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# The impact of the COVID-19 pandemic on fish and food perception, consumption, and purchasing behaviors of Turkish consumers

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## ABSTRACT

The fact that the coronavirus was detected in the Wuhan fish market has affected attitudes toward food, especially fish. This survey questioned the opinions and behaviours during and after lock-downs to understand the temporary and permanent effects of the pandemic. Respondents were concerned about virus transmission from food, especially during lockdowns (58%), while less concerned about transmission from fish (22.9%). Although the majority (57.1%) think that eating fish protects against the virus, they (>60%) did not tend to consume more fish. Most respondents (49.6%) were concerned about food shortages and experienced food insecurity. Food consumption increased (58%) during lockdowns but decreased (29%) afterwards. Vegetables/fruits (51.4%), bakery (48.4%), grains/legumes (37.5%) consumption increased due to home cooking, and chicken preferred as animal protein. Although respondents preferred to buy online and packaged food, the majority (>60%) were concerned about the freshness of online-ordered fish and did not prefer it (>80%). Participants stocked food during the lockdowns (47.3%) but did not make it a habit afterwards. Respondents' answers showed that fish prices increased for budget during the pandemic. Findings will be helpful for the seafood sector and contribute to creating resilient and sustainable food environments that can better respond to future shocks that may affect humanity.

**Keywords:** Pandemic, Seafood, Food security, Attitudes, Fisheries

## Introduction

The first SARS-CoV-2 virus, coronavirus, was identified in China in December 2019. The coronavirus was initially detected in the seafood and animal market in Wuhan (Sağlık Bakanlığı, 2023). Then, the number of cases outside of China and the number of countries with cases increased rapidly, and the World Health Organization (WHO, 2023a) declared the novel coronavirus (COVID-19) pandemic on March 11, 2020. As of May 2020, the COVID-19 pandemic caused approximately 330,000 million people to be infected and 14,510 people to die worldwide (WHO, 2023b). In December 2020, the WHO announced that the governments should implement lockdown measures to isolate and quarantine all contacts (WHO, 2023c). Following this, countries started to implement these measures. On April 14, 2021, a partial lockdown was declared in Türkiye, restricting going out after 7 p.m. on weekdays and weekends (Ministry of Interior, 2021a). Then, a complete lockdown was declared from 29 April 2021 to 17 May 2021(Ministry of Interior, 2021b). After this date, the nighttime and weekend lockdowns were enforced, and as of July 1, 2021, the lockdowns were ended (Ministry of Interior, 2021c). Similar lockdowns and restrictions were imposed in most countries around the world.

The size of the pandemic, lockdowns, and quarantine have created psychosis and panic in the public. Worldwide health crises of this magnitude are rare and lead to many lasting global changes. Indeed, the Covid-19 pandemic has had a significant impact, causing economic, sociocultural, and behavioural changes (UN, 2020). The pandemic has affected individuals in terms of dietary habits, and people have realised that food security and availability are vital needs (Pulighe & Lupia, 2020). Movement restrictions, limited access to grocery stores, restaurant closures, disruption of the food supply chain, and stay-at-home announcements have affected consumers' food-related behaviours and led to changes such as stockpiling, panic buying, home cooking, and online shopping (Cranfield, 2020; Mandal et al., 2021). In a very recent study, Galanakis (2023) reported that the effects of the pandemic on food security continue today and emphasised that the pandemic will lead to food insecurity in the future due to limited food access, increased food costs, disrupted global trade, and deficiencies in food distribution. Therefore, more research is needed to create sustainable policies to ensure food security during such shocks that may occur in the future (Mandal et al., 2021).

As well as other foods, the fact that the coronavirus was first detected in the Wuhan fish market reveals the potential for people to be particularly concerned about fish consumption. Therefore, it is necessary to examine the impact of the pandemic on opinions and behaviours related to fish consumption. Akdemir et al. (2020) emphasised the importance of studies determining this pandemic's medium and long-term impact on fish and other food-related behaviours. The head of the UN World Health Organization (WHO) stated that even though the emergency regarding COVID-19 is over, the disease remains a global threat and reminded that the risk of new variants causing new cases and deaths continues (UN, 2023). Understanding communities' perceptions of food, access to food, and particularly micronutrient-dense food such as fish will enable governments to better respond to shocks that may affect humanity in the future (Love et al., 2021).

Considering these requirements, the current study aimed to determine the effects of the COVID-19 pandemic on (1) food safety and insecurity concerns, (2) fish and other food consumption preferences, and (3) fish and other food purchase patterns.

## Materials and Methods

### *Study Area*

The study was conducted in Istanbul, the most populated city in Türkiye. Istanbul, with a population of 15 907 951, constitutes 18.65% of Türkiye's population (Turkish Statistical Institute, 2022a) and is the province with the highest (98.7%) internet access rate (Turkish Statistical Institute, 2022b). Since Istanbul provides career and income opportunities, people from different social and cultural backgrounds live in this metropolitan.

