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Consumers' Perception of Food Safety Risks After the COVID-19 Pandemic: A Study on Türkiye

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ABSTRACT

The COVID-19 pandemic has notably reshaped consumer perceptions of food safety, with lasting effects on food purchasing and consumption behaviors. This study examines Turkish consumers' perceptions of food safety risks during and after the pandemic, aiming to contribute to both national and international literature on the topic. A cross-sectional survey was conducted between April and July 2023 in seven major Turkish cities (Istanbul, Ankara, Izmir, Trabzon, Adana, Van, and Gaziantep), with 1,016 respondents participating. The survey explored various socio-demographic factors influencing food safety risk perception using an ordered probit model. The results reveal that 86% of respondents consider food produced and sold in Türkiye risky, with 20.4% rating it as critically unsafe. Key factors influencing risk perception include concerns about open market sales, food additives, food labeling accuracy, and vendor hygiene practices. Additionally, socio-demographic characteristics such as marital status, age, education level, and household size significantly impact risk perception. Married individuals, older adults, and those with higher education levels tend to have heightened food safety concerns. These findings highlight the importance of targeted food safety education and policies that address diverse consumer profiles. The study provides insights for enhancing food safety strategies and fostering consumer confidence, especially during and after health crises.

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Introduction

SARS-CoV-2, which was detected spreading in Wuhan, Hubei Province, China, at the end of 2019, soon became a global public health threat under the name COVID-19. The virus, which spreads rapidly through person-to-person contact and contact with contaminated surfaces or objects, led to measures such as the closure of public spaces, including food and beverage establishments, and the imposition of curfews worldwide (Ceniti et al., 2021; Olaimat et al., 2020). The COVID-19 pandemic is considered one of the largest global health crises of the 21st century. The pandemic has deeply affected not only health systems but also economic and social structures, particularly consumption behaviors (Maqbool and Sheth, 2020; Loayza and Pennings, 2020; Górnicka et al., 2020).

COVID-19 Pandemic and the Food Sector

The acceptance that the COVID-19 pandemic emerged among workers in the Wuhan seafood and wild animal market, where various mammals were sold live or for immediate consumption, has become a concern for both consumers and producers. While genetic studies agree that SARS-CoV-2 has a zoonotic origin, there is no evidence linking food contact or consumption to COVID-19. However, the impact and role of food safety and public health in controlling pathogen spread reveals the close relationship of the pandemic with food consumption (Thomas et al., 2021; Ceniti et al., 2021). The COVID-19 pandemic has impacted the global food system in many ways. These impacts include food reliability, food safety, contamination of food and food-contact materials, hygiene and sanitation procedures, resilience and sustainability, the closure of food establishments, changes in food consumption habits, and consumer behaviors (Gunduz and Cengiz, 2022).

An individual can contract COVID-19 by being exposed to a contaminated droplet on a surface or object

and touching their face. In this scenario, the handling or consumption of contaminated food products may carry the same risk as contact with a surface or object. While concerns about potential transmission via the food chain have increased during the pandemic, SARS-CoV-2 cannot be considered a foodborne virus, as there is no continuous link between food consumption and the disease. However, it is clear that the virus remains active and stable under refrigerated and frozen conditions in many types of food. Specifically, frozen foods have been identified as one of the main sources of the resurgence of COVID-19 in cities in China. Additionally, it has been confirmed that the virus is stable on many surfaces and materials commonly used in food packaging (Ceniti et al., 2021). In addition to killing millions of people, the virus has significantly impacted society by disrupting health systems, toppling the global economy, affecting food and agriculture, and leading to long-term geopolitical developments (Maqbool et al., 2024).

Food safety has emerged as one of the areas most affected by the COVID-19 pandemic, and the pandemic has had significant impacts on this area worldwide (Gossling, 2020). Guidelines published by health authorities during the pandemic have made it mandatory to implement various measures regarding food safety. While the World Health Organization (WHO) has stated that COVID-19 is not transmitted through food, it has emphasized the need to tighten hygiene standards and food processing procedures (WHO, 2020).

