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Impacts of the COVID-19 outbreak on food safety attitude, knowledge, and behavior

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ABSTRACT

The potential impact of the virus on food safety during the COVID-19 outbreak has posed a critical challenge to governments, the food industry, and consumers worldwide. The aim of this study is to evaluate the knowledge, attitudes, and behaviors of adult people regarding food safety during the COVID-19 outbreak. It is a cross-sectional study which is based on internet survey data of 1049 residents from seven regions of Turkey. The survey includes questions about the level of knowledge and attitude toward food safety during the COVID-19 outbreak. It has been observed that over 90% of the participants have correct knowledge about what to do in food shopping during the COVID-19 process. 56.6% of the participants stated that COVID-19 can be transmitted through food or food packaging, 81.0% stated that food packages should be disinfected in order to be protected from COVID-19 and 37.7% stated that COVID-19 is more resistant than other bacteria or viruses. While the presence of gender ($p = 0.748$) and chronic disease ($p = 0.181$) does not affect the number of correct answers to questions about food safety during the COVID-19 process, education ($p < 0.001$) and age group ($p < 0.001$) do. Those who are in the COVID-19 risk group and those living with the individual(s) in the COVID-19 risk group (respectively; $p = 0.036$, $p = 0.033$). Turkish consumers had a high level of knowledge about food safety, positive attitudes, frequent hand hygiene, cleaning and sanitizing activities, and adherence to social seclusion standards when shopping or dining out.

1. Introduction

The novel coronavirus disease (COVID-19), officially designated severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been declared a public health emergency of international concern by the World Health Organization (WHO) since January 2020. Various other guides, aimed at assisting the food sector, have been established and updated in light of new knowledge from governments and/or various food associations on a local or international level. Despite the serious health concern posed by the SARS-CoV-2 virus, the European Food Safety Authority (EFSA) thinks there is still no scientific proof that food represents a risk or a channel of transmission, owing to coronaviruses' poor survival on surfaces such as food products or packaging [1]. Researchers create scenarios for possible foodborne carry-through or carry-over contamination routes, such as contamination from meat/-meat products (carry-through) based on evidence that this virus can be transmitted through pigs and rabbits, or by spreading COVID-19 from personnel to food products/food contact surfaces (carry-over) [2]. Some pandemic mitigation methods, such as hand washing and surface cleaning, reinforce industry standard food safety practices, while others, such as face coverings and social distancing, may also prevent the spread of foodborne illness agents. The COVID-19 outbreak isn't done yet, and it won't be the last to strike the food sector [3]. Many people's daily lives have been damaged by the severe acute respiratory syndrome-coronavirus-2 (SARS-Cov2) outbreak and people quickly altered their lifestyles, particularly their dietary patterns, in an effort to stop the spread of COVID-19 [4]. Furthermore, the COVID-19 infection is having a negative influence on each country's economy, with marketing issues throughout the food supply chain being one of the worst-affected regions [5]. According to a study, over half of customers are concerned about meals made outside the home, while 30% are concerned about meal preparation at home [6]. Despite the fact that the virus has not been classified as a foodborne disease, the public is concerned that it could survive on raw animal products [7].

It has been reported that consumers lack basic knowledge and safety practices for home food handling, food safety incidents and public

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health events can have a substantial impact on their food safety awareness. People with less information are more inclined to panic as a result of mass media reporting about a food hazard issue, whereas residents with greater levels of education have a stronger amplification effect of food scandals on their food safety concerns [8].

There has been no proven evidence of SARS-CoV-2 transmission by the intake of contaminated food or water till now. However, because to SARS-durability CoV-2's in a variety of environmental conditions and its persistence on routinely touched surfaces, particularly food-contact surfaces, many concerns remain unsolved. As a result, assessing the virus's potential influence on food safety is a critical problem for governments, the food industry, and consumers around the world [5].

In this research it was investigated that to analyse the predictors of consumer food-handling behaviour in food hygiene during the COVID-19 outbreak. This study examines and provides a preliminary assessment of the effects of the Coronavirus Disease 2019 (COVID-19) outbreak on the food safety hygienic patterns and behaviour of various groups of Turkish consumers.

