

Food purchasing, preservation, and eating behavior during COVID-19 pandemic:

A consumer analysis

Sibel Bolek

Sağlık Bilimleri Üniversitesi, University of Health Sciences, İstanbul, Turkey

***Corresponding Author:** Sibel Bolek, Sağlık Bilimleri Üniversitesi, University of Health Sciences, İstanbul, Turkey.
Email: sibel.bolek@sbu.edu.tr

Submitted: 7 April 2021; Accepted: 21 August 2021; Published: 11 September 2021

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PAPER

Abstract

Due to the highly infectious virus known as COVID-19 impacting the lives of the populace, more than any other event in recent memory, there is a pandemic in the world. In order to determine food purchasing behavior and eating habits, food preservation techniques and source of knowledge about COVID-19, 992 consumers living in İstanbul, the most populous city in Turkey, were surveyed. The questionnaire was disseminated to participants via an online platform. Thirty questions, including the demographics of participants, changes in purchasing behavior, knowledge, and attitudes about food preservation techniques, changes in eating habits, and source of knowledge about COVID-19, were asked. The results of this study surveyed that COVID-19 has changed food purchasing and eating habits of Turkish consumers significantly ($p < 0.05$). During the survey in late March of 2020 and late December of 2020, about 65% of respondents have tried to consume more food that boost the immune system and 58% of the respondents have been more willing to buy fresh products. Consumers have greatly adopted preserving of food stuffs by freezing during quarantine days. This survey revealed that the effective use of media tools could increase awareness and lead to behavioral changes that can reduce the spread of COVID-19, especially in consumers aged over 65 years.

Keywords: COVID-19; eating habits; food purchasing habits; media

Introduction

COVID-19 pandemic is one of the greatest challenges that the world has faced without prior preparation. COVID-19 is much more than a health crisis. It is also an inevitable economic crisis because of the sudden decline in economic activities. The pandemic is giving rise to substantial changes in the social habits of the people throughout the world, which will leave deep scars. Moreover, the COVID-19 pandemic has caused apprehensions about threats to food security (Hirvonen *et al.*, 2021). One of the reasons why COVID-19 pandemic has led to significant changes is the uncertainty about what will happen in the near future, as well as food purchasing, food preservation, and consumption behavior of people

because of the lockdown and social isolation directives. During the pandemic, people are compelled to stay at home and to go outside only to meet the most urgent needs such as purchasing food. Hence, COVID-19 has changed consumers' life and spending habits (Criteo Coronavirus Survey, 2020). One of the major problems that COVID-19 has indicated is the debate on food insecurity faced by majority of the population. COVID-19 caused a critical weakness in the US food supply system (Chenarides *et al.*, 2021). It has threatened the accessibility of food by effecting food costs and infrastructure such as public transit access, distribution, shortages of certain products, and changes in food assistance (Niles *et al.*, 2020). This statement has revealed the significance of food security in times of crises and shocks.

The COVID-19 pandemic holds several implications for Canadian food supply chains such as maintaining and enhancing supply chain resilience (Hobbs, 2020).

The pandemic is evidently challenging the whole food chain system. One of the major concerns shared by all food companies is preserving the health of workers and the provision of sufficient workforce because of those who do not want to work due to sickness or the fear of coronavirus. Food security is also related to access of consumers to food rather than food availability during lockdown (Gundersen *et al.*, 2021). Chenarides *et al.* (2021) reported that food prices are a key determinant of food insecurity. On the other hand, consumers are also expected to take additional measures to protect their health. News about the importance of a strong immune system in the fight against COVID-19 prompted consumers to purchase foods that strengthen the immune system. Food achievement patterns were also substantially altered in comparison to pre-COVID levels (Restrepo *et al.*, 2021). Understanding the COVID-19 effect behind restriction policies is also substantial (Aday and Aday, 2020). Changes in the food purchasing behavior varied by age, gender, and education (Ali *et al.*, 2021; Wang *et al.*, 2020).

Investigating changes in food purchasing, preservation, and consumption habit is critical to both understand how habits of consumers change and adapt during lockdown and to ensure beneficial guidance in emergency management efforts. Creating shock-resistant food systems requires collective action through the entire agri-food chain (Bakalis *et al.*, 2020). In particular, at the start of the pandemic crisis, consumer demand for food has soared and some store shelves have been emptied due to over-buying of basic products. Examining for food insecurity and providing resources may decrease short- and long-term results, such as potential long-term effects on health outcomes related to duration of household food insecurity and higher health care expenditures associated with food insecurity. Each country should realize the seriousness of the situation and sometimes tighten or relax measures according to the spread of the pandemic. Therefore, the aim of this survey was to understand how a pandemic such as the COVID-19 influences the food purchasing and preservation behavior. It was hypothesized that food choice, preservation motives, and nutritional quality of diet changed during COVID-19 outbreak. This survey aimed to help address consumer awareness, knowledge and, attitudes about food preservation techniques creating influential food safety and nutrition communications that would help policy makers, educators, communities, health professionals, companies, and others to best understand the most important issues for consumers to adjust their policies and strategies to the current pandemic circumstances. The results

of the present study could be a standard in food security, health care, and other service settings during COVID-19 and beyond. Food retailers and distributors may consider increasing their capacity to cope with temporary excess demand by investing in capital and labor resources.

Literature Review

Many studies have been conducted to explain changes in dietary and food purchasing habits during the COVID-19 pandemic. Moreover, several studies have been performed to determine effects of COVID-19 pandemic on food supply chains and consumer panic buying behaviors (Hobbs, 2020). Grashuis *et al.* (2020) investigated the grocery shopping preferences during the COVID-19 pandemic. Their results revealed that COVID-19 caused significant changes in grocery shopping preferences. When COVID-19 is spreading at an increasing rate, consumers are not usually willing to shop at grocery stores. Ben Hassen *et al.* (2020) investigated impact of COVID-19 on food behavior and consumption in Qatar. Their results indicated that consumers adopted healthier diets and increased the consumption of domestic food because of food safety concerns. Chang and Meyerhoefer (2021) surveyed the effects of COVID-19 on online food shopping services. According to their results, COVID-19 pandemic caused a significant increase in online food shopping in Taiwan. Celik and Dane (2020) surveyed the effects of COVID-19 pandemic outbreak on food consumption preferences. Their survey revealed that the first food choice of consumers shifted from meat and bakery to fruits and vegetables. Marty *et al.* (2021) surveyed nutritional value of diet and food choice motives during the COVID-19 pandemic in France. Their results revealed that consumers' awareness of the importance of sustainable food choices significantly increased. However, to the best of the author's knowledge, no data with respect to the real food preservation habits of the population during COVID -19 are available, so far. The present study aimed to analyze both changes in food purchasing and preservation habits which help food authorities to take the necessary precautions during pandemic situations such as COVID-19.