COVID-19 Pandemic and Consumer Preferences

The COVID-19 pandemic has increased consumers' concerns about food safety and made them more sensitive regarding their food choices, leading to a higher demand for healthy and reliable food (Olaimat et al., 2020; Bouranta and Psomas, 2024). Uncertainties about how COVID-19 spreads and how long the virus can survive on surfaces have led to concerns about food safety among consumers. These concerns have affected trust in food production and distribution processes, resulting in significant changes in consumers' food shopping habits and consumption preferences (Ceniti et al., 2021). During and after the COVID-19 pandemic, the virus became the focal point for consumers and the source of their fears. Due to consumers' increased sensitivity towards food production and consumption, food safety, which is one of the key factors determining the demand for food products, has gained even more importance during and after the COVID-19 pandemic (Mikailsoy, 2022). While the risk of foodborne transmission of COVID-19 is negligible, the pandemic has had a significant impact on the food industry and influenced the industry's food safety practices (Trmčić et al., 2021).

The rising demand for hygiene and safety of food products has forced the food industry to take action on labeling practices, packaging methods, and cleanliness standards (Jabbar and Rahman, 2021). After the pandemic, people around the world have started to search for suitable food products for healthy eating. People have tended to consume more reliable products from trustworthy companies, and natural sources. After the COVID-19 pandemic, consumers' perceptions of food safety risks have changed both nationally and internationally. Surfaces for food preparation, packaging materials, countertops, conveyor belts, interior surfaces of transportation vehicles, and all other areas where human contact with food is possible have become areas where food processors must pay attention to prevent the spread of COVID-19 (Olaimat et al., 2020). At the beginning of the pandemic, concerns about the potential for food products to carry the virus triggered a review of food safety policies and practices (Nicola et al., 2020). These changes have impacted not only food safety standards but also consumer behavior. Specifically, compliance with hygiene rules and increased awareness about food safety have emerged as efforts to strengthen consumers' sense of security (Hobbs, 2020).

COVID-19 Pandemic and Türkiye

In addition to the challenges faced by Türkiye's health system during the pandemic, the country has also encountered significant challenges in food safety and economic stability. Various strategies have been developed in Türkiye to ensure the continuity of the food supply chain. Measures such as implementing social distancing practices, the use of personal protective equipment, and tightening hygiene protocols have been adopted in food businesses, ensuring food safety (Küçük, 2021). Additionally, various public service announcements and educational campaigns have been organized to inform consumers about food safety during the pandemic. These regulations in the field of food safety have been crucial in protecting public health and minimizing foodborne risks during the pandemic. The long-term effects of the pandemic on food safety in Türkiye have had implications for producers and consumers. Disruptions in the supply chain during the pandemic have led to increases in food prices and difficulties in obtaining certain products (Yılmaz and Çetinkaya, 2022). Furthermore, investments in digitalization and technology have increased to cope with the effects of COVID-19. Food producers in Türkiye have begun adopting automation and digital monitoring systems to overcome the challenges brought by the pandemic. The impact of COVID-19 on Turkish consumers' perceptions of food safety risks has been addressed in only a limited number of studies (Gül and Çelik, 2021). There is a need for further information on how regional differences, socio-economic factors, and cultural influences shape these perceptions.

This study aims to contribute to both national and international literature by focusing on consumers' perceptions of food safety risks during the COVID-19 pandemic in Türkiye and aims to deepen knowledge in this field. Understanding the impact of the pandemic on food safety is important not only for evaluating the current situation but also for developing more effective strategies against similar crises in the future.

Materials and Methods

Material

Within the scope of the research, a face-to-face cross-sectional survey was designed to measure the food safety risk situation caused by the Covid-19 pandemic on consumers and to identify the factors causing it. The survey was conducted between April and July 2023 in the largest cities of seven regions in Türkiye (Istanbul, Ankara, Izmir,

Trabzon, Adana, Van, and Gaziantep). The sample size for each city was determined based on its proportion in the total population. The survey was conducted with 1,016 individuals by a commercial research company (Ayna Market Research Inc.). The final sample size was determined using an infinite population and a 95% confidence level (p = 0.05).