### *Implementation of Surveys*

An electronic questionnaire was designed and applied to 10 people to test accuracy and comprehensibility. Ethical approval was obtained from the Istanbul University Ethics Committee (file number 2022/106). After the necessary arrangements, it was shared on Google's online survey platform and applied to 498 people between April and December 2022. The electronic survey form was sent to many people online via e-mail and social media applications. These people were invited to participate in the survey and were asked for the contact information of other people living in Istanbul. Thus, many people were reached through the snowball method, widely used for sample enrichment (Noy, 2008). Although internet access is high in Istanbul, 39 printed questionnaires were applied face-to-face to Istanbul University cleaning workers to collect data from people with low education and/or income levels who may not be reached via online forms. At the first step of the survey, people were informed

that they were free to decide to participate, to leave it at any time and that the survey results would be used for scientific publication. One (1) person disapproved, and only those who agreed could continue with the survey. Participants who agreed were asked whether they had any food science, dietetics, or nutrition education. The survey was terminated for 26 individuals replying to this question positively. In this way, it was ensured that the opinions of ordinary people who were not authorised in food-related fields were taken. Therefore, the questionnaire was completed by 510 people, excluding (1) who disapproved of participating in the survey and (26) who were educated in food, dietetics, or nutrition sciences. The sample size was determined according to Yamane (1967) formula. The population of Istanbul was used, the level of precision was chosen as 0.05, and the sample size was calculated as 399.98. The research sample of 537 is well above this number.

Participants were warned that only 1 person from each household should answer the form considering the COVID-19 pandemic conditions. Then, demographic questions were asked to determine the participant profile, and the socio-demographic characteristics were presented in Table 1. Income-related questions were asked in TL (Turkish Lira) and converted to US$ using the exchange rate (TCMB, 2023) at the time of the survey. The subsequent 13 questions focused on the impact of the COVID-19 pandemic on fish and other food consumption preferences, food safety and accessibility concerns, and food purchasing patterns. Since it was aimed to determine the temporary and permanent effects of the pandemic, these questions were asked about the opinions or behaviours during and after COVID-19 lockdowns. The questionnaire used a 3-point Likert scale as “Yes, No idea, No”. Apart from this, 2 other questions were asked about possible concerns about buying fish online: "If you order online, do you think the fish might spoil until it reaches you?" and "If you order online, do you think they send you stale fish?". These questions were asked as a general opinion independent of the lockdowns, and the answer options were “Yes, No idea, No”. It was also aimed to determine the impact of restaurant closures/restrictions and increased home cooking on food consumption during the pandemic. For this purpose, 6 leading food names, such as fish, bakery, red meat, poultry, vegetable-fruit, and grain-legume, were given. The last 2 questions were asked: "Are there any foods you consume less because you cannot go to restaurants / Are there any foods you consume more because you cook at home?" and multiple answers were allowed. Thus, 17 questions were asked of the participants apart from demographic questions.

**Table 1.** Socio-demographic characteristics of the study participants (n = 510)

| VARIABLES | Category | Number of respondents | Respondents in % |
|---|---|---|---|
| **Gender** | Male | 253 | 49.6 |
| | Female | 255 | 50.0 |
| | Not prefer to say | 2 | .4 |
| **Age** | <26 | 138 | 27.1 |
| | 26 - 40 | 210 | 41.2 |
| | >40 | 162 | 31.8 |
| **Education** | Primary education | 142 | 27.8 |
| | Secondary education | 156 | 30.6 |
| | Higher education | 212 | 41.6 |
| **Monthly income** | <341 $ | 102 | 20.0 |
| | 341 $ -682 $ | 219 | 42.9 |
| | 683 $ - 1365 $ | 146 | 28.6 |
| | >1365 $ | 43 | 8.4 |
| **Size of household** | 1 | 48 | 9.4 |
| | 2-4 | 343 | 67.3 |
| | 5-6 | 109 | 21.4 |
| | 7 + | 10 | 2.0 |
| **Working status** | Job loss | 63 | 12.4 |
| | No job loss | 447 | 87.6 |

### *Data Analysis*

The data analysis was conducted using SPSS 20 (Statistical Package for Social Sciences). Descriptive statistical analysis, including frequencies and percentages, was performed to summarise the socio-demographic characteristics of the respondents. Non-parametric analyses were employed due to the Likert-type measurement of the data.

The Non-Parametric Wilcoxon Signed Rank test for paired samples was employed to assess the presence of statistically significant differences in responses to fish and food-related questions during and after the lockdown periods. The questions can be found in Figure 1 and Figure 2. The analysis revealed a significant difference in all variables except for the question related to fish consumption ($p$-value < 0.05). Contrarily, for the question about fish consumption of 'eating more fish than before, during and after lockdowns, there was no statistically significant difference at the 0.05 confidence level ($p$-value > 0.05). Consequently, the findings indicate the absence of a statistically significant difference in fish consumption between the periods of lockdowns and post-lockdowns. After conducting the significance test, frequencies

and percentages were analysed to draw inferences about "*The impact of the Pandemic on food and fish consumption*," "*Tendency towards packaged food and online shopping due to virus concerns*," and "*Food insecurity*".

The demographic variables (gender, age, education, income) used in this study were measured with three or more categories. The Kruskal-Wallis test is a non-parametric test used to analyse the differences between means among three or more categorical groups of an independent variable. Therefore, the Kruskal-Wallis test was applied to examine the relationships between demographic variables and concerns about receiving spoiled or stale products when ordering fish online.