Survey Design

With feedback from key state-level agencies as well as reviews of relevant literature, a survey was developed by observing consumer food behavior to evaluate the changes in food purchasing and preservation behavior of consumers in İstanbul, the most populous city in Turkey. The questionnaire was pilot tested on 20 comparable consumers for clarity and validity, and necessary adjustments were done. Data were collected by a specific

questionnaire. The questionnaire was carefully designed to minimize its influences on consumers and to achieve accurate information that will reflect the consumers' own attitudes. The questionnaire was disseminated to participants via an online platform. The survey lasted from late March to late December of 2020. No direct interactions, such as face-to-face interviews, were carried out. Consumers were asked about their food purchasing, food preservation, and consumption behavior during the COVID-19 pandemic. The data were collected by interviewing 992 randomly selected consumers. Questionnaire design is highlighted in the following sections: (i) demographics of respondents, (ii) changes in purchasing behavior of consumers, (iii) knowledge and attitudes of consumers about food preservation techniques, (iv) changes in eating habits, and (v) source of knowledge about COVID-19 and food. The sections were designed to determine the changes in food purchasing, preservation, and dietary habits as well as to reveal information sources of consumers during the COVID-19 pandemic.

Ethical Aspects

The respondent information required an individual and anonymous completion of the questionnaire. Consumers could quit at any time. It was not possible to link the specific answers to individuals.

Statistical Analysis

Data were subjected to analysis of variance (ANOVA) by the General Linear Model (GLM) procedure of SAS statistical programme (SAS, 1999). All the means were compared by Duncan's multiple range test at the level of $p < 0.05$.

Results

Respondents' characteristics

The demographic properties of consumers are given in Table 1. The age of the youngest consumer was 18, whereas the oldest was 79 years old. Thirty percent of the consumers were under 20 years of age, 39% were between the ages of 20 and 65 years, and 37% were over 65 years. Forty-seven percent of the consumers were male. Thirty percent of the consumers were university graduates, 44% were high school graduates, and 26% were elementary school graduates. Monthly average income of 40% of the participants was between 2400 and 4000 TL (Turkish Lira). In the twelfth month of 2020, 1 dollar was roughly 7.45 TL, and 1 Euro was roughly 8.90 TL. Only 3% of the

Table 1. Socioeconomic and demographic characteristics of the participants.

Age	
<20	30%
20–65	39%
>65	37%
Gender	
Female	53%
Male	47%
Education	
Elementary	26%
High school	44%
University	30%
Monthly income ^a	
<2400 TL ^b	20%
2400–4000 TL	40%
4000–7500 TL	32%
7500–15,000 TL	21%
>15,000 TL	3%

^aNational average gross income per person was 11,019 dollars in Turkey in 2020.

^bTL: Turkish Lira, 1 Euro = 8.90 TL (December, 2020).

respondents had their monthly average income above 15,000 TL, which can be considered as a very good salary according to Turkish life standards.

Changes in the purchasing behavior of consumers

Changes in the purchasing behavior of consumers are given in Table 2. Most of the consumers ($83 \pm 0.15\%$) have changed shopping habits since the COVID-19 pandemic started ($p < 0.05$). Forty percent ($40 \pm 0.08\%$) of the consumers have adopted online purchasing, whereas $60 \pm 0.06\%$ of the consumers have adopted in-store food purchasing. Consumers from all demographics, but especially from the age group below 65 years, have adopted online food purchasing ($p < 0.05$). The citizens aged below 65 years have been restricted to venture out of their homes shortly after the first case has been seen in Turkey. As grocery shopping remains a necessity during the pandemic, many people have questions about how to shop safely. Grocery stores have imposed more and more safety rules such as metering consumers and requiring consumers to wear masks. Due to the news that the virus can live on boxes and cans, consumers have gotten fearful and anxious when shopping at physical grocery stores. It seems that online food purchasing is likely to continue long after the pandemic. Scacchi *et al.* (2021) reported that the COVID-19 pandemic caused adoption of online grocery purchase among Italian consumers, suggesting a modern and low-risk shopping method.

At the beginning of the COVID-19 pandemic, because of market uncertainties, some of the major agricultural producing nations implemented export restrictions. They mainly focused on staple crops that are of high importance for food security including maize, wheat, and rice. Moreover, consumers who believed that they would suffer from food shortages due to COVID-19 stockpiled food in their homes. Shelves were emptied quickly in markets. However, as seen in Table 2, 90 ± 0.07 of the consumers have not experienced food product shortages.

Health professionals are recommending people consider taking some foods for strengthening their immune system daily as the coronavirus lockdown continues. As seen in Table 2, only 10 ± 0.05 of the consumers has purchased food products which they would not have purchased if it was not for COVID-19.

The risk of COVID-19 cross-contamination to food is very low (Gov.uk., 2020). However, since COVID-19 is a respiratory disease (Butler and Barrientos, 2020), the possibility of the respiratory tract becoming infected when chewing contaminated food cannot be completely ruled out. As seen in Table 2, sixty-six percent ($66 \pm 0.11\%$) of the consumers purchased more packaged food since the COVID-19 pandemic started ($p < 0.05$). Since people are encouraged to wash foodstuff purchased from supermarkets, which is far more easily done when the product is plastic-wrapped, plastic packaging has played an important role in food safety during lockdown (Packaging Europa, 2020). Consumers from all demographics, but especially those aged more than 65 years ($p < 0.05$), have had a more favorable opinion of the healthfulness of packaged foods. At the same time, $27 \pm 0.08\%$ of the respondents said that they have not changed their perceptions on the healthfulness of packaged foods.

Healthy diet has a great importance for health, particularly in times when the immune system might need to fight back (Kau *et al.*, 2011). Sustaining a healthy lifestyle and nutritious diet is extremely important during the COVID-19 pandemic. Avoiding nutrient deficiencies helps ensure that all nutrients required for immune cell triggering, interaction, differentiation, or functional expression are available as needed. Fruits and vegetables are increasingly being consumed thanks to their properties of nutrition and freshness, which are much appreciated. Moreover, freshwater fish and seafood are popular among consumers since their perception is associated with healthy, high-quality products. As seen in Table 2, 58 ± 0.12 of the consumers have been more willing to buy fresh products since the COVID-19 pandemic started ($p < 0.05$). When the results were evaluated in terms of age groups, it was seen that there was

no statistically significant difference ($p > 0.05$). Głabska *et al.* (2020) reported that the COVID-19 pandemic has increased the importance of health and weight control of Polish adolescents.