The survey contains three groups of questions related to the dependent and independent variables, for use in regression analysis of the research data. The first group includes the dependent variable "Individuals' perceptions of food safety risks after COVID-19. The second group includes a scale measuring individuals' general attitudes towards food safety. Finally, questions related to the socio-demographic characteristics of the survey participants are included. All questions were designed using a Likert scale to measure responses in an ordered manner. This enabled calculating the impact of independent variables on the food safety risk perception levels, thus achieving the research objectives.

Method

The relationship between the factors influencing consumers' perceptions of food safety risks after COVID-19 and their food purchasing and consumption behaviors was identified using an ordered probit model. The choice of the model is based on the ranking of the survey questions (both dependent and independent variables) from low to high using a Likert scale. Instead of logistic distribution-derived odds ratios, probit analysis converts event probabilities into cumulative standard normal distribution scores (Harrell, 2015).

Generally, the ordered probit model can be determined from an unobserved latent variable (y_i^*)

$$y_i^* = x_i'\beta + \varepsilon_i \quad (1)$$

Here, i donates the consumers $i = 1,2,\ldots,N$, x_i is the vector of independent explanatory variables, β is the vector of unknown slope parameters, and ε_i is the unobserved individual error term with a standard logistic distribution. In short, in the ordered probit model, the dependent variable (i.e., individuals' frequency of consumption) is classified based on the values the unobserved latent variable (y_i^*) takes within certain threshold intervals τ_k

$$\begin{aligned} &= 0 \text{ if } y* \leq 0 \quad (2)\\ &= 1 \text{ if } 0 < y* \leq \mu 1\\ &= 2 \text{ if } \mu 1 < y* \leq \mu 2\\ &.\\ &.\\ &.\\ &= J \text{ if } \mu J-1 \leq y*, \end{aligned}$$

Where μ 's are unknown parameters to be estimated with β (Greene, 2012).

For empirical analysis, descriptive statistics for data analysis were performed using SPSS 21, and the ordered probit regression model was constructed using the STATA program.

Results and Discussion

The socio-demographic characteristics of the 1,016 individuals who participated in the face-to-face survey conducted as part of the study are shown in Table 1.

The percentage values regarding consumers' perceptions of the risks posed to human health by the hygiene conditions of food sold in Türkiye and the residues, hormones, additives, preservatives, etc., contained in them are shown in Table 2.

When Table 2 is examined, it is evident that consumers have a high perception of food safety risks after COVID-19. 86% of the individuals who participated in the survey, indicated that foods produced and sold in Türkiye are risky in terms of safety. 20.4% of the individuals surveyed found food to be critically risky in terms of safety. On the other hand, only 3.1% expressed that there is a risk-free environment in terms of food safety.

A scale covering the general structure of food safety was created within the scope of the study, and individuals were asked to evaluate the questions on this scale to determine their attitudes on the subject. Descriptive statistics regarding attitudes towards food safety after the COVID-19 process are shown in Table 3.

Table 1. Socio-demographic characteristics of the sample

	f	%
Gender		
Female	457	45
Male	559	55
Age		
15–24	247	24.3
25–34	334	32.9
35–44	213	21
45–54	139	13.7
55–65	68	6.7
≥65	15	1.5
Household size		
1	87	8.6
2	141	13.9
3	271	26.7
4	252	24.8
≥5	265	26.1
	f	%
Income		
No permanent income	258	25.4
<5500	177	17.4
5501–7500	248	24.4
7501–9000	153	15.1
9001–11500	95	9.4
>11501	85	8.4
Education		
Uneducated	15	1.5
Primary	232	22.8
High School	263	25.9
University	449	44.2
Graduate level	57	5.6
Marital Status		
Single	501	49.3
Married	515	50.6

Table 2. Consumers' Post-COVID-19 Food Safety Risk Assessment

Risk-free	Slightly risky	Risky	Very risky	Vitally risky
%3.1	%10.2	%37.5	%28.7	%20.4

Table 3. Evaluation of Attitudes Towards Food Safety After COVID-19.