Hypothesis 1. Socio-demographic characteristics influence the knowledge about "COVID-19 and food safety."

Hypothesis 2. Being in the COVID-19 risk group or living with someone who is affects the level of knowledge about "COVID-19 and food safety".

Hypothesis 3. COVID-19 has affected individuals' attitudes towards food safety.

2. Methods

The average number of COVID-19 cases in Turkey on the days when the data was collected was 2.381.078 [9]. Due to the high number of cases, social distance rules were applied. Therefore, administering the surveys face-to-face created significant difficulties for both volunteers and researchers. For this reason, it became necessary to create an internet-based survey. The survey was distributed using Google Forms by sharing the open link on social media accounts. The questions were prepared in the form of a 3-point Likert type to determine the correct and incorrect answers of the participants to the food safety questions, as well as the questions they were unsure whether they were correct or incorrect. It was taken into consideration that participants could participate in the survey with devices with different features such as computers, smartphones, and tablets. Previews were made in the survey, and it was prepared in a way that would not require additional action such as scrolling to see all options on smaller screens, and the questions were avoided in a table (grid/matrix) form [10,11]. In internet-based surveys, the application process is unsupervised, outside the researcher's control area [12]. To minimize any problems that may arise in this context, an explanation was written at the beginning of the survey. In the statement, it was stated that no assistance should be received while filling out the survey or that the questions should be answered without doing any research. It was also stated that each individual had the right to participate only once.

The sample size is calculated with $n = N \times p \times p \times Z^2 \div [(N - 1 \times t2) + (p \times q \times Z2)]$ formula (N = Population, n = Number of samples, p = Frequency of occurrence of the feature, q = Frequency of not seeing the feature we are interested in the universe, Z = Standard value according to confidence level, t = Tolerable error) [13]. The sample size was calculated as a minimum of 384 people with a 95% confidence level and a 5% margin of error. The survey link was kept open until no response was received for three consecutive days and response acceptance was turned off. The inclusion criteria were: i) to be volunteer, ii) to be 18 years of age and older, iii) To be able to use the internet. Exclusion criteria: i) fill out the survey incompletely. In this process, 1049 volunteers were reached within the criteria. The number of questionnaires conducted is 2.7 times this number and this increases the power of the sample.

Demographic and other characteristics of the participants such as age, gender, education level (7 questions) and knowledge of food safety during COVID-19 outbreak (16 questions) and attitude about food safety during COVID-19 outbreak (7 questions) were collected via an online questionnaire. The questions asked about food safety knowledge were prepared in a 3-point Likert type by using the questions in the article titled "*Questions relating to food safety customers*" on the official website of WHO and the answers to these questions.

The data were collected for twenty days between 07–27 January 2021. Before starting the survey, the participants were informed about the study. Responses were collected anonymously and they were informed that they could withdraw after the survey started. After checking the "I approve" option for their participation, they were able to start the survey.

2.1. Statistical analysis

SPSS v.22 program was used for statistical analysis of the data. In the evaluation of the data, it was tested whether the data showed a normal distribution (Kolmogorov-Smirnov). Student's *t*-Test was used for two-group comparisons of normally-distributed parameters, and Mann-Whitney *U* test was used for two-group comparisons of non-normally-distributed parameters. The Kruskal Wallis test was used for the comparisons of groups of three or more that did not show normal distribution, and the Anova test was used for the comparisons of groups of three or more with normal distribution. Chi-square test and were used to compare categorical data. Significance was evaluated at $p < 0.05$ levels.

2.2. Ethical considerations

Ethical compliance of the practises to be conducted in the study was evaluated and approved by the Local Ethics Committee of İzmir Demokrasi University (Desicion No:2020/24–5).

3. Results

1054 volunteers were reached in the study. Five of the volunteers were excluded from the study because they filled out the questionnaires incompletely. The study was completed with 1049 participants from 67 different cities from seven regions of Turkey. 26.5% of the participants are women and 73.5% are men. When analyzed in terms of age groups, it is seen that more than half of the participants (55.9%) are between the ages of 18–24 years. 83% of the participants had high school or higher education, 79.5% are students and employees. 19.2% of the participants have a known disease, 16.8% are in the COVID-19 risk group and 46.9% are living with at least one individual in the COVID-19 risk group. The demographic characteristics of the participants are summarized in Table 1.