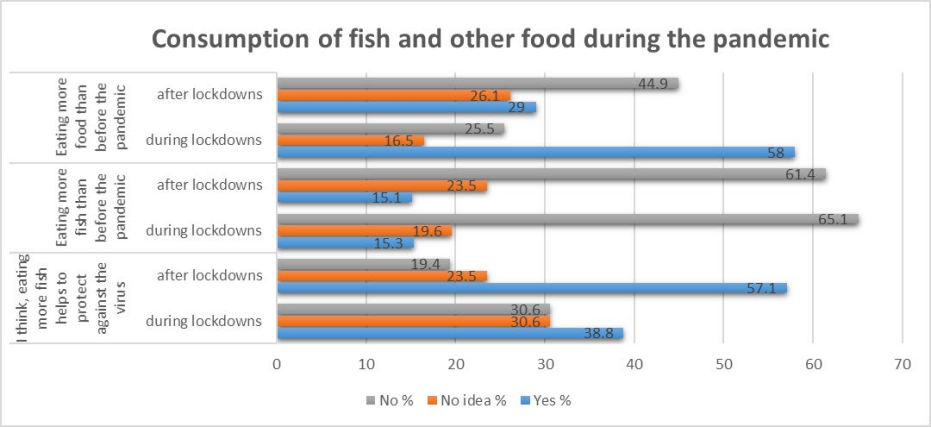


**Figure 1.** Consumption of fish and other food during the pandemic

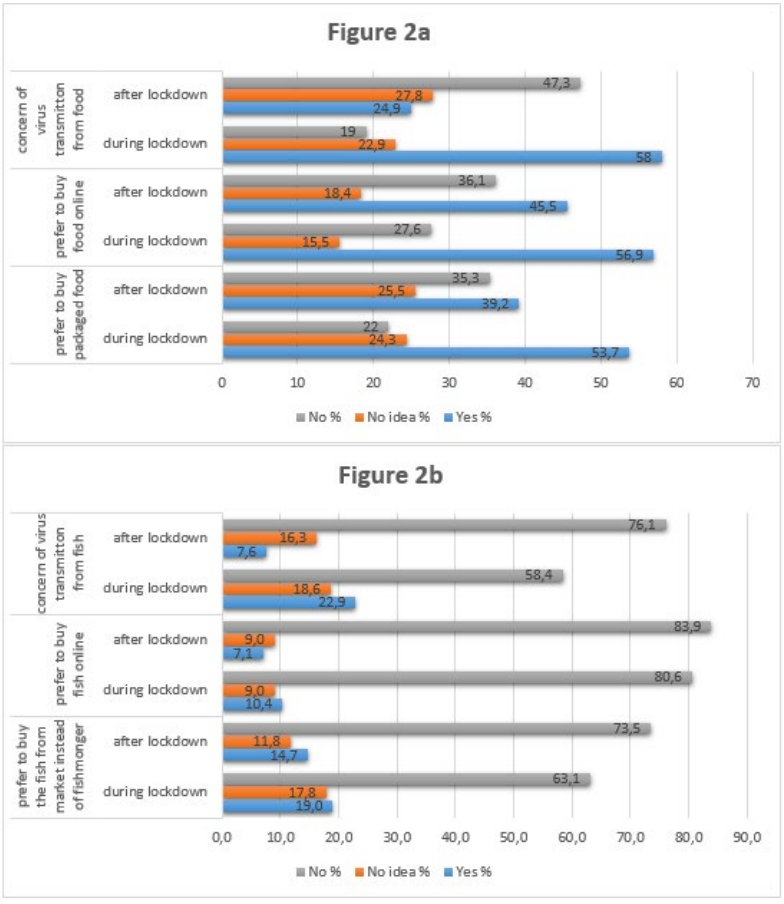


**Figure 2.** Virus-related concerns and change in purchasing preferences (a) Food, (b) fish

## Results and Discussion

### *The Effect of the Pandemic on Food and Fish Consumption*

Despite its unpleasant effects, the pandemic has raised global awareness to change the food system to be more environmentally friendly, inclusive, sustainable, and resistant (Ruiz-Salmón et al., 2021). The vulnerability of the global food system was exposed during the pandemic. Thus, the importance of creating food systems that will be more resilient to future pandemics or other shocks was recognised (O'meara et al., 2022). Increasing awareness and demand for food supply and safety worldwide will inevitably lead to lasting changes in the food sector (Güney et al., 2020). The lockdowns, restrictions, and social and psychological factors affected individuals' dietary habits (Caso et al., 2022). While some studies have shown an increase in the consumption of unhealthy or junk food (Sanchez-Sanchez et al., 2020; Cavagnari et al., 2022), others have reported a trend toward the consumption of healthy foods such as fish (Perez-Rodrigo et al., 2020). This study reveals a statistically significant difference in food consumption during and after the lockdowns ($p$-value < 0.05). Most respondents (58%) stated they consumed more food during the lockdowns than before (Figure 1). After the lockdowns, the proportion of this response was 29%, indicating that consuming too much food did not turn into a habit. However, the situation was different for fish consumption. There is no statistically significant difference in fish consumption during and after the lockdowns ($p$-value > 0.05). More than 60% of respondents (Figure 1) said they did not eat more fish during or after the lockdowns. Therefore, they have consistently stated that they have not increased fish consumption compared to before the pandemic. However, fish have been reported to be one of the antiviral functional foods to cope with coronavirus (Alkhatib, 2020), and increased fish intake is recommended for high-risk individuals. Pardo (2020) used nutritional support containing fish oil to cure critical patients infected with SARS-CoV-2. Likewise, Yu et al. (2021) identified tuna protein peptides as possible SARS-CoV-2 inhibitors. In our survey, the respondents stated that they think consuming fish could help to protect against the virus. The proportion of respondents who thought eating fish could protect against the virus (during lockdowns, 38.8%) increased even more after the lockdowns (57.1%). It can be said that the idea about the benefit of fish consumption increased in the later stages of the pandemic. However, this idea did not lead to an increase in fish consumption during the pandemic. The consumer tended to eat more fish in many countries, considering its health benefits. Portuguese consumers reported increased consumption of foods such as fish and vegetables and decreased consumption of ready foods and snacks, as they tend to buy healthier foods to protect themselves from coronavirus (Martins et al., 2022). Similarly, Palestinian students' fish consumption increased during the pandemic (Radwan et al., 2021). Revoredo-Giha & Russo (2020) studied the effect of the COVID-19 pandemic on British consumers and noted that the pandemic led to an increase in meat and fish purchases. In a survey conducted in Bangladesh, 72.8% of respondents reported consuming more fish during the pandemic due to its health benefits, and 95% also reported that they liked eating fish in general (Kashem et al., 2021). On the other hand, in a survey conducted in Türkiye, 66% of the participants stated that the pandemic did not change their fish consumption, similar to our findings (Haskaraca et al., 2021). Kartari et al. (2021) even reported a decreased fish consumption in Türkiye during