Variable	Mean	SD
Food sold in open areas is risky for food safety.	4.28	.911
I think more attention should be paid to the production and expiration dates of food.	4.24	.931
My concerns regarding the additives in food have increased.	4.02	1.076
Food products should be purchased from more well-known brands.	3.98	1.041
My concerns regarding food safety and quality standards have increased.	4.15	.919
I prefer to buy food products in glass packaging.	3.89	1.076
I pay more attention to whether the places where I buy food adhere to hygiene rules.	4.36	.795
I believe that all fresh agricultural and food products should be sold packaged.	4.02	1.024
I have concerns about the accuracy of the information on food product labels.	3.75	1.056
I have concerns about the hygiene of food producers and/or sellers.	3.99	.936
I am more careful about storing food products.	4.13	.861
I am more careful about the hygienic handling of the food products I bring home.	4.30	.868

1: Strongly Disagree; 5: Strongly Agree; SD: Standard deviation

Table 4. Results of the Ordered Probit Regression Model

Variable	Coeff.	Std. Error	P > |z|	[95% Conf.	Interval]
Food sold in open areas	.17641	.04516	0.000***	.08790	.26493
Production and expiration dates	-.01925	.05660	0.734	-.13019	.09168
Use of additives	.17609	.051655	0.001***	.27733	.07484
Well-known food brands	0.00385	.04724	0.935	-.08873	.09644
Food safety and quality standards	.24626	.05673	0.000***	.13506	.35746
Use of glass packaging	-.02823	.03878	0.467	-.10425	.04778
Food selling locations	-.06125	.06691	0.360	-.19239	.06989
Packaged products	-.02601	.03784	0.492	-.10017	.04815
Label safety	.15554	.03729	0.000***	.08245	.22863
Seller hygiene	.12417	.04322	0.004***	.03944	.20889
Storage conditions	.07277	.052423	0.165	-.02995	.17554
Sanitation of food purchased from outside	.04978	.050750	0.327	-.04968	.14925
Cut1	-.135666	.274532		-.67333	.40200
Cut 2	.66558	.27018		.13602	1.1951
Cut 3	1.8854	.27342		1.3499	2.4217
Cut 4	2.76388	.27229		2.2124	3.3083

* $p < 0.01$, ** $p < 0.05$, *** $p < 0.010\%$; LR $\chi2$ (27) = 208.37; Prob > $\chi2$ = 0.0000

Individuals have assigned high average values to all the attitudes related to food safety listed in Table 3. Therefore, the high-risk perception regarding food product safety seen in Table 2 is also reflected here. The attitudes that individuals rated the highest on average were "being more attentive to whether the places where food is purchased comply with hygiene rules," "being more careful about the hygiene, disinfection, and expiration dates of food products brought home," and "agreeing that food sold in open areas is risky in terms of food safety."

These findings show that individuals' concerns about food safety focus not only on individual hygiene and disinfection standards but also on the safety of the places where food is purchased and the environments in which they are sold.

The high-risk perception and cautious attitudes toward food safety reflect individuals' general understanding of health and safety. This sensitivity emphasizes the need for the continuous review and improvement of hygiene standards for food sources and environments. Concerns about food sold in open areas point to the necessity for stricter regulations and inspections for such products.

The results of the regression model created to examine the attitudes that influence individuals' risk perceptions regarding the safety of food sold post-COVID-19 are shown in Table 4. In the constructed model, the food safety risk evaluation results during the COVID-19 pandemic, shown in Table 2, are considered the dependent variable, and the attitudes presented in Table 3 are regarded as independent variables. Thus, it has been revealed which of the attitudes listed in Table 3 increase the likelihood of risk perception. The results of the designed regression model are presented in Table 4.