While 57% of the participants reported that the fear of COVID-19 contamination from food decreased compared to the first periods of the epidemic, 50.2% reported that this fear still continues, while 13.3% reported that they were fed up and did not care about food safety.

Due to their concerns about food hygiene, since the epidemic started, 77.3% reported that the frequency of eating out has decreased, 71.6% have reduced the frequency of ordering food from outside, and 83.8% have paid more attention to food hygiene than ever since the epidemic started. The attitudes and behaviors of the participants regarding COVID-19 and food safety are similar (see Table 2).

Participants gave more than 90% correct answers to questions on hand hygiene, safe physical distance, and rules to be followed while shopping for food. The statement that food packaging materials should be disinfected to be protected from the coronavirus was the most incorrectly answered question. The answers given by the participants to the questions about COVID-19 and Food hygiene are given in Table 3.

Gender ($p = 0.748$) and whether having a known disease ($p = 0.181$)

Table 1
Demographic and other characteristics of participants.

		n	%
Gender	Male	278	26.5
	Female	771	73.5
	Total	*1049*	*100.0*
Age (years)	18–24	586	55.9
	25–34	183	17.4
	35–44	126	12.0
	45–54	120	11.4
	55–64	25	2.4
	65 +	9	0.9
	Total	*1049*	*100*
Education	High School	543	51.8
	University	327	31.2
	Secondary school	31	3.0
	Primary School	94	9.0
	Primary school dropout	34	3.2
	Uneducated-literate	20	1.9
	Total	*1049*	*100*
Profession	Student	522	49.8
	Employe	312	29.7
	Retired	97	9.3
	Housewife	41	3.9
	Unemployed	37	3.5
	Others	40	3.8
	Total	*1049*	*100*
Known Disease	Yes	*201*	*19.2*
	No	*848*	*80.8*
	Total	*1049*	*100*
COVID-19 risk group	Yes	*176*	*16.8*
	No	*777*	*74.1*
	Do not know	*96*	*9.1*
	Total	*1049*	*100*
Living with at least one individual in the COVID-19 risk group	Yes	*492*	*46.9*
	No	*557*	*53.1*
	Total	*1049*	*100*

Table 2
Attitudes and behaviors regarding Covid 19 and Food safety.

	Agree		Uncertain		Disagree	
	n	%	n	%	n	%
Since the outbreak began, I have had concerns about the transmission of diseases from food, and these concerns continue.	527	50.2	253	24.1	269	25.6
Since the outbreak started, I have had concerns about the transmission of diseases from food, but by taking precautions, I have reduced/got rid of my worries.	598	57.0	275	26.2	176	16.8
I am tired. I no longer care about food and beverage cleaning in the outbreak.	137	13.1	132	12.6	780	74.4
Since the outbreak started, my frequency of eating out has decreased as I have concerns about food hygiene.	811	77.3	89	8.5	149	14.2
Since the outbreak started, my frequency of ordering food from outside has decreased as I have concerns about food hygiene.	751	71.6	81	7.7	217	20.7
Since the outbreak started, I have been paying more attention to food cleaning than ever before.	879	83.8	91	8.7	79	7.5

Table 3
Covid 19 and food hygiene questions.