the pandemic. This may be because fish consumption in Türkiye is relatively low, 6.7 kg per capita (Anon, 2021), compared to many other countries. Dietary habits may have played a role in participants not consuming more fish, although they thought eating fish would help protect against the virus's effects. The pandemic has also reduced fish consumption in Congo (Manyong et al., 2022) and ten countries in East and Southern Africa (Nchanji & Lutomia, 2021). Similarly, Di Renzo et al. (2020) reported decreased fish consumption in Italy. They stated that limited daily shopping may be a reason for the reduced demand for perishable fresh foods such as fish. This statement is supported by Belton et al. (2021) for seafood consumption in Africa and Asia.

A notable pandemic effect is the increased preference for eating at home (Filimonau et al., 2022). Consumers have started to cook at home kitchen more than ever. Galanakis (2023) noted that the closure of restaurants and the increased home cooking could lead to a lasting change in attitudes towards food. Likewise, Revoredo-Giha & Russo (2020) reported substituting restaurants and catering food services with at-home consumption during the pandemic and reported reduced intake of meat and fish due to the effects of the pandemic. In this study, participants were asked whether they reduced the consumption of some foods due to the closure of restaurants during the pandemic, and fish was found to be the most affected food. Most (58%) respondents reported decreased fish consumption since they could not eat it out (Figure 3). It has been reported that the closure of restaurants during the pandemic significantly impacted fish consumption (Love et al., 2021), and the fish sector has been negatively affected by the drastic decline in out-of-home food consumption (Pititto et al., 2021). In the present study, although ≥50% of respondents reported decreased consumption of bakery and red meat due to the closure of restaurants, they also reported that they started to cook bakery products at home more than ever. However, a few respondents (<20%) preferred to cook fish and red meat at home. Consumers preferred to cook

vegetable-fruit, bakery, and grain-legume at home during the pandemic and used chicken as animal protein (Figure 3). Similarly, Mandal et al. (2021) reported increased vegetable consumption in Bangladesh, and dried fish, poultry, lentils, and eggs have replaced fish consumption. It was reported that the Italian consumer consumed less fish but more homemade food, vegetables, and poultry during the pandemic (Di Renzo et al., 2020). The fact that some consumers do not prefer or find it difficult to cook fish at home may have led them to prefer easier (and often cheaper) alternatives to fish (Pititto et al., 2021).

As food intake is essential not only for individuals but also at the national and global levels (Martins et al., 2022), it is essential to identify the food-related impacts of the pandemic. Changes in food intake patterns can determine global food trade and many industries, such as agriculture, livestock, fisheries, and food processing.

### *Tendency to Packaged Food and Online Shopping Due to Virus Concerns*

It is globally known that the Covid-19 pandemic started in the Wuhan seafood market in China. The virus was isolated from fish cutting boards, and the fish trade was drastically reduced. Fish scientists had to defend against public concerns about fish consumption (Abbadi., 2020). Although scientific studies report that SARS-CoV-2 does not affect or contaminate seafood (Bondad-Reantaso et al., 2020), worldwide disinformation has led to consumer concern about the transmission of the virus through fish consumption (Genc et al., 2020). The fact that the COVID-19 pandemic was first detected in seafood and animal markets also created a perception against seafood in the minds of consumers, and consumers in some regions avoided fish and seafood consumption during the pandemic (Kartari et al., 2021).