Hygiene and sanitation are imperatives that must be strictly followed in the food industry. Food handlers should implement hygiene practices accurately to protect the consumers from foodborne diseases. The food safety measures such as cleaning of surfaces and utensils, frequent hand-washing, and cooking food to the right temperature are already implemented to prevent foodborne illnesses. There is every reason to believe that the existing effective hygiene and sanitation measures are as effective on COVID-19 as on other microbiological risks. However, as seen in Table 2, $55 \pm 0.09\%$ of the consumers are not sure whether consuming the food they purchase is safe during COVID-19 ($p < 0.05$). When the results were evaluated in terms of age groups, it was seen that there was no statistically significant difference ($p > 0.05$). Food businesses should implement additional hygiene and sanitation measures, based on risk, all the more in the case an employee tests positive for COVID-19.

Ellison *et al.* (2021) surveyed a panel of 1370 U.S. households during the COVID-19 pandemic. The results of their study revealed that The COVID-19 pandemic has substantially changed what is “normal” globally, touching all aspects of life, including food purchasing and acquisition preferences.

Knowledge and attitudes of consumers about food preservation techniques during the COVID-19 pandemic

Appropriate food preservation has allowed for less trips to the grocery store and less time in public places during the COVID-19 pandemic. As seen in Table 3, freezing has been the most preferred food preservation method. Sixty-six percent ($66 \pm 0.08\%$) of the consumers have frozen their foods during the COVID-19 pandemic ($p < 0.05$). Freezing is a preferred method since it eliminates the need for purchasing additional equipment and utensils that are required for drying and canning. Most of the respondents (95%) who have adopted freezing to a great extent during the pandemic were aged below 20 years ($p < 0.05$). This may be due to the lack of time for young consumers. However, elderly people have also adopted drying and canning. Turkish people have had refrigerators in their houses for the past 40 years, so the consumers over 65 years are experienced in drying and canning that are ancient food preservation techniques before the advent of refrigerators.

As seen in Table 3, only $20 \pm 0.06\%$ of the consumers have felt it necessary to wash or remove packaging before

Table 2. Changes in the purchasing behavior of consumers.

Results obtained for different age groups				
	Overall	<20	20–65	>65
I have changed shopping habits since the COVID-19 pandemic started.				
a) Yes	83 ± 0.15 ^a	82 ± 0.08 ^a	85 ± 0.12 ^a	83 ± 0.09 ^a
b) No, never	17 ± 0.12 ^b	18 ± 0.07 ^b	15 ± 0.12 ^b	17 ± 0.07 ^b
I have adopted.....food purchasing since the COVID-19 pandemic started (Fill in the blank).				
a) Online	40 ± 0.08 ^b	51 ± 0.04 ^a	53 ± 0.12 ^a	15 ± 0.08 ^b
b) In store	60 ± 0.06 ^a	49 ± 0.05 ^a	47 ± 0.12 ^b	85 ± 0.09 ^a
I have experienced food product shortages at stores from which I am trying to buy.				
a) Yes	22 ± 0.07 ^b	20 ± 0.06 ^b	27 ± 0.12 ^b	18 ± 0.10 ^b
b) No, never	78 ± 0.10 ^a	80 ± 0.08 ^a	73 ± 0.13 ^a	82 ± 0.10 ^a
I have purchased food products which I wouldn't have done if it wasn't for COVID-19.				
a) Yes	10 ± 0.05 ^b	5 ± 0.06 ^b	2 ± 0.08 ^b	22 ± 0.11 ^b
b) No, never	90 ± 0.07 ^a	95 ± 0.06 ^a	98 ± 0.07 ^a	78 ± 0.14 ^a
I have purchased more packaged food since the COVID-19 pandemic started.				
a) Yes	66 ± 0.11 ^a	70 ± 0.12 ^a	65 ± 0.10 ^a	63 ± 0.15 ^a
b) No, never	34 ± 0.10 ^b	30 ± 0.13 ^b	35 ± 0.12 ^b	37 ± 0.15 ^b
I have had a more favorable opinion of the healthfulness of packaged foods				
a) Yes	73 ± 0.05 ^a	63 ± 0.11 ^a	72 ± 0.11 ^a	85 ± 0.06 ^a
b) No, never	27 ± 0.08 ^b	37 ± 0.10 ^b	28 ± 0.11 ^b	15 ± 0.07 ^b
I have been more willing to buy fresh products since the COVID-19 pandemic started				
Yes	58 ± 0.12 ^a	55 ± 0.05 ^a	57 ± 0.10 ^a	62 ± 0.09 ^a
No	42 ± 0.12 ^b	45 ± 0.06 ^b	43 ± 0.10 ^b	38 ± 0.08 ^b
I am very confident that the food I am purchasing is safe to consume.				
Yes	21 ± 0.14 ^b	31 ± 0.05 ^b	23 ± 0.12 ^b	20 ± 0.08 ^{b,c}
No	24 ± 0.10 ^b	20 ± 0.04 ^c	25 ± 0.11 ^b	24 ± 0.07 ^b
I am not sure	55 ± 0.09 ^a	49 ± 0.04 ^a	52 ± 0.12 ^a	56 ± 0.14 ^a

The values are expressed as the mean ± SD, and different superscript letters show significant differences ($p < 0.05$).

putting food items in the freezer since the start of the COVID-19 pandemic. While it is possible for a person to contact COVID-19 from touching an infected surface or object and then touching his or her face, there is currently no evidence to support the idea that the virus can be spread by food packaging (CSIS, 2020). A majority of the Turkish people (76 ± 0.05%) seem to understand this issue well. When the results were evaluated in terms of age groups, it was seen that there was no statistically significant difference ($p > 0.05$).

Freezing retards the growth of microorganisms and enzymes that cause food spoilage. However, freezing has very little impact on the infectivity of foodborne enteric viruses (Bozkurt *et al.*, 2020; Nasheri *et al.*, 2019). Only a few studies have been performed on the effect of freezing on coronavirus infectivity. Lamarre and Talbot (1989) showed that the infectious titer of

human coronavirus did not cause any significant reduction when subjected to 25 cycles of thawing and freezing. As shown in Table 3, 44% of the Turkish consumers think that freezing the foods kills the COVID-19 virus. When the results were evaluated in terms of age groups, majority of all age groups have no idea about this question ($p < 0.05$).

