarının saptanması: Küresel kriz-Covid 19 pandemi dönemleri için karşılaştırma. Mehmet Akif Ersoy Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 8(2), 1123-1140.
- Zurayk R. 2020. Pandemic and food security: A view from the Global South. *Journal of Agriculture, Food Systems, and Community Development*, 9(3), 17-21. <https://doi.org/10.5304/jafscd.2020.093.014>