Table 4 shows the results of the ordered probit regression model, which reveals significant relationships between individuals' food safety attitudes and risk perception. Accordingly, concerns such as the sale of food in open markets exposure of food to additives and issues related to adherence to quality standards increase food safety risk perception. Additionally, concerns about the "accuracy of the information on food labels" and "hygiene practices of food vendors" increase the likelihood of higher food safety risk perception.

The ordered probit regression results obtained in this study detail how food safety perceptions are influenced by various factors. The ordered regression analysis presented in Table 4 shows that the sale of food in open markets significantly increases individuals' food safety risk perception. These findings highlight how food safety risk perception is shaped by various environmental and product-related factors, both directly and indirectly. Bellia et al. (2022) explore the scientific interactions and connections between street food sales and food safety. They suggest that street food is associated with various health hazards that is attracting increasing consumer attention. Their studies indicate that open-market food sales generally fail to meet hygiene standards, which exacerbates food safety risks. Sezgin and Şanlıer (2016) identify that the most criticized aspects of street food are the contamination risks of the places where food is produced and sold, as well as the inadequate hygiene practices, attitudes, and procedures followed by vendors during food preparation and storage.

According to the results of the study, concerns about artificial additives used in food production increase individuals' food safety risk perception. Research by Bearth et al. (2014) shows that most Swiss consumers approach the use of food additives, particularly artificial ones, with skepticism. Consumers' perceptions of risks from additives can be more influential on product acceptance than the perceived personal benefits of the product. Zhong et al. (2018) found that Chinese consumers change their purchasing behavior based on concerns about food safety, and they tend to be more sensitive to negative information about additives than positive information. The study concluded that consumers who are more satisfied with food safety are less willing to accept additives than those who are dissatisfied. Shim et al. (2011) also found in their study of 430 consumers in Seoul, Korea, that participants were highly concerned about preservatives, colorants, and artificial sweeteners in foods.

The findings of the study show that concerns about the accuracy of information on food labels and issues regarding the labeling of food products increase food safety risk perception. Additionally, there is a positive relationship between concerns about vendor hygiene and consumers' food safety risk perception, with the likelihood of food safety risk increasing as concerns about vendor hygiene rise. Nkosi and Tabit (2021) studied the food safety knowledge of street food vendors, and the hygienic conditions of their selling environments in the Zululand Region of South Africa. They found that in areas with a high volume of street food sales, there is a food safety risk for consumers and the general public. This risk is primarily due to vendors' insufficient food safety knowledge, inadequate street food sales infrastructure, and inadequate monitoring and control by authorities. Desye et al. (2023) emphasized the importance of understanding street food vendors' knowledge, attitudes, and practices to ensure food safety, particularly in low- and middle-income countries where urbanization and street food popularity are increasing. Their study shows that there is a significant gap in food safety knowledge, attitudes, and practices among street food vendors in these countries. According to Isanovic et al. (2023), consumer distrust in food vendors has increased due to intentional adulteration, unsafe sales practices, and new methods used for food production. Batu et al. (2024) found that due to increased concerns about food hygiene since the onset of the pandemic, 77.3% of participants reduced their frequency of eating out, 71.6% decreased their frequency of ordering takeout, and 83.8% reported paying more attention to food hygiene since the beginning of the pandemic. Additionally, participants correctly answered over 90% of questions about hand hygiene, safe physical distancing, and the rules to be followed during food shopping.

Finally, the results of the study indicate that increased concerns about food quality standards also elevate food safety risk perceptions.

All the findings emphasize that food safety risk perception is influenced by multiple factors, and these factors are crucial components to consider in food safety policies and practices. Policymakers and food safety experts should take these findings into account when developing strategies to improve food safety and ensure their effective implementation.

The analysis results regarding the socio-demographic data, that increase consumers' food safety risk perception, are presented in Table 5. The findings of this study reveal the impact of socio-demographic characteristics on food safety risk perception. The analyses show that various socio-demographic factors significantly affect individuals' perceptions of food safety risks.