In this study, there is a significant statistical difference between concerns about the transmission of the virus from food and seafood ($p$-value<0.05). This can be followed through Figure 2a and Figure 2b. It was found that the participants were concerned about virus transmission from food, mainly during lockdowns (58%) (Figure 2a), but a few were concerned about virus transmission from fish (Figure 2b). Indeed, the correlation between fish consumption and the worldwide incidence of COVID-19 (0.089573896) is very weak, and the assumption that COVID-19 is a zoonotic disease does not seem appropriate for fish (Abbadi, 2020). Bondad-Reantaso et al. (2020) stated that SARS-CoV-2 belongs to the Coronaviridae family, genus Betacoronavirus, and Betacoronaviruses are not known to infest nor infect seafood; instead, they infect mammals. They noted that fish surfaces, like any other surface, can be contaminated with SARS-CoV-2 when handled by infected individuals. Therefore, they emphasised that the likelihood of SARS-CoV-2 transmission is negligible with proper food handling and sanitation. Since SARS-CoV-2 can be isolated from frozen foods, storage, and packaging materials, it can remain highly stable on fish or meat under cold and frozen storage conditions. Therefore, policies and risk mitigation strategies must be established to prevent food contamination (Han et al., 2021).

In the present study, respondents (56.9% during and 45.5% after lockdowns) indicated that they preferred to buy food online (Figure 2a) and packaged (53.7% during, 39.2% after lockdowns). Consumers worldwide have experienced changes in their food supply during the COVID-19 pandemic due to restrictions and/or fear of contamination (Dumitras et al., 2021). The packed food become crucial due to the pandemic. The necessity of hygiene and the importance of packaging to preserve foods from contamination became priorities for the consumer. The consumer considered packaged foods safe because they were protected by a package that guaranteed product hygiene. A study with Turkish consumers reported that packaged foods were primarily preferred (79.3%) during the Covid-19 pandemic (Cosansu et al., 2022). Following the COVID-19 pandemic, 34% of consumers stated that hygienic packaging is one of the main criteria when purchasing food (Timpanaro & Cascone, 2022). One of the essential food-related impacts of the Covid-19 pandemic is the consumer's tendency to buy food online. Food orders have shifted online in many countries, depending on the countries' digital development level. In Qatar and the United Arab Emirates, online food shopping increased by 30% compared to before the COVID-19 pandemic (Faour-Klingbeil et al., 2021). Due to the pandemic, Italian consumers have also increased online food shopping (Cavallo et al., 2020). Güney et al. (2020) reported that Turkish consumers are concerned about virus transmission during shopping in the market and tend to buy food online. Regarding buying fish, it was determined that the respondents did not prefer to buy fish online or from the market and continued to buy fish from the fishmonger (Figure 2b). Especially in terms of online shopping, the majority of the participants (>80%) stated that they do not prefer to buy fish online.

Figure 4 shows the responses to the questions about the possible effects of freshness concerns on online fish shopping. The effect of freshness concerns on the consumer's approach to online fish shopping is presented in Figure 4. It is determined that 62.16% of the participants are concerned that the fish ordered online may spoil until it arrives, and 71.18% are concerned that stale fish will be sent when ordered online. Concern about freshness is an important reason to avoid ordering fish online. Similarly, a study examining the impact

of the pandemic on meat consumption in Türkiye reported that respondents were concerned about spoilage when ordering online (Haskaraca et al., 2021).

The effect of demographic variables (gender, age, education, income) on concerns related to online fish orders has been examined using the non-parametric Kruskal-Wallis test. The obtained results are summarised in Table 2. There is a statistically significant difference in age, education and income ($p$-value <0.05) for fish spoilage until it arrives in online shopping. Regarding concerns about being sent stale fish in online shopping, there is a significant difference only in terms of education ($p$-value < 0.05). There is no significant difference in other variables such as gender, age, and income ($p$-value > 0.05). For online fish ordering, the concern that the fish might spoil until it arrives is lower among the younger age, higher education, and higher income groups. Similarly, highly educated respondents are the least concerned about sending stale fish when they order fish online (Table 2). Examining the "mean rank" column in Table 2 can also interpret these results. It has also been reported that education level is an influential factor in consumer attitude towards food during the pandemic (Rodríguez-Pérez et al., 2020). It has been observed that gender does not create a statistically significant difference for both concerns.

***Food Insecurity***

Lack of regular access to safe and nutritious food for a healthy life is referred to as food insecurity. It may be experienced at different levels, such as the lack of regular access to sufficient and safe food and/or lack of resources to obtain food FAO (2023). COVID-19 has threatened food insecurity by restricting access to and availability, leading to instability in food prices and a shift to less nutritious foods (Laborde et al., 2020). The COVID-19 outbreak has caused millions to experience food insecurity in Congo and has threatened the country's progress toward Sustainable Development Goal 2 (SDG2) (Manyong et al., 2022). The pandemic has more impact than a worldwide disease, including socioeconomic and food security, and its effects on food security are not yet apparent (Elsahoryi et al., 2020). In this study, 49.6% of the respondents declared they were concerned about food shortage during the lockdowns (Figure 5), which shows that they experienced food insecurity. Ahmed et al. (2021) similarly reported food insecurity among households in Bangladesh during the Covid-19 pandemic. In Jordan, around 60% of the population was reported to have experienced moderate or severe food insecurity during the pandemic (Elsahoryi et al., 2020). Food-insecure households have been much more affected by the COVID-19 pandemic due to their lack of access to healthy food (Kent et al., 2022). The pandemic has made everyone realise the undeniable importance of food security and nutrition (Galanakis, 2023). The need for large-scale sustainability policies to ensure food and nutrition security is recognised (Mandal et al., 2021).