According to the recent study by Pastorino *et al.* (2020), the 92°C and 15 min protocol was able to totally inactivate the virus (>6 Log₁₀ decrease). As given in Table 3, 77% of the Turkish consumers agree that cooked meat is not a great risk for the consumer in terms of COVID-19.

Fifty-five percent (55%) of the Turkish consumers do not agree that COVID-19 can spread through dairy products. However, 20% of them have no idea about this issue.

Table 3. Knowledge and attitudes of consumers about food preservation techniques during the COVID-19 pandemic.

Results obtained for different age groups				
	Overall	<20	20–65	>65
Which food preservation technique have you adopted most during COVID-19 quarantine days?				
a) Drying	21 ± 0.05 ^b	3 ± 0.02 ^b	27 ± 0.09 ^b	33 ± 0.04 ^b
b) Freezing	66 ± 0.08 ^a	95 ± 0.05 ^a	61 ± 0.10 ^a	42 ± 0.05 ^a
c) Canning	13 ± 0.07 ^c	2 ± 0.01 ^b	12 ± 0.08 ^c	25 ± 0.04 ^c
I have needed to wash or remove packaging before putting in the freezer since the COVID-19 pandemic started.				
a) Yes	20 ± 0.06 ^b	22 ± 0.09 ^b	31 ± 0.07 ^b	18 ± 0.04 ^b
b) No, never	76 ± 0.05 ^a	78 ± 0.10 ^a	69 ± 0.08 ^a	82 ± 0.05 ^a
Freezing the foods kills the COVID-19 virus.				
I absolutely agree	18 ± 0.04 ^c	12 ± 0.02 ^c	23 ± 0.07 ^b	18 ± 0.03 ^c
I agree	26 ± 0.03 ^b	23 ± 0.04 ^b	25 ± 0.06 ^b	30 ± 0.03 ^b
I have no idea	39 ± 0.05 ^a	41 ± 0.04 ^a	32 ± 0.06 ^a	45 ± 0.04 ^a
I do not agree	10 ± 0.06 ^d	14 ± 0.02 ^c	12 ± 0.03 ^c	4 ± 0.08 ^d
I absolutely disagree	7 ± 0.05 ^d	10 ± 0.03 ^c	8 ± 0.09 ^d	3 ± 0.06 ^d
Cooked meat is not a great risk for the consumer in terms of COVID-19.				
I absolutely agree	42 ± 0.07 ^a	41 ± 0.05 ^a	45 ± 0.12 ^a	40 ± 0.12 ^a
I agree	35 ± 0.06 ^b	35 ± 0.04 ^b	38 ± 0.06 ^b	33 ± 0.08 ^b
I have no idea	12 ± 0.06 ^c	10 ± 0.03 ^c	7 ± 0.06 ^c	20 ± 0.06 ^c
I do not agree	8 ± 0.05 ^d	11 ± 0.04 ^c	11 ± 0.04 ^c	5 ± 0.04 ^d
I absolutely disagree	3 ± 0.05 ^e	3 ± 0.02 ^d	3 ± 0.04 ^d	2 ± 0.05 ^e
The COVID-19 can spread through dairy products				
I absolutely agree	11 ± 0.05 ^a	8 ± 0.07 ^{c,d}	9 ± 0.03 ^d	17 ± 0.02 ^b
I agree	13 ± 0.04 ^d	12 ± 0.07 ^c	14 ± 0.04 ^c	13 ± 0.04 ^{b,c}
I have no idea	20 ± 0.03 ^b	20 ± 0.06 ^b	10 ± 0.07 ^d	30 ± 0.06 ^a
I do not agree	17 ± 0.02 ^c	20 ± 0.04 ^b	22 ± 0.06 ^b	10 ± 0.04 ^c
I absolutely disagree	38 ± 0.04 ^a	40 ± 0.02 ^a	45 ± 0.06 ^a	30 ± 0.05 ^a

The values are expressed as the mean ± SD, and different superscript letters show significant differences ($p < 0.05$).

The results of this section indicated that much more education is needed on food and COVID-19.

Changes in eating habits of consumers during the covid-19 pandemic

Since many nutritional deficiencies may cause immune dysfunction resulting in increased susceptibility to infectious diseases, special attention should be given to promote immune function to enhance viral resistance among the populace (Khayyatzadeh, 2020). Poor nutritional quality diet is one of the main risk factors for non-communicable diseases (Marty *et al.*, 2021). As shown in Table 4, 65 ± 0.15% of the respondents have tried to consume more food that boost the immune system, and 62 ± 0.09% of the consumers have eaten more often since the COVID-19 pandemic started ($p < 0.05$). When the results were evaluated in terms of age groups, it was seen that there was no statistically significant difference ($p > 0.05$).

Antioxidants cause an increase in the number of T-cell subsets, lymphocyte response to mitogen, interleukin-2 production, potentiated natural killer cell activity, and the response to influenza virus vaccine compared with placebo (Chandra, 1992). Many studies have stated that fruits and vegetables that supply micronutrients can support immune function thanks to their high antioxidant activity and their rich vitamin C, vitamin E, and beta-carotene content. Sixty-four percent (64 ± 0.04%) of the respondents have tried to eat more fresh fruit and vegetable since the COVID-19 pandemic started (Table 4). Turkish consumers have had a proper eating habit regarding fruit and vegetable consumption since the COVID-19 pandemic started.

The increase in the consumption of dairy products of consumers was investigated (Table 4). Fifty-two percent (52 ± 0.07%) of the respondents have tried to consume more dairy products since the COVID-19 pandemic started. Dairy products are a great source of energy, protein, and

Table 4. Changes in eating habits.