	Agree		Uncertain		Disagree	
	n	%	n	%	n	%
There is no evidence that COVID-19 is transmitted through food or food packaging.	466	44.4	319	30.4	264	25.2
Corona viruses cannot reproduce in food.	739	70.4	198	18.9	112	10.7
It is not necessary to disinfect food packaging materials to protect against the corona virus.	199	19.0	215	20.5	633	60.3
Hands should be washed properly after handling food packages and before eating.	1014	96.7	24	2.3	10	1.0
It is sufficient to wash the fruits and vegetables with tap water in accordance with the hygiene rules as usual.	671	64.0	189	18.0	189	18.0
It is sufficient to wash hands thoroughly with soap and water (according to hand washing rules) before touching food.	941	89.8	76	7.2	32	3.1
This virus is no more resistant than normal viruses and bacteria found in food, it is sufficient to thoroughly cook the food at least 70 °C.	654	62.3	322	30.7	73	7
When shopping for food, safe physical distance should be maintained from shoppers and employees throughout the entire shopping.	1022	97.4	19	1.8	8	0.8
A shopping trolley or basket can be used, provided that the handle is sterilized before and after use.	974	92.9	44	4.2	30	2.9
Avoid touching the mouth, nose and eyes while shopping for food.	1024	98.1	16	1.5	4	0.4
Direct hand contact with food should be minimized by using tongs and serving utensils in stores and markets.	978	93.2	47	4.5	24	2.3
Where possible, contactless payment should be preferred instead of cash/banknotes.	1000	95.3	40	3.8	9	0.9
Take-outs are safe if service providers follow good personal and food hygiene practices.	878	83.7	129	12.3	42	4
Hands should be washed with soap after accepting food/grocery deliveries.	1031	98.3	13	1.2	5	0.5
The usual household cleaning and disinfection products effectively eliminate the virus from household surfaces.	624	59.5	333	31.7	92	8.8
Bleach, surface virucidal disinfectants and ethanol-based products (at least 70%) should be used only in the cleaning and disinfection of homes with suspected or confirmed COVID19 patients at home.	579	55.2	170	16.2	300	28.6

did not affect the number of correct answers. The correct number of individuals between the ages of 18–24 was lower than all groups ($p < 0.001$). The correct number of individuals aged 45–54 and 55–64 was higher than individuals aged 25–34 (p value 0.001 and 0.14, respectively). While the number of correct answers for high school graduates is higher than university graduates ($p < 0.001$), it is lower than primary and secondary school graduates. The number of correct answers for secondary school graduates was found to be significantly higher than university graduates ($p = 0.038$) (see Table 4).

Individuals who are in the COVID-19 risk group or who are in the COVID-19 risk group at home have more concerns about the

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Number of correct answers to questions about Covid 19 and food safety and related situations.

		Number of correct answers (mean)	sd	p
Gender	Male	12.22	2.29	0.748
	Female	12.19	2.23	
Age	18–24	11.69	2.20	<0.001
	25–34	12.37	2.28	
	35–44	12.78	1.91	
	45–54	13.49	1.87	
	55–64	13.92	1.80	
	65 +	12.11	2.67	
Education	High School	11.70	2.12	<0.001
	University	11.66	2.26	
	Secondary school	13.94	1.69	
	Primary School	12.88	2.47	
	Primary school dropout	12.03	1.91	
	Uneducated-literate	12.70	1.69	
Known presence of disease	Yes	12.46	2.18	0.181
	No	12.14	2.25	

transmission of viruses from food when the epidemic starts (p:0.036) and the continuation of these concerns is higher in these groups ($p = 0.033$). There was no statistical difference between being in the COVID-19 risk group or living with someone from the COVID-19 risk group and other attitudes and behaviors ($p > 0.05$).

4. Discussion

In this study volunteers had a high level of knowledge about food safety, positive attitudes, frequent hand hygiene, cleaning and sanitizing activities, and adherence to socially seclusion standards when shopping or dining out. It can be said that to minimize the spread of COVID-19, the campaigns in raising awareness and knowledge, helped to increase consumers' knowledge and to adopt positive attitudes while shopping, preparing meals, and eating out. Boosting customers' food safety awareness can improve their food safety behaviour dramatically. These findings not only provide a more accurate picture of the situation, but they also provide a better understanding of customers' food safety awareness and understanding conduct in the face of the COVID-19 outbreak, but also to the body of knowledge on the effects of public health crises on. The findings of a research have significant implications for Chinese policymakers and the catering industry. The government should use public health events to raise public awareness about food safety and encourage people to change their bad eating habits. Also, rapid transmission of food safety information during public health incidents is required to prevent consumer panic and raise consumer awareness of food safety [8]. The intention to adopt safe food handling methods was favourably influenced by the following factors: attitude, perceived behavioural control, and subjective norms. On intention, attitude and perceived behavioural control both had stronger effects. Consumers are known to think that handling food safely is simple, which increases their intention to do so. This comfort may be related to internal or external factors, such as consciousness or time. Consumers may believe they are capable of carrying out actions that are within their control, in this case, handling food safely [14].