**Table 2.** Kruskal Wallis Test Results for Socio-demographic variables (n= 510)

| | | If I order online, I think the fish may spoil until it arrives | | | if I order online, I think they will send stale fish | | |
|---|---|---|---|---|---|---|---|
| **VARIABLES** | **Category** | **Mean Rank** | **Chi-Square** | **p-value** | **Mean Rank** | **Chi-Square** | **p-value** |
| **Gender** | Male | 263.34 | 2.145 | .342 | 257.86 | .399 | .819 |
| | Female | 248.13 | | | 253.46 | | |
| | Not prefer to say | 203.75 | | | 216.75 | | |
| **Age** | <26 | 225.58 | 10.536 | .005 | 235.44 | 5.620 | .060 |
| | 26 - 40 | 265.01 | | | 261.43 | | |
| | >40 | 268.65 | | | 264.90 | | |
| **Education** | Primary education | 312.13 | 64.139 | .000 | 293.24 | 25.585 | .000 |
| | Secondary education | 272.43 | | | 257.17 | | |
| | Higher education | 205.11 | | | 228.99 | | |
| **Monthly income** | <341 $ - | 254.58 | 7.871 | .049 | 267.49 | 4.503 | .212 |
| | 341 $ - 682 $ | 259.55 | | | 253.98 | | |
| | 683 $ - 1365 $ | 265.00 | | | 258.93 | | |
| | >1365 $ | 204.79 | | | 223.15 | | |