Results obtained for different age groups				
	Overall	<20	20–65	>65
I have tried to consume more food that boosts the immune system since the COVID-19 pandemic started.				
a) Yes	65 ± 0.15 ^a	60 ± 0.16 ^a	70 ± 0.09 ^a	65 ± 0.10 ^a
b) No	45 ± 0.16 ^b	40 ± 0.18 ^b	30 ± 0.08 ^b	35 ± 0.09 ^b
I have eaten.....since the COVID- 19 pandemic started. (Fill in the blank)				
a) Less often	38 ± 0.08 ^b	46 ± 0.10 ^b	33 ± 0.14 ^b	36 ± 0.09 ^b
b) More often	62 ± 0.09 ^a	54 ± 0.07 ^a	67 ± 0.12 ^a	64 ± 0.08 ^a
I have tried to consume more fresh fruit and vegetable since the COVID-19 pandemic started				
a) Yes	64 ± 0.04 ^a	50 ± 0.02 ^a	71 ± 0.14 ^a	70 ± 0.05 ^a
b) No	36 ± 0.07 ^b	50 ± 0.03 ^a	29 ± 0.12 ^b	30 ± 0.06 ^b
I have tried to consume more dairy products since the COVID-19 pandemic started.				
a) Yes	52 ± 0.07 ^a	42 ± 0.06 ^b	53 ± 0.05 ^a	56 ± 0.04 ^a
b) No	48 ± 0.08 ^b	48 ± 0.04 ^a	47 ± 0.03 ^b	44 ± 0.04 ^b
I have tried to consume more wholegrain since the COVID-19 pandemic started				
a) Yes	35 ± 0.10 ^b	30 ± 0.06 ^b	39 ± 0.05 ^a	37 ± 0.04 ^b
b) No	65 ± 0.09 ^a	55 ± 0.07 ^a	41 ± 0.05 ^a	48 ± 0.04 ^a
I have tried to consume less red meat since the COVID-19 pandemic started				
a) Yes	49 ± 0.02 ^a	50 ± 0.06 ^a	45 ± 0.14 ^b	51 ± 0.07 ^a
b) No	51 ± 0.03 ^a	50 ± 0.06 ^a	55 ± 0.12 ^a	49 ± 0.07 ^a
I have tried to consume more fish and seafood since the COVID-19 pandemic started				
a) Yes	53 ± 0.06 ^a	45 ± 0.03 ^b	55 ± 0.11 ^b	58 ± 0.06 ^{a,b}
b) No	47 ± 0.05 ^b	75 ± 0.04 ^a	68 ± 0.11 ^a	65 ± 0.04 ^a
I have tried to consume more home cooked meal since the COVID-19 pandemic started.				
a) Yes	77 ± 0.08 ^a	61 ± 0.05 ^a	85 ± 0.08 ^a	85 ± 0.11 ^a
b) No	23 ± 0.07 ^b	39 ± 0.06 ^b	15 ± 0.07 ^b	15 ± 0.12 ^b
I have taken vitamin supplement since the COVID-19 pandemic started				
a) Yes	51 ± 0.04 ^a	32 ± 0.07 ^b	41 ± 0.06 ^b	54 ± 0.08 ^a
b) No, never	49 ± 0.05 ^a	68 ± 0.08 ^a	59 ± 0.04 ^a	46 ± 0.09 ^b

The values are expressed as the mean ± SD, and different superscript letters show significant differences ($p < 0.05$).

micronutrients, including riboflavin, calcium, selenium, magnesium, and vitamins B₅ and B₁₂ (Gaucheron, 2011). Therefore, it is very healthy to increase the trend towards the consumption of dairy products.

Whole-grain food intake has a protective effect against oxidative stress, inflammatory and pathology of infectious origin (Jacobs *et al.*, 2007). Since micronutrients are generally present in higher concentrations in the outer part of the grain, refined flours which comprise only starchy endosperm are lower in micronutrients than whole grains. As seen in Table 4, only 35 ± 0.10% of the respondents have tried to consume more wholegrain since the COVID-19 pandemic started. In Turkey, the most consumed types of bread are traditional white bread, which comprise only starchy endosperm. This explains why 65% of consumers answered “no” to the question.

Increasing consumption of red meat, especially in its processed forms, has negative health effects (Richi *et al.*, 2015). However, 51% of the Turkish consumers have not tried to consume less red meat since the COVID-19 pandemic started. The average red meat consumption in 2019 was 13.6 kg per capita which is less than the developed countries (Özen *et al.*, 2019). This rate, which is already low in Turkey, has not changed much with the advent of the COVID-19 pandemic. When the results were evaluated in terms of age groups, it was seen that there was no statistically significant difference ($p > 0.05$).

Fish and other sea foods are a rich source of high protein. They are low in calories, total fat, and saturated fat. They contain numerous vitamins and minerals. As seen in Table 4, 53 ± 0.06% of the respondents have tried to consume more fish and seafood since the COVID-19 pandemic started.

Seventy-seven percent ($77 \pm 0.08\%$) of the consumers have tried to consume more home-cooked meal since the COVID-19 pandemic started. In Turkey, during the quarantine days, people started to share their home-made meals and healthy diets through social media. Moreover, people have tried to bake bakery products such as bread, muffin pida. Then, they have shared photographs of them with “stay at home” hashtag in social media.

When the results were evaluated in terms of age groups, consumers over 65 years have paid more attention to eating healthy than other age groups ($p < 0.05$). Older people appear to be at a higher risk of developing more serious complications of COVID-19 disease (CDC, 2020). Although younger people appear generally to be at lower risk (Jordan *et al.*, 2020), majority of the consumers aged below 25 years have also paid more attention to eating healthy. It seems that consumers will want to continue maximizing their health in order to boost their immunity and reduce vulnerability to disease long after the pandemic. Marinković and Lazarević (2021) surveyed eating habits and consumer food shopping behavior in Serbia during the COVID-19 pandemic. Their study revealed that eating and purchasing habits of consumers were altered significantly during the Covid-19 pandemic.

Source of knowledge about COVID-19 and food

Consumers have received a variety of information about COVID-19 and food from the websites, television, newspapers, scientific journals, university scientists, health professionals, talk shows, and magazines. Many professors and scientists from universities have been invited to TV programs to share their opinions and studies on COVID-19. Moreover, they have given several advices through newspapers. Furthermore, the Minister of Health of the Republic of Turkey have often shared decisions and advises of the scientific committee of COVID-19 through TV and social media.

The source of information is of crucial importance. When people do not trust the source of information, they generally are not willing to change their behaviors (Bolek, 2020). It was investigated whether consumers found media tools reliable during the COVID-19 outbreak.

Fifty-nine percent of the participants have opined that publications and websites of the government give extremely reliable information about the COVID-19 pandemic (Table 5). When the results were evaluated in terms of age groups, this ratio was relatively low (39%) for the participants aged below 25 years ($p < 0.05$). However, majority of the consumers (75%) aged over 65 years rely on websites and government publications for information on COVID-19.

Fifty-nine percent of the consumers think that the daily news on TV is extremely reliable or reliable, whereas 36% of the consumers think that daily news on TV is unreliable or extremely unreliable. Majority of the participants (87%) aged over 65 years rely on daily news on TV ($p < 0.05$). It was revealed that the “age” criterion significantly affected the ratio of trusting the daily news in Turkey ($p < 0.05$).