The collection of study data started on January 7, 2021. The vaccination program in Turkey started on January 13, 2021, and priority groups were vaccinated first. The study findings show that participants are concerned about transmitting the COVID-19 virus through food and continue to take precautions in this regard [15]. This can be explained by the fact that vaccination was limited when the research data was collected hence the participants felt at high risk.

In our study, 25.2 % of the people thought that corona virus could be transmitted by food package. In addition, 19% said that the food packages do not need to be disinfected. In a research similar with us, anticipated that if consumers perceived plastic packaging as a potential barrier against the danger of infection, they would buy more plastic-packaged food in response to food safety concerns. According to this study, the COVID-19 epidemic has had little effect on the majority of Canadians' (65%) trust in the food chain. Beyond that, it is an essential mitigating factor in the influence of the outbreak on consumer attitudes and behaviour at least for the purposes of this study. The global COVID-19 pandemic has resulted in a surge in the use of single-use plastic for take-out and fast food, as well as the reversal of several rules prohibiting the use of plastic bags due to safety concerns. According to research, women are more sensitive to food safety issues than males. So it's not unexpected that women expressed greater anxiety about food safety during COVID-19. Women were also more likely to say they had purchased more single-use plastics packed food since the epidemic began, which is consistent with the pattern [16]. One of the known facts is that facts by touching a contaminated droplet on a surface or object and then touching their own eyes, nose, or mouth, a person may be able to contract COVID-19. In this case, handling or consuming contaminated food products may carry the same risk as coming into contact with a surface or object [1]. But as of yet, there are no basic reports indicating that COVID-19 spreads through food items. Actually, there is no evidence that food or food packaging can directly spread COVID-19. Additionally, there has not yet been evidence of or experience with the spread of MERS-CoV and SARS-CoV through food intake. Nevertheless, a report claims that the human coronavirus 229 E (HuCoV-229 E) can live for at least five days on surfaces made of polyvinyl chloride (PVC), polyfluorotetraethylene (PTFE), glass, ceramic tiles, stainless steel, and silicon rubber. It can also live for three days at a temperature of 21 °C and a relative humidity of 30–40% [17].

In a research that conducted in Brasilia, it was shown that food-safety awareness had no effect on intention ($p = 0.30$), but it had a positive effect on the other extended theory of planned behaviour (TPB) components. All TPB components were positively influenced by risk perception. The findings of this study back up TPB's utility and expansion, demonstrating that public-health crises can lead to changes in food-safety-related consumer behaviour. Customers can influence their attention and perception of danger by increasing their worry and anxiety. The social consequences that consumers experience have an impact on risk-related decision-making because they integrate emotional and cognitive components [14]. Similarly, when the ratios given to the answers to the questions posed in Table 3 were examined in our study, it was observed that consumer food hygiene behaviours changed significantly in the right directions. According to the Al-Jaberi et al. [18] study, Jordanian women who handled food at home during the COVID-19 epidemic exhibited poor knowledge, negative attitudes, and dangerous food handling techniques. Thus, it is essential to keep the public informed about safe food handling procedures through ongoing education. Food handling and household practices receive less attention than food supply chains when it comes to food safety initiatives. Therefore, in order to safeguard family members against foodborne illnesses, domestic food handlers need to receive thorough instruction and training. In terms of study outcomes, in a different study the significance of a handwashing campaign during an emerging disease outbreak by drawing attention to the fact that individuals who do not practice regular handwashing are more likely to contract the disease [19]. Hand washing should be done on a regular basis. When an infected individual coughs or sneezes, similar viruses are transferred by droplets. Coughing, sneezing, breathing, and even inhaling the virions are further ways for SARS-CoV-2 to spread. Importantly, avoiding close contact with individuals and touching the face with hands may be necessary to reduce the risk of SARS-CoV-2 contamination in the food business [20]. Related with this concept in our research (Table 3), it can be seen that consumer's perceptions were determined as the ratios; "Hands should be washed properly after handling food packages and before eating" was 96.7%, "It is sufficient to wash hands thoroughly with soap and water