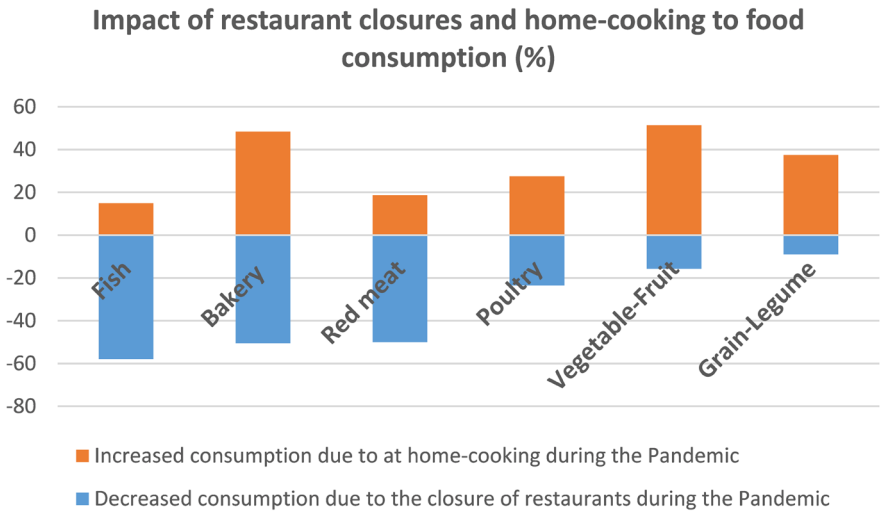


**Figure 3.** Impact of restaurant closures and home-cooking to food consumption (%)

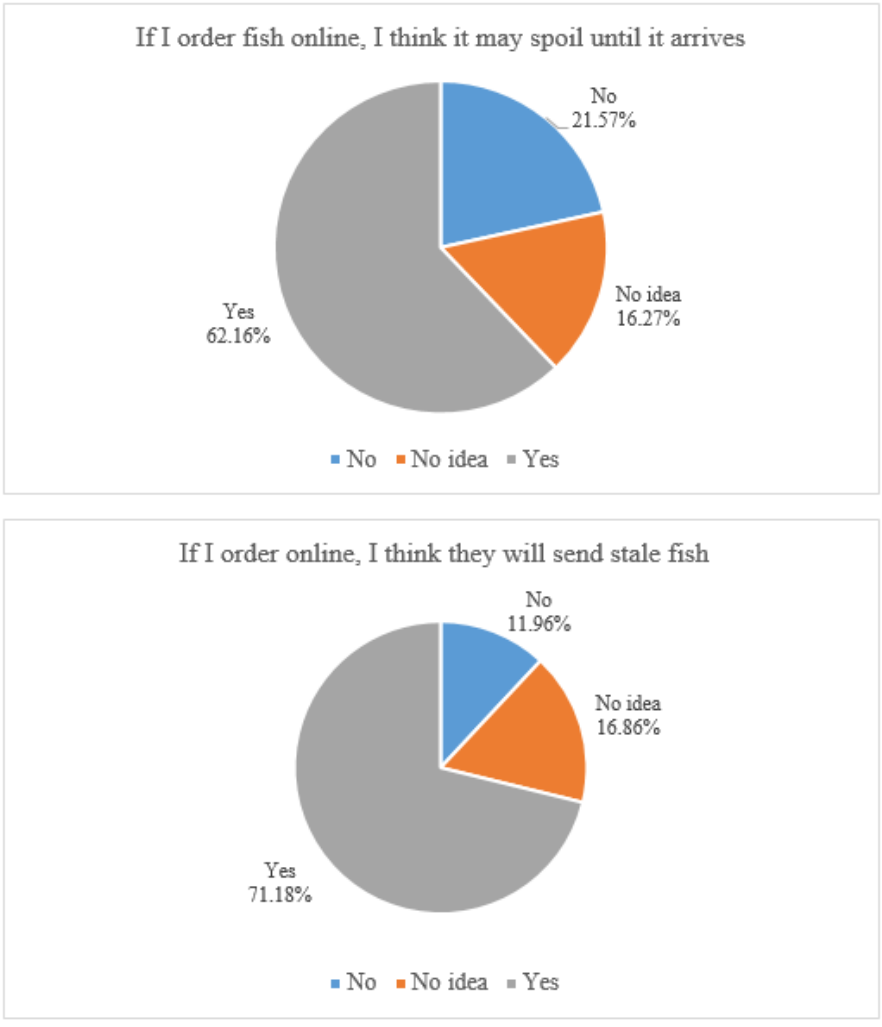


**Figure 4.** The possible effects of freshness concerns on online fish shopping

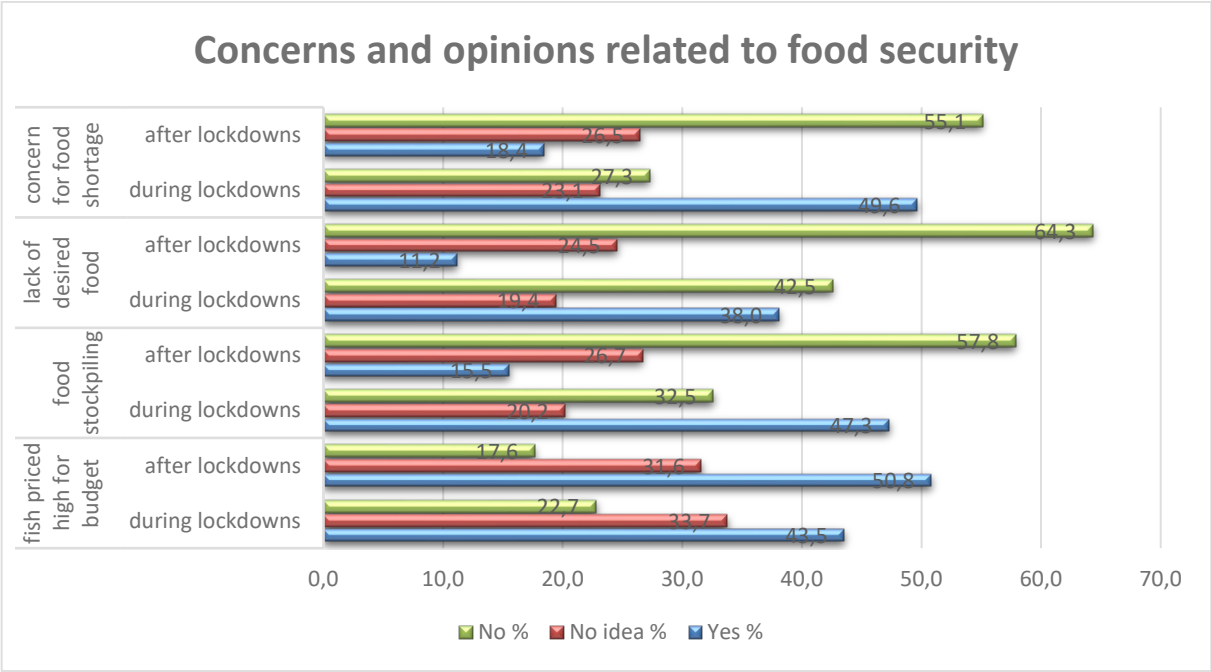


**Figure 5.** Concerns and opinions related to food security

Changed conditions during the pandemic led to concerns about food supply, and many people realised that food availability is the primary need (Güney et al., 2020). As presented in Figure 5, although some respondents (38%) experienced a lack of desired food during the lockdowns, most (64.3%) reported no problems during the following period. In a similar study conducted in Indonesia, participants reported that some foods, such as fish, were unavailable as before during the pandemic (Partelow et al., 2023). Zhang et al. (2021) examined the impacts of the COVID-19 outbreak on the seafood trade in China, which has a critical position and influence in the seafood trade. They suggested improving domestic regulations and increasing international cooperation to minimise the impact of such crises and ensure food supply. This crisis has revealed the necessity of establishing a more sustainable food system in the coming years (Cavallo et al., 2020).

Revoredo-Giha & Russo (2020) stated that the COVID-19 pandemic caused an unprecedented shock to British consumers, especially for meat and fish chains. They stated that the pandemic led to fears of future shortages and a tendency to stockpile. Respondents of this survey stated that they tended to stock food (47.3%) during the lockdowns but did not continue to do so (57.8%). It shows that food stockpiling has not become a habit (Figure 5). Akdemir et al. (2020) also reported that Turkish consumers' food stocking increased after the Covid-19 pandemic. Ahmed et al. (2021) examined the effects of the pandemic on food insecurity in Bangladesh and reported that households rely on food stocks to cope with the food crisis. Indeed, half of the Bangladeshi households stockpiled long-lasting foods such as rice, lentils, and potatoes during the pandemic (Mandal et al., 2021). On the other hand, in a survey conducted in Russia, more than 70% of respondents stated that they bought more than usual each shopping but did not stock food (Hassen et al., 2021).