Newspapers carry information about economy, politics, sports, entertainment, business, trade, industry, and commerce. Many professors and scientists from universities have written articles in newspapers about COVID-19, and they have given advice about hygiene precautions since the COVID-19 pandemic started. As seen in Table 5, majority (81%) of the respondents think that the newspapers are extremely reliable or reliable. Kiouisis (2001) showed that newspapers were regarded as more credible than the Internet and television. Hence, newspapers have the very important duty of raising public awareness.

Eighty-four percent of the consumers from all demographics stated that scientific journals are extremely reliable or reliable, whereas only 3% of the consumers think they are unreliable or extremely unreliable. Consumers think that newspapers are as reliable as scientific journals ($p > 0.05$).

Eighty-four percent of the consumers from all demographics indicated that university scientists are extremely reliable or reliable. These results revealed that scientists are one of the primary sources of trusted information and they are very important for public education about COVID-19.

Health professionals have a very important role in improving access and quality of health care for the population. They have been at the front line of the COVID-19 outbreak response and they have been exposed to hazards that put them at risk of infection. As shown in Table 5, 58% of the participants rely on them.

Magazines and talk shows have a wide audience in Turkey and sometimes scientists are invited to these programs. However, only $10 \pm 0.07\%$ of the consumers have found them extremely reliable since the COVID-19 pandemic started.

Conclusion

The results of this survey revealed that the COVID-19 pandemic has caused substantial changes in food purchasing behavior and eating habits of Turkish consumers. Consumers from all demographics, but especially from the age group below 65 years, have adopted online food

Table 5. Source of knowledge about COVID-19 and food.

Results obtained for different age groups				
	Overall	<20	20–65	>65
Websites and publications of government				
a) Extremely reliable	26 ± 0.02 ^b	16 ± 0.05 ^{d,c}	28 ± 0.11 ^b	35 ± 0.04 ^b
b) Reliable	33 ± 0.04 ^a	23 ± 0.02 ^b	36 ± 0.14 ^a	40 ± 0.04 ^a
c) Unreliable	26 ± 0.05 ^b	35 ± 0.03 ^a	25 ± 0.14 ^{b,c}	18 ± 0.04 ^c
d) Extremely unreliable	11 ± 0.03 ^c	20 ± 0.07 ^c	8 ± 0.12 ^c	5 ± 0.04 ^d
e) No idea	4 ± 0.04 ^d	6 ± 0.02 ^d	3 ± 0.12 ^{c,d}	2 ± 0.04 ^{d,e}
Daily news on television				
a) Extremely reliable	30 ± 0.05 ^a	22 ± 0.04 ^{b,c}	27 ± 0.08 ^b	40 ± 0.09 ^a
b) Reliable	31 ± 0.04 ^a	23 ± 0.07 ^{b,c}	32 ± 0.04 ^a	37 ± 0.10 ^a
c) Unreliable	22 ± 0.08 ^b	31 ± 0.06 ^a	23 ± 0.05 ^c	12 ± 0.08 ^b
d) Extremely unreliable	14 ± 0.07 ^c	24 ± 0.03 ^b	14 ± 0.04 ^d	5 ± 0.08 ^c
e) No idea	3 ± 0.06 ^d	0 ± 0.04	4 ± 0.03 ^e	6 ± 0.06 ^c
Television and radio programs				
a) Extremely reliable	29 ± 0.04 ^a	25 ± 0.04 ^b	30 ± 0.04 ^a	33 ± 0.04 ^{a,b}
b) Reliable	27 ± 0.04 ^a	20 ± 0.04 ^c	27 ± 0.04 ^{a,b}	35 ± 0.04 ^a
c) Unreliable	25 ± 0.04 ^{a,b}	33 ± 0.04 ^a	22 ± 0.04 ^b	20 ± 0.04 ^c
d) Extremely unreliable	14 ± 0.04 ^c	20 ± 0.04 ^c	16 ± 0.04 ^c	7 ± 0.04 ^d
e) No idea	3 ± 0.04 ^d	2 ± 0.04 ^d	5 ± 0.04 ^d	3 ± 0.04 ^{d,e}
Newspapers				
a) Extremely reliable	55 ± 0.04 ^a	54 ± 0.04 ^a	50 ± 0.04 ^a	60 ± 0.04 ^a
b) Reliable	26 ± 0.04 ^b	21 ± 0.04 ^b	27 ± 0.04 ^b	29 ± 0.04 ^b
c) Unreliable	8 ± 0.04 ^c	6 ± 0.04 ^{c,d}	16 ± 0.04 ^c	3 ± 0.04 ^{c,d}
d) Extremely unreliable	5 ± 0.04 ^d	9 ± 0.04 ^c	4 ± 0.04 ^d	3 ± 0.04 ^{c,d}
e) No idea	6 ± 0.04 ^{c,d}	10 ± 0.04 ^c	3 ± 0.04 ^d	5 ± 0.04 ^c
Scientific journals				
a) Extremely reliable	70 ± 0.14 ^a	69 ± 0.05 ^a	72 ± 0.11 ^a	70 ± 0.10 ^a
b) Reliable	14 ± 0.12 ^b	28 ± 0.04 ^b	23 ± 0.12 ^b	20 ± 0.08 ^b
c) Unreliable	2 ± 0.10 ^c	1 ± 0.04 ^c	2 ± 0.08 ^c	3 ± 0.08 ^c
d) Extremely unreliable	1 ± 0.12 ^c	0 ± 0.03	1 ± 0.05 ^c	2 ± 0.06 ^c
e) No idea	3 ± 0.10 ^c	2 ± 0.03 ^c	2 ± 0.05 ^c	5 ± 0.06 ^c
University scientists				
a) Extremely reliable	43 ± 0.14 ^a	38 ± 0.14 ^b	42 ± 0.09 ^a	50 ± 0.12 ^a
b) Reliable	41 ± 0.12 ^{a,b}	44 ± 0.12 ^a	38 ± 0.10 ^b	40 ± 0.12 ^b
c) Unreliable	10 ± 0.08 ^c	8 ± 0.13 ^c	18 ± 0.09 ^c	4 ± 0.13 ^c
d) Extremely unreliable	3 ± 0.16 ^d	6 ± 0.13 ^{c,d}	1 ± 0.07 ^d	2 ± 0.13 ^{c,d}
e) No idea	3 ± 0.16 ^d	4 ± 0.10 ^d	1 ± 0.07 ^d	4 ± 0.14 ^c
Health professionals				
a) Extremely reliable	28 ± 0.07 ^{a,b}	21 ± 0.07 ^b	28 ± 0.07 ^b	35 ± 0.06 ^a
b) Reliable	30 ± 0.08 ^a	29 ± 0.04 ^a	32 ± 0.08 ^a	30 ± 0.05 ^b
c) Unreliable	18 ± 0.04 ^c	20 ± 0.05 ^b	18 ± 0.05 ^c	15 ± 0.04 ^c
d) Extremely unreliable	11 ± 0.04 ^{d,e}	15 ± 0.03 ^c	12 ± 0.05 ^d	5 ± 0.03 ^d
e) No idea	13 ± 0.05 ^d	15 ± 0.02 ^c	10 ± 0.06 ^{d,e}	15 ± 0.03 ^c
Talk shows and magazines				
a) Extremely reliable	10 ± 0.07 ^c	15 ± 0.05 ^c	3 ± 0.06 ^e	12 ± 0.04 ^c
b) Reliable	31 ± 0.06 ^a	29 ± 0.05 ^b	24 ± 0.06 ^{b,c}	39 ± 0.04 ^a
c) Unreliable	33 ± 0.04 ^a	37 ± 0.04 ^a	35 ± 0.08 ^a	28 ± 0.04 ^b
d) Extremely unreliable	15 ± 0.05 ^b	9 ± 0.04 ^d	26 ± 0.05 ^b	9 ± 0.04 ^{c,d}
e) No idea	11 ± 0.05 ^c	10 ± 0.02 ^d	12 ± 0.04 ^d	12 ± 0.04 ^c

