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The Impact of the COVID-19 Pandemic on Changes in Food Choice, Purchase, and Consumption Patterns in the World: A Review Study

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ABSTRACT

Background: The COVID-19 pandemic has caused serious disruption to food security in the world. Declining incomes, purchasing power, and food production and rising prices in the food supply and consumption chain have affected and increased the risk of food insecurity, the most important consequence of which is the worsening of world hunger and malnutrition. The outbreak of the COVID-19 pandemic since December 2019 in Wuhan, and its spread around the world has caused major changes in people's lives; one of the most important affected areas is the food and nutrition sector. This study aims to evaluate the effect of the COVID-19 pandemic on changes in food choice, purchase, and consumption. **Methods**: Keywords "food", "nutrition", "choice or select", "buy or purchase", "consumption" and "behavior" in combination with the word "COVID-19" were used to search for English articles in Google Scholar, PubMed, and Scopus. All articles from the beginning of the pandemic to the end of May 2021 were included in this study. After deleting some studies due to non-English language, duplication, inconsistency with the intended purpose, and being reviewed, 25 articles entered the final phase. **Results**: The results indicate that forced quarantine and travel restrictions with the formation of new nutritional behaviors have affected the quality of nutrition of different populations. It has positive consequences, such as reducing ready meals and fast foods, increasing attention to nutrients to promote and maintain health and reduce food waste. The negative consequences include increased intake of snacks, high-calorie foods, canned foods, and processed meats in some countries. **Conclusion**: Decreased nutritional quality from this pandemic can have adverse effects on public health. More detailed studies are needed to examine the impact of quarantine on food choice, purchase, and consumption during the COVID-19 pandemic.

Keywords: *COVID-19; Food; Purchase; Nutrition*

Introduction

In December 2019, the corona virus started in Wuhan, the center of Hubei Province china. It spread rapidly, infected individuals, and engaged health-related organizations (Singhal, 2020). In

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March 2020, COVID-19 was known as an infectious disease by the world Health Organization (WHO) (Matsuo *et al.*, 2021).

At the end of that month, more than 100 countries around the world announced that they had adopted "Lockdown" measures (Snuggs and McGregor, 2021). These sudden changes in people's lives have had negative impacts on their mental health and behaviors, such as eating habits (Bakaloudi DR *et al.*, 2021).

It should be noted that diseases not only affect people's health, but also change their economic, social, agricultural, food security, and dietary status. Agriculture is one of the most important sectors of human development and is related to food security (Obayelu *et al.*, 2021), and this pandemic has created serious challenges for the stable and sustainable functioning of food markets (Jámbor *et al.*, 2020).

Transportation, commerce economy, subsistence, food supply chain, and food production sector have been all affected and damaged as a result of this worldwide pandemic and the due lockdown regulations (Gopinath, 2020). The COVID-19 pandemic has led to a limit on the number of specific food items that consumers could already buy easily (Sim *et al.*, 2020). In addition to the psychological and emotional problems of to the coronavirus outbreak, limited access to daily food purchase may lead to a reduction in consuming fresh foods, especially fruits, vegetables and fish, and increase in consuming processed foods, such as snacks, ready-to-eat foods, junk foods, snacks, and cereals (Di Renzo *et al.*, 2020).

Recent studies have reported changes in food shopping behaiors during this period. For example, a study in Italy showed that people are buying more foods with long-term food storage, such as pasta, frozen foods, and ultrahigh temperature (UHT) milk than before. On the other hand, the purchase of fresh foods, such as fruits, dairy products with short expire dates and fresh vegetables has decreased during this period (Bracale and Vaccaro, 2020).

It has been well established that food choices are associated with mental and physical health. Some groups may be more vulnerable to the changes of diet and meals during the lockdown. For example, evidences suggest that pandemic anxiety may contribute to greater weight gain in obese adults (Sarlio-Lähteenkorva *et al.*, 2004, Steptoe *et al.*, 1995). Therefore, due to the new conditions created in terms of food access and the mentioned limitations, this review study was conducted to investigate the effect of the COVID-19 pandemic on changes in food choice, purchase, and consumption.