(according to hand washing rules) before touching food" was 89.76% and "Hands should be washed with soap after accepting food/grocery deliveries" was 98.3%. During the COVID-19 pandemic, different forms of handwashing behavior were linked to the degree of area deprivation in the general population. People living in more impoverished neighborhoods were less likely to conduct handwashing behavior, which involves washing hands after using the restroom, after returning home, and using soap, even though the rate of practicing hand hygiene activity was generally quite high. The results point to the possible significance of taking local deprivation into account when putting policies encouraging handwashing into action, especially because handwashing is a well-known and successful preventative tool against infectious diseases [21]. This study looked at the relationships between handwashing behavior during the COVID-19 pandemic and perceived vulnerability, perceived severity, subjective norm, and influenza vaccine uptake. One finding of this study is that, in an attempt to educate the public about the ease of transmission of COVID-19 and the potential efficacy of handwashing as a preventative measure the government should endeavor to establish a common standard for handwashing. Developing a social norm in the society to promote routine handwashing could be advantageous for everyone's health, not just in the event of a pandemic. The COVID-19 pandemic has significantly raised demand for online meal delivery across the globe. The ways in which consumers research and choose ready-to-eat meals have undergone significant changes in recent years [22].

Lacombe et al. (2020) [23] explained that during the COVID-19 era, the food supply chain has remained unaffected by changes in consumer purchasing patterns have been accustomed to taking cover. Also, a new assessment of food safety is required since the dynamics of consumer food acquisition have changed as a result of the epidemic. Just for public health, improving food safety is a top priority, and transparency and traceability in the food chain can be very helpful. In particular, these applications provide information on food storage conditions, contact tracing, health inspections, safe handling, and avoiding food waste [23].

In our study the people mostly agree about "since the pandemic started, my frequency of ordering food from outside has decreased as I have concerns about food hygiene". But, in other countries such as Thailand in order to address the issue and focus on online delivery, many restaurants have modified their business structures. Food delivery services have emerged as the answer for restaurants and food manufacturers to avoid contact during the COVID-19 outbreak. Additionally, according to the customer opinions, food delivery services should work to manage the food and maintain hygienic standards throughout the delivery process [24]. While fear prevents customers from eating out, it is challenging for them to eat exclusively at home for a prolonged amount of time. Taking into account the anxiety and concern that COVID-19 brought about, it makes sense to believe that a situation like this would occur again in the future [25]. In a study it was concluded that food workers must adhere to the best hygienic procedures in order to prevent COVID-19 infection, especially in the event of a pandemic since poor hygiene can raise the risk of sickness. Furthermore, a number of diseases that can damage the respiratory system and result in pneumonia or even gastrointestinal infections might spread due to improper hygiene. Therefore, upholding good standards for cleaning and hygiene is crucial for both employees and the workplace itself. The majority of employees wore gloves and masks even while they weren't at work. In the research, less than one-third of workers agreed that taking COVID-19 procedures raised food safety standards, decreased cross-contamination, increased productivity in food facilities, and significantly boosted food handlers' personal hygiene [26]. Food handlers frequently come into contact with different biological elements. Furthermore, the coronavirus can survive for a few days on common handling surfaces used in the food business, such as glass, plastic, and metal. Workers must be aware of proper safety practices and willing to follow them in order to stop the spread of COVID-19. It would be a great job to raise awareness of this issue among consumers and factory employees. Thus, in a research about food handlers was shown that in Bangladesh's food sectors are well-versed in COVID-19, have a positive outlook, and follow the recommended procedures [27].

Shi et al. (2020) [8] study also shows a strong positive relationship between people' understanding of food safety and behaviour and the presence of COVID-19 cases in a local community. Residents with a focus on COVID-19 outbreak-related information typically have more understanding of and behaviour linked to food safety. The marginal impacts of COVID-19 cases in a community on citizens' food safety knowledge and behaviour drop dramatically when the variable of attention on COVID-19 outbreak-related information is controlled [8].