The values are expressed as the mean ± SD, and different superscript letters show significant differences ($p < 0.05$).

purchasing. Majority of the respondents have been more than willing to buy fresh products since the COVID-19 pandemic started. Consumers have adopted the practice of preserving their foods by freezing during quarantine days. Moreover, the COVID-19 pandemic has caused many changes in the eating habits of Turkish consumers. Sixty-five percent of the consumers have tried to consume more food that boosts the immune system since the COVID-19 pandemic started. Furthermore, they have had a proper eating habit regarding fruit and vegetable consumption. When the results were evaluated in terms of age groups, consumers over 65 years paid more attention to eating healthy than other age groups ($p < 0.05$). On the other hand, 77% of the consumers have tried to consume more home-cooked meal since the COVID-19 pandemic started. Furthermore, Turkish consumers relied on media tools to a great extent to obtain information about COVID-19. Data obtained from the study indicated that much more education is needed on food and COVID-19. Media tools should be used effectively to communicate accurate information during the COVID-19 pandemic. Future research should investigate how the pandemic affects long-term disparities in food and nutrition for disadvantaged populations and how the evolution of food security impacts, as well as food assistance expansion and health care screenings, may affect food insecurity outcomes as COVID-19 unfolds. Furthermore, it is necessary to carry out studies to compare the effects of media types in conditions such as COVID-19.

References

- Aday, S. and Aday, M. S., 2020. Impact of COVID-19 on the food supply chain. *Food Quality and Safety* 4(4): 167–180. <https://doi.org/10.1093/fqsafe/fyaa024>
- Ali, S., Khalid, N., Javed, H.M.U. and Islam, D.M., 2021. Consumer adoption of online food delivery ordering (OFDO) services in Pakistan: The impact of the COVID-19 pandemic situation. *Journal of Open Innovation: Technology, Market, and Complexity* 7(1): 10. <https://doi.org/10.3390/joitmc7010010>
- Bakalis, S., Valdramidis, V., Argyropoulos, D., Ahrne, L., Chen, J., Cullen, P. J., et al. 2020. Perspectives from CO+ RE: How COVID-19 changed our food systems and food security paradigms. *Current Research in Food Science*, 3, 166. <https://doi.org/10.1016/j.crf.2020.05.003>
- Ben Hassen, T., El Bilali, H. and Allahyari, M.S., 2020. Impact of COVID-19 on food behavior and consumption in Qatar. *Sustainability* 12(17): 6973. <https://doi.org/10.3390/su12176973>
- Bolek, S., 2020. Consumer knowledge, attitudes, and judgments about food safety: a consumer analysis. *Trends in Food Science and Technology*, 102, 242–248. <https://doi.org/10.1016/j.tifs.2020.03.009>
- Bozkurt, H., Phan-Thien, K.Y., van Ogtrop, F., Bell, T. and McConchie, R., 2020. Outbreaks, occurrence, and control of norovirus and hepatitis a virus contamination in berries: a review. *Critical Reviews in Food Science and Nutrition*, 61(1), 116–138. <https://doi.org/10.1080/10408398.2020.1719383>
- Butler, M.J. and Barrientos, R.M., 2020. The impact of nutrition on COVID-19 susceptibility and long-term consequences. *Brain, Behavior, and Immunity*, 87, 53–54. <https://doi.org/10.1016/j.bbi.2020.04.040>
- Celik, B. and Dane, S., 2020. The effects of COVID-19 pandemic outbreak on food consumption preferences and their causes. *Journal of Research in Medical and Dental Science* 8(3): 169–173.
- Center for Disease Control and Prevention (CDC), 2020. Coronavirus disease 2019 (COVID-19). Available at: <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/older-adults.html>
- Center for Strategic and International Studies (CSIS), 2020. Covid-19 and food security. Available at: <https://www.csis.org/programs/global-food-security-program/covid-19-and-food-security>
- Chandra, R.K., 1992. Effect of vitamin and trace-element supplementation on immune responses and infection in elderly subjects. *Lancet* 340: 1124. [https://doi.org/10.1016/0140-6736\(92\)93151-C](https://doi.org/10.1016/0140-6736(92)93151-C)
- Chang, H.H. and Meyerhoefer, C.D., 2021. COVID-19 and the demand for online food shopping services: empirical Evidence from Taiwan. *American Journal of Agricultural Economics* 103(2): 448–465. <https://doi.org/10.1111/ajae.12170>
- Chenarides, L., Manfredo, M. and Richards, T.J., 2021. COVID-19 and food supply chains. *Applied Economic Perspectives and Policy* 43(1): 270–279. <https://doi.org/10.1002/aep.13085>
- Criteo Coronavirus Survey, 2020. Coronavirus consumer trends: consumer electronics, pet supplies, and more. Resource document. Available at: <https://www.criteo.com/insights/coronavirus-consumer-trends/>
- Ellison, B., McFadden, B., Rickard, B.J. and Wilson, N.L., 2021. Examining food purchase behavior and food values during the COVID-19 pandemic. *Applied Economic Perspectives and Policy* 43(1): 58–72. <https://doi.org/10.1002/aep.13118>
- Gaucheron, F., 2011. Milk and dairy products: a unique micronutrient combination. *Journal of the American College of Nutrition* 30(Suppl 5): 400S–409S. <https://doi.org/10.1080/07315724.2011.10719983>
- Głabaska, D., Skolmowska, D. and Guzek, D., 2020. Population-based study of the changes in the food choice determinants of secondary school students: Polish adolescents' COVID-19 experience (PLACE-19) study. *Nutrients* 12(9): 2640. <https://doi.org/10.3390/nu12092640>
- Gov.uk.(2020).Guidanceforconsumersoncoronavirus(COVID-19)and food. Available at: <https://www.gov.uk/government/publications/guidance-for-consumers-on-coronavirus-covid-19-and-food/guidance-for-consumers-on-coronavirus-covid-19-and-food>
- Grashuis, J., Skevas, T. and Segovia, M.S., 2020. Grocery shopping preferences during the COVID-19 pandemic. *Sustainability* 12(13): 5369. <https://doi.org/10.3390/su12135369>
- Gundersen, C., Hake, M., Dewey, A. and Engelhard, E., 2021. Food insecurity during COVID-19. *Applied Economic Perspectives and Policy* 43(1): 153–161. <https://doi.org/10.1002/aep.13100>
- Hirvonen, K., de Brauw, A. and Abate, G.T., 2021. Food consumption and food security during the COVID-19 pandemic in Addis

- Ababa. *American Journal of Agricultural Economics* 103(3): 772–789. <https://doi.org/10.1111/ajae.12206>
- Hobbs, J.E., 2020. Food supply chains during the COVID-19 pandemic. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie* 68(2): 171–176. <https://doi.org/10.1111/cjag.12237>
- Jacobs, D.R., Jr, Andersen, L.F. and Blomhoff, R., 2007. Whole-grain consumption is associated with a reduced risk of noncardiovascular, noncancer death attributed to inflammatory diseases in the Iowa Women's Health Study. *The American Journal of Clinical Nutrition* 85(6): 1606–1614. <https://doi.org/10.1093/ajcn/85.6.1606>
- Jordan, R.E., Adab, P. and Cheng, K.K., 2020. Covid-19: risk factors for severe disease and death. *BMJ* 368: m1198. <https://doi.org/10.1136/bmj.m1198>
- Kau, A.L., Ahern, P.P., Griffin, N.W., Goodman, A.L. and Gordon, J.I., 2011. Human nutrition, the gut microbiome and the immune system. *Nature* 474(7351): 327–336. <https://doi.org/10.1038/nature10213>
- Khayyat-zadeh, S.S., 2020. Nutrition and infection with COVID-19. *Journal of Nutrition and Food Security* 5(2): 93–96. <https://doi.org/10.18502/jnfs.v5i2.2795>
- Kiousis, S., 2001. Public trust or mistrust? Perceptions of media credibility in the information age. *Mass Communication and Society* 4(4): 381–403. https://doi.org/10.1207/S15327825MCS0404_4
- Lamarre, A. and Talbot, P.J., 1989. Effect of pH and temperature on the infectivity of human coronavirus 229E. *Canadian Journal of Microbiology* 35(10): 972–974. <https://doi.org/10.1139/m89-160>
- Marinković, V. and Lazarević, J., 2021. Eating habits and consumer food shopping behaviour during COVID-19 virus pandemic: insights from Serbia. *British Food Journal* (Ahead of print) <https://doi.org/10.1108/BFJ-11-2020-1072>
- Marty, L., de Lauzon-Guillain, B., Labesse, M. and Nicklaus, S., 2021. Food choice motives and the nutritional quality of diet during the COVID-19 lockdown in France. *Appetite* 157: 105005. <https://doi.org/10.1016/j.appet.2020.105005>
- Nasheri, N., Vester, A. and Petronella, N., 2019. Foodborne viral outbreaks associated with frozen produce. *Epidemiology and Infection* (147): 1–8. <https://doi.org/10.1017/S0950268819001791>
- Niles, M.T., Bertmann, F., Belarmino, E.H., Wentworth, T., Biehl, E. and Neff, R., 2020. The early food insecurity impacts of COVID-19. *Nutrients* 12(7): 2096. <https://doi.org/10.3390/nu12072096>
- Özen, D., Tekindal, M.A. and Çevrimli, M.B., 2019. Modeling and forecasting meat consumption per Capita in Turkey. *Erciyes Üniversitesi Veteriner Fakültesi Dergisi* 16(2): 122–129. <https://doi.org/10.32707/ercivet.595626>
- Packaging Europa, 2020. Live! Coronavirus coverage: packaged food manufacturers turn to direct-to-consumer channel. Available at: <https://packagingeurope.com/navigating-the-coronavirus-crisis/>
- Pastorino, B., Touret, F., Gilles, M., De Lamballerie, X. and Charrel, R.N., 2020. Evaluation of heating and chemical protocols for inactivating SARS-CoV-2. *BioRxiv* (Ahead of print). <https://doi.org/10.1101/2020.04.11.036855>
- Restrepo, B.J., Rabbitt, M.P. and Gregory, C.A., 2021. The effect of unemployment on food spending and adequacy: Evidence from coronavirus-induced firm closures. *Applied Economic Perspectives and Policy* 43(1), 185–204. <https://doi.org/10.1002/aapp.13143>
- Richi, E.B., Baumer, B., Conrad, B., Darioli, R., Schmid, A. and Keller, U., 2015. Health risks associated with meat consumption: a review of epidemiological studies. *International Journal of Vitamin and Nutrition Research* 85(1–2): 70–78. <https://doi.org/10.1024/0300-9831/a000224>
- SAS, 1999. Proprietary software. Release 8.2 (TS2MO), SAS Ins., Cary, NC.
- Scacchi, A., Catozzi, D., Boietti, E., Bert, F. and Siliquini, R., 2021. COVID-19 lockdown and self-perceived changes of food choice, waste, impulse buying and their determinants in Italy: QuarantEat, a cross-sectional study. *Foods* 10(2): 306. <https://doi.org/10.3390/foods10020306>
- Wang, E., An, N., Gao, Z., Kiprop, E. and Geng, X., 2020. Consumer food stockpiling behavior and willingness to pay for food reserves in COVID-19. *Food Security* 12(4): 739–747. <https://doi.org/10.1007/s12571-020-01092-1>