Materials and Methods

Eligibility criteria and search strategy: Manuscripts that assessed the effect of the COVID-19 on purchase, choice or consumption of food and nutrition or eating behavior during the pandemic in the world, were included. The inclusion criteria were non-review articles and articles in English language.

Information sources: Keywords, including "food", "nutrition", "choice or select", "buy or purchase", "consumption", and "behavior", in combination with the word "COVID-19" were used for searching English articles in Google Scholar, PubMed, and Scopus. All related articles from the beginning of the pandemic to the end of May 2021 were included in this study.

Study design: The observational, prospective or retrospective, and case reports were used in this study. In this validity review study, articles were searched by one author and repeated. The citations were saved in EndNote x9 (produced by Clarivate Analytics. PA. USA), and after removing duplicate articles, titles and abstracts were evaluated. The non-English, without full text, and review articles were excluded from the study. Then, a final selection was conducted.

Data extraction: Data extraction was performed in duplicate by 2 authors and included the following attributes. They included country of origin, author(s), aims, purpose, or objective; population characteristics; sample size; methodology or methods, outcomes and

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description of measuring; and related findings.

Results

In searching, 97 articles were extracted. After reviewing the abstracts, 37 articles due to inconsistency with the purpose of the review, 21 articles due to duplication, 8 articles due to lack of abstract or non-English language, and 6 articles due reviewing methodology were excluded. Finally 25 articles were included. In this way, the review stage was finalized. **Figure 1** shows the steps of performing the survey. **Table 1** summarizes the findings of the studied survey.

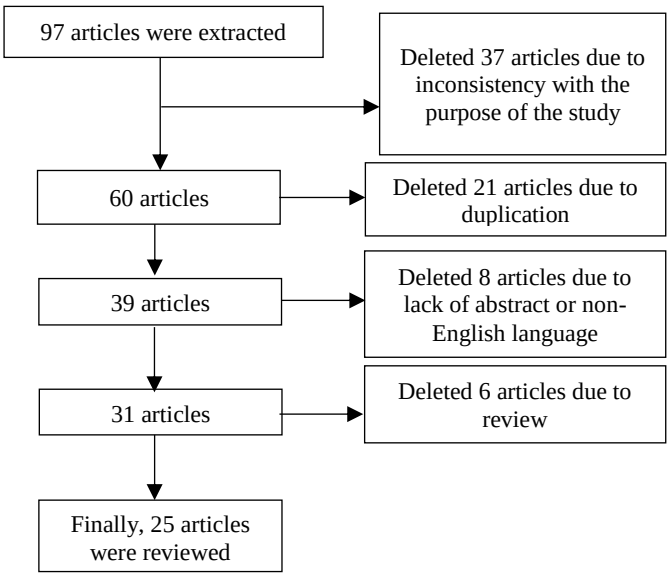


Figure 1. The study stages.

Table 1. Results of changes in food selection, purchase, and consumption during the COVID-19 pandemic.

NO	Authors and date	Country(region)/ sample size	Gender and age	Method	Results
1	Snuggs et al. (Snuggs and McGregor, 2021)	uk/ 240	Male and female > 18 years	Online questionnaire	Attention to choosing healthy foods in order to control their weight and improve their mood
2	Mandal et al. (Mandal *et al.*, 2021)	Bangladesh/ 397	Male and female, > 18 years	Online and phone interview with questionnaire	Significant reduction in consumption of fresh fish as the main food of the people of this country due to rising prices, reduction of food purchases, change of shopping direction to online
3	Cavallo et al. (Cavallo *et al.*, 2020)	Italy / 456	Male and female, > 18 years	Online questionnaire	Significant reduction in food consumption outside the home compared to before the pandemic, increase in consumption of stored and canned foods in exchange for fresh foods
4	Ben Hassen et al. (Ben Hassen *et al.*, 2020)	Qatar / 579	Male and female, > 18 years	Online questionnaire	Clear changes in consumption and purchases, changes from unhealthy foods to healthy foods, increased online food purchases, no frightened purchases to store food
5	Mitchell et al. (Mitchell *et al.*, 2020)	New York / 381564	Male and female, > 18 years	Online questionnaire	Significant increase in consumption of vegetables, increase in consumption of meat and starchy vegetables

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NO	Authors and date	Country(region)/ sample size	Gender and age	Method	Results
6	Widayat et al. (Widayat and Arifin, 2020)	Indonesia / 157	Girl and boy, 15-25 years	Online questionnaire	Most respondents cooked at home, increasing online food purchases
7	Ellison et al. (Ellison *et al.*, 2020)	America/ 1370	Male and female, > 18 years	Online questionnaire	Reducing expend for foods outside the home, increase the share of payments for food purchases, increase dry food purchases, taste was the most important factor in food selection
8	Chenarides et al. (Chenarides *et al.*, 2020)	Arizona America/861	female, > 18 years	Online questionnaire	Increase in food purchases more than usual, avoidance of in-person purchases and increase in online purchases
9	Scacchi et al. (Scacchi *et al.*, 2021)	Italy / 1865	Male and female, > 18 years	Online questionnaire	Further increase in food purchases and consumption, 53% reduction in food waste, less acceptance of online food shopping and reduced sales of bakery products, fresh fish, and salty snacks
10	Huber et al. (Huber *et al.*, 2021)	Germany / 1964	Male and female, 17-50 years	Online questionnaire	No change in the amount of food consumption (52%), significant reduction in food consumption in restaurants and coffee shops
11	Ruíz-Roso et al. (Ruíz-Roso *et al.*, 2020)	Italy, Spain, Brazil, Colombia, Chile/ 726	Girl and boy, 16-19 years	Online questionnaire	Increased consumption of processed foods (this increase was more evident in American countries)
12	Błaszczyk-B et al. (Błaszczyk-Bębenek E *et al.*, 2020)	Poland/ 312	Male and female, > 18 years	Online questionnaire	More than 50% increase in food consumption at home, increase in snack consumption during the day
13	Başaran et al. (Başaran and Pekmezcİ Purut, 2021)	Turkey/ 3017	Male and female, > 18 years	Online questionnaire	Increasing the frequency of consumption of dairy products, vegetables, fruits and reduce the frequency of consumption of bread, meat products and beverages, and increasing the desire to consume healthy foods
14	Janssen et al. (Janssen *et al.*, 2021)	Denmark - Germany - Slovenia / 2680	Male and female, > 18 years	Online questionnaire	Foods with the most changes in consumption include frozen foods, canned food, cakes and biscuits and foods with the least changes in consumption include bread, alcoholic beverages and dairy products
15	Bracale et al. (Bracale and Vaccaro, 2020)	France / 10796	Stores and supermarkets	Online questionnaire	Increased consumption of pasta, flour, eggs, frozen foods and long life milk, reduced consumption of fresh foods, increased baking of bread, pizza, and homemade cakes
16	Schmitt et al. (Schmitt *et al.*, 2021)	Brazil/ 458	Male and female, > 18 years	Online questionnaire	Preference to buy in person, reduced food waste, paying attention to food prices
17	Ben Hassen et al. (Ben Hassen *et al.*, 2021)	Russia/ 1297	Male and female, > 18 years		Reduced number of times of buying and increased the amount bought of foods, increasing face-to-face shopping and less online food buying, reduce access to fruits and vegetables and grains due to rising prices

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Table 1. Results of changes in food selection, purchase, and consumption during the COVID-19 pandemic.

NO	Authors and date	Country(region)/ sample size	Gender and age	Method	Results
18	Chen et al. (Chen *et al.*, 2021)	Wuhan, China/ 156	Male and female, > 18 years	Online questionnaire	Increasing the purchase of fresh food online, decreasing the popularity of online food buying
19	Poelman et al. (Poelman *et al.*, 2021)	Netherlands/ 1030	Male and female, > 18 years	Online questionnaire	Increased willingness to use door-to-door food delivery services, reduced food consumption in women compared to men
20	Celik et al. (Celik and Dane, 2020)	Italy/ 411	Male and female, > 18 years	Online questionnaire	Changing the first and the second food preferences from red meat and processed foods to fruits and vegetables, changing the first and the second food preferences from food price and health to food quality and health
21	Głabska et al. (Głąbska *et al.*, 2020)	Poland/ 2448	Girl and boy, 15-20 years	Online questionnaire	Sensory attractiveness and price are the most important factors in choosing food before and during the lockdown, increasing the importance of weight control and food health
22	Romeo-Arroyo et al. (Romeo-Arroyo *et al.*, 2020)	Spain/600	Male and female, > 18 years	Online questionnaire	Consumption of more than of 50% of foods, similar to the before, except for fish, fruits, and sweets
23	Marty et al. (Marty *et al.*, 2021)	France / 938	Male and female, > 18 years	Online questionnaire	Decreased nutritional quality of the diet in the early months of the pandemic, increased consumption of fruits and vegetables, legumes, fish and seafood.
24	Hirvonen et al. (Hirvonen *et al.*, 2021)	Addis Ababa (Ethiopia)	Male and female, > 18 years	Phone surveys	Increasing food intake, not consuming vegetables (59%), not consuming raw meat (61%), reducing consumption of nuts and legumes (16%)

Discussion

In this review study, the effect of the COVID-19 pandemic on changes in food selection, purchase, and consumption in the world has been investigated. Reviewing the studies showed that during the COVID-19 pandemic, food selection, purchase, and consumption changed in many populations. Some of these changes have been favorable and some unfavorable.

During the COVID-19 crisis, a series of health practices were provided to populations by responsible organizations at both the international and national levels in the form of health care recommendations. They were replaced the usual methods and events of social relations which naturally have long-term effects and as care behaviors, are frequently recommended and emphasized by relevant authorities. Frequent recommendation of these behaviors by the authorities is led to the formation of new behaviors and social interactions (Shafiee Seifabadi and Bagheri Dolatabadi, 2020).

Quarantine and social isolation and the preference for spending less time outside homes, and spending more time with family members, in addition to better health care and nutrition during this period, have led to some positive consequences in the habits and behaviors of food selection and preparation. As a result, more time is spent for cooking at home and consumption of home-cooked food (Ben Hassen *et al.*, 2021, Cavallo *et al.*, 2020, Huber *et al.*, 2021, Scacchi *et al.*, 2021, Widayat and Arifin, 2020). Some studies and surveys in the UK, Italy, Russia, France, and Indonesia have shown that attention to the purchase and supply of healthy and high-quality

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foods that help control weight and improve mood has increased more than before the pandemic (Ben Hassen *et al.*, 2021, Cavallo *et al.*, 2020, Celik and Dane, 2020, Mandal *et al.*, 2021, Marty *et al.*, 2021, Snuggs and McGregor, 2021). These results were not only observed in the adult and youth groups, but also in adolescents in Poland studies (Głąbska *et al.*, 2020). In a review study by Matsuo et al., increasing the purchase and consumption of fruits and vegetables has been mentioned as a positive outcome during this period (Matsuo *et al.*, 2021). In other studies, the results were similar (Celik and Dane, 2020, Marty *et al.*, 2021, Mitchell *et al.*, 2020, Scacchi *et al.*, 2021). In a study in Turkey, it was observed that during the pandemic, in addition to the increase in the consumption of fruits and vegetables, the consumption of dairy products and dietary supplements has also increased (Başaran and Pekmezcİ Purut, 2021). These results were inconsistent with studies in Germany and the Netherlands, in which the consumption of fruits and vegetables, as well as dairy products, were not significantly different from the pre-pandemic period (Huber *et al.*, 2021, Poelman *et al.*, 2021).

On the other hand, with the spread of the pandemic, although social isolation and forced quarantine are essential measures to protect public health, the results show that physical activity and eating behaviors have changed during this period (Ammar *et al.*, 2020). Being in quarantine and social isolation can lead to less time outside homes, limited recreation, and entertainments and family parties, as well as fear and anxiety caused by the possibility of developing COVID-19 in oneself or loved ones. All of them, lead to less physical activity (Ammar *et al.*, 2020) and an increase in the volume and number of meals (Błaszczyk-Bębenek E *et al.*, 2020) or unhealthy snacks (Ben Hassen *et al.*, 2021, Scacchi *et al.*, 2021). Increasing the number of meals does not necessarily mean that the diet is useful due to its high quality, because it can be done by consuming comfortable foods, such as sweets, sweet drinks, snacks, and sauces (Matsuo *et al.*, 2021). In many studies, participants tended to consume foods with high energy density and high concentrations of sugar and fat (comfortable foods to overcome feelings of fear and anxiety and to improve mood (Marty *et al.*, 2021) or as a way for spending time with family and relatives and holding home parties (Marty *et al.*, 2021). Increasing the consumption of these foods usually leads to negative health consequences (Matsuo *et al.*, 2021). Some participants in various studies have cited the good taste of foods (high-calorie foods high in sugar, other carbohydrates, and/or fats) as dietary preferences during this period (Ellison *et al.*, 2020, Głąbska *et al.*, 2020). According to these surveys, these foods help suppressing negative emotions during this period (Landaeta-Díaz *et al.*, 2021). In some studies, increase in caloric intake has been observed (Hirvonen *et al.*, 2021, Marty *et al.*, 2021).

In many studies, increase in the volume or number of meals consumed by the adolescent age group (Pietrobelli *et al.*, 2020) and increase in the consumption of chips and sugary drinks have been reported (Matsuo *et al.*, 2021).

Many studies have also shown changes in food selection and purchasing behaviors due to quarantine conditions and social isolation. These changes include reduction in the frequency of food purchases (Ben Hassen *et al.*, 2021, Janssen *et al.*, 2021), increase in the use of home delivery services (Chenarides *et al.*, 2020), change the purchasing method from face-to-face to online shopping (Ben Hassen *et al.*, 2021, Chen *et al.*, 2021, Ellison *et al.*, 2020, Mandal *et al.*, 2021, Poelman *et al.*, 2021, Widayat and Arifin, 2020). These changes are especially among people with higher education levels (Ben Hassen *et al.*, 2021, Poelman *et al.*, 2021), but less among the elderly (Chen *et al.*, 2021). Moreover, the changes consist of increase in the volume of shopping in each purchase time, increase in food storage (Ben Hassen *et al.*, 2021, Cavallo *et al.*, 2020, Chenarides *et al.*, 2020, Scacchi *et al.*, 2021), increase in purchases from local retailers (Chenarides *et al.*, 2020) instead of hypermarkets and chain stores due to proximity of local stores and fast delivery of requested items via email or

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phone (Cavallo *et al.*, 2020). Furthermore they include increase in the purchase of domestic food due to the concerns about foods safety of foreign products (Ben Hassen *et al.*, 2021), and selection and purchase of food items that can be stored for a long time, such as legumes, canned vegetables, milk with long shelf life, cooked meat, and pasta, instead of fresh foods and probiotic dairy products (Ben Hassen *et al.*, 2021, Bracale and Vaccaro, 2020, Cavallo *et al.*, 2020, Chenarides *et al.*, 2020, Ellison *et al.*, 2020, Janssen *et al.*, 2021, Mandal *et al