First, it was found that married individuals have a higher food safety risk perception compared to single individuals. This may suggest that married individuals have greater concerns about food safety or are more cautious about protecting the health of family members. This finding is in line with existing literature, as married individuals, particularly those with children, may be more sensitive to food safety due to health concerns.

Table 5. The relationship between consumers' food safety risk perception and socio-demographic characteristics

Variable	Coeff.	Std. Error	P > |z|	[95% Conf. Interval]	
Gender	-.06497	.06737	0.335	-.19702	.06707
Marital Status	.144631	.07972	0.070*	-.01163	.30089
Age	.05012	.02728	0.066*	-.00334	.10659
Education	.10553	.04081	0.010**	.02554	.18552
Income	.00133	.02297	0.954	-.04369	.04637
Household Size	-.03460	.01951	0.076*	-.07285	.00365
Cut1	-1.39845	.23827		-1.86542	-.93144
Cut 2	-.63146	.23209		-1.08636	-.17656
Cut 3	.522004	.231668		.067942	.97306
Cut 4	1.33614	.23339		.878704	1.7935

* $p < 0.01$, ** $p < 0.05$, *** $p < 0.010\%$; LR $\chi2$ (27) = 208.37; Prob > $\chi2$ = 0.0000

An important relationship was also found between age and risk perception. As age increases, individuals' food safety risk perception also rises. This may be because older individuals have higher concerns about their health and are therefore more sensitive to food safety risks. Previous studies have shown that older individuals are more cautious about their health and have greater concerns about food safety risks. Mikailsoy (2022) also found a positive relationship between age and food safety risk perception.

A relationship was also found between educational level and food safety risk perception. As the level of education increases, individuals perceive a riskier environment regarding food safety. This can be explained because individuals with higher education levels are better able to understand food safety risks and perceive them more clearly. Education can shape risk perceptions by increasing individuals' knowledge and awareness of food safety. Mikailsoy (2022) found statistically significant results between education level and food safety awareness.

In their studies on consumer attitudes and behaviors regarding food safety in Türkiye and the European Union, Eryılmaz and Kılıç (2020) stated that consumers with higher education and income levels are more aware of food safety issues. Mikailsoy (2022) also found a linear relationship between education level and food safety awareness in European Union countries, where living standards and social consciousness are higher.

Finally, a negative relationship was identified between household size and risk perception. As household size increases, individuals' food safety risk perception decreases. This may indicate that larger families are better able to manage food safety practices or that food safety risks are shared more effectively.

Conclusion

The COVID-19 pandemic has become an unprecedented global crisis affecting all sectors of life. During this review process, it can be concluded that the COVID-19 pandemic intensified the social and ecological situation of agriculture, food supply, food safety, and environmental sustainability around the world.

In light of current information and cases, the transmission of SARS-CoV-2 through food has not been reported as a route of transmission. However, infected individuals and contaminated surfaces in food production and service facilities may serve as sources of transmission due to the ability of the coronavirus to survive on inanimate surfaces (Gunduz and Cengiz, 2022).

In conclusion, these findings show that individual attitudes and risk perceptions regarding food safety have significant effects on food safety policies and practices. Future studies can contribute to the development of strategies to improve food safety by exploring these relationships in greater detail. This study contributes to our understanding of how food safety risk perception is influenced by various factors and the impact of these interactions on individual attitudes and behaviors. Future research, by examining these interactions more deeply, can help in the development of effective strategies to improve food safety.

These findings demonstrate that socio-demographic factors have a significant impact on food safety risk perception and shape individuals' food safety behaviors and attitudes. Policymakers and food safety experts should develop targeted education and awareness strategies by considering the risk perceptions of individuals with different socio-demographic profiles. This approach can offer more effective solutions to enhance food safety.

Declarations

Ethical Approval Certificate

The experimental procedures of this study were approved by the Scientific Research and Publication Ethics Committee in Social and Human Sciences of Çukurova University (Approval date: 03.02.2023, Approval No: 6).

The authors contributed equally to all writing processes of the article.

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Conflict of Interest

The authors declare no conflict of interest.

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