The increased food prices have been one of the other important issues of the pandemic. The decrease in export volumes has affected the fish supply chain, making it more challenging to access fish and increasing prices (Mandal et al., 2021). In this study, 43.5% of respondents reported that fish prices were high for their budget during the lockdowns. The number of respondents reporting high fish prices (50.8%) increased further in the later stages of the pandemic (Figure 5). In a survey conducted in Bangladesh, 72% of respondents stated that the pandemic had increased fish prices, similar to the present study. The Covid-19 pandemic led to a 5.3% drop in global trade volume (WTO, 2023). Love et al. (2021) studied the impacts of COVID-19 on the seafood trade to build resilience in the seafood system and proposed immediate and long-term research to guide strategic investments**.** Actions such as the supply of ready-to-cook or processed seafood, online fish delivery, and implementation of adequate cold storage in fish production areas are the policies that governments should pay more attention to in the case of future pandemics (Mitra et al., 2022). The COVID-19 pandemic has revealed the importance of technologies enabling the food industry to prepare for future epidemics and pandemics by ensuring food safety and a safe supply chain (Han et al., 2021).

Nchanji & Lutomia (2021) emphasised that the pandemic offers essential lessons in restructuring food supply systems for sustainability in the future and proposed short food supply chains, inclusive legal support instruments, and economic partnerships among countries as policy interventions for sustainable production and consumption. It should be a critical priority for governments and all stakeholders to understand the experiences of communities with food insecurity during the COVID-19 pandemic and to develop tailored policies to respond to future shocks that may affect population nutrition (Zorbas et al., 2023).

## *Conclusion*

The COVID-19 pandemic has highlighted the importance of systems and technologies that will enable the food industry to prepare for future shocks. This study reveals behavioural changes and opinions on fish and food consumption during the Covid-19 pandemic. It provides a perspective on the changes the pandemic may cause in future consumption patterns and purchasing behaviours (Figure 6). Since the coronavirus was first detected in the Wuhan fish market, it may raise concerns about fish consumption in various communities. For this reason, it is essential to examine the effect of the pandemic on opinions and behaviours related to fish consumption and other foods. During the pandemic, Turkish consumers increased their food consumption, tended to packaged and stocked food, and were concerned about food shortage and potential virus contamination from food. Although they think that eating more fish may help protect against the virus and they are not worried that the virus will be transmitted from the fish, they did not tend to consume more fish and stated that the fish prices are high for their budget. Although they increased online food shopping, they did not prefer online fish shopping for freshness concerns. Our findings are helpful for the local and international fish trade. They will provide information for fish producers, fishermen, suppliers, processors, and retailers to create healthy, sustainable food environments more resilient to future shocks.

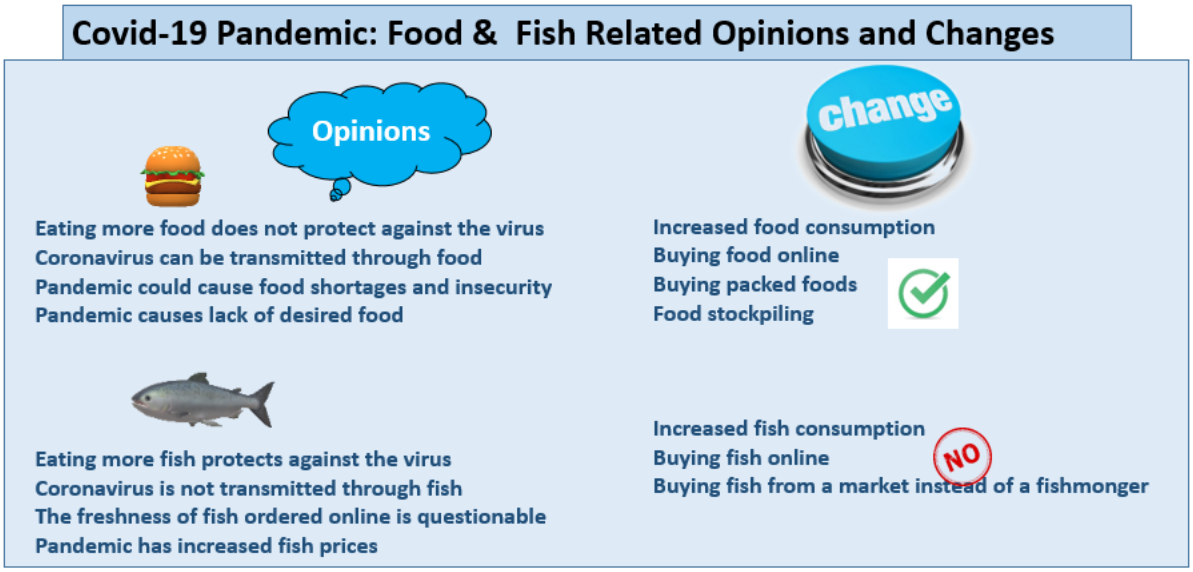


**Figure 6.** Behavioral changes and opinions on fish and food consumption due to the COVID-19 Pandemic

**Compliance with Ethical Standards**

**Conflict of interest:** The authors declare no actual, potential, or perceived conflict of interest for this article.

**Ethics committee approval:** The survey titled "The Effect of Covid-19 Pandemic on the Consumption of Seafood and Other Foods" with file number 2022/106 was discussed at the Istanbul University Social and Human Sciences Research Ethics Committee meeting dated 30.05.2022 and numbered 06 and found ethically appropriate. Verification code: BSRSPLA6E3 Pin code: 25652 Document tracking address: https://www.turkiye.gov.tr/istanbul-universitesi-ebys Approval no: E-35980450-663.05-952818

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