During COVID-19, similar to our study, the view of consumers in Indonesia and Malaysia on food safety was investigated. The results showed that respondents had a high degree of food safety awareness (the average score was over 6), and more than 90% received a score of at least 5 (out of maximum of 9 points). These findings are consistent with earlier research from Indonesia and Malaysia. Gender, age, and educational attainment were found to have an impact on food safety knowledge, attitude, and practices. The findings were consistent and showed negligible correlations between food safety knowledge food safety practices and food safety knowledge food safety attitude among Malaysians [28].

On the other hand, it was claimed that the pandemic had a positive effect on consumers' food-buying and eating habits. For instance, a Tunisian research discovered that the limitations and lockdowns reduced food waste. In Italy, 54 % of respondents said they used leftovers more often than a third of the time. Furthermore, many were forced to cook meals at home, bake bread, and make desserts as a result of the closing of restaurants and cafes. For instance, a significant US survey on grocery shopping patterns revealed that Americans cook more (41 %), meal plan (27 %), and experiment with new dishes and recipes (20%). Collectively, these adjustments might support healthy eating habits and have a good impact on eating behaviours [29]. In our research, 77.3% of consumers in Turkey have confirmed that they reduce their eating habits outside the home.

There are concerns in the literature regarding the coverage error of web-based surveys. These concerns stemmed from the fact that many individuals in the research population could not enter the sampling frame, especially since the population using the internet in the past years was much smaller than today [30,31]. However, today internet usage rates are much higher. For example; According to TUIK 2020 data, approximately 91% of households in Turkey have internet access [32]. In addition, when TUIK data is examined, the internet usage rate in Turkey in the last three months is approximately 92% among those aged 16–24, 94% among those aged 25–34, 89% in the 35–44 age range, 75% in the 45–54 age range, it is 51% in the 55–64 age range, and 27% in the 65–74 age range [33]. This indicates that certain people in the research population (for example, older individuals) are less likely to be represented in the sample. Additionally, besides having internet access to complete a web-based survey, it is necessary to have a certain technical proficiency to easily use the internet and the device on which the survey will be completed [34]. In this context, it should be considered that even if some participants in the research population had the opportunity to connect to the Internet, there is a possibility that people may not be able to participate in the survey online [35]. The most important advantage of internet-based surveys is that they can reach a much larger number of participants, a wider geographical area and participants with different characteristics, at lower costs and in a shorter time, compared to printed surveys [12]. On the other hand, in these web-based surveys, participants receive information from researchers. Since they did not receive a face-to-face invitation, participation was voluntary. The principle of participation is strengthened, participants can easily leave the research whenever they want, and thus errors resulting from compulsory participation in the research are reduced [12]. While benefiting from the clear advantages offered by the method, it is recommended to minimize the disadvantages with the precautions taken [35]. The measures taken

in this study are explained in the method section. Although the rate of internet access in Turkey is very high, the sample is limited to volunteers who are competent in using the internet and the necessary devices and we could reach through web-based announcements consisting of individuals. The cross-sectional results of the study can be considered as another limitation. Results have only been observed nationally. Examining consumers' perspectives by other countries can further increase the reliability of the study on the country base and put the differences of consumers' attitudes and behaviours internationally.

5. Conclusion

This study is one of the rare studies examining the immediate effects of the COVID-19 pandemic on purchasing, consumption and food safety perception in Turkey. According to the study findings, it was shown that the knowledge level of the participants in the study about food safety was high and was affected by age and education. It was also determined that the participants had a positive attitude towards food safety. It has been shown that the majority (>70%) of the participants' concerns about food safety during the COVID-19 epidemic affected their eating/ordering habits and that they paid more attention to food hygiene than before. The study's overall findings are distinctive and instructive. Future longitudinal research may shed more light on the pandemic's long-term effects on consumer food dynamics and whether those dynamics will return to their pre-pandemic state. Further research is recommended to comprehend the mechanisms underlying these alterations and behaviours fully.

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Informed consent statement

Informed consent was obtained from all subjects involved in the study.

CRediT authorship contribution statement

Zehra Batu: Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Reyhan Irkin:** Validation, Methodology, Investigation, Conceptualization. **Helen Onyeaka:** Writing – review & editing, Visualization, Validation, Supervision, Investigation, Conceptualization.

Declaration of competing interest

All authors declare no competing interests.

Data availability

Data will be made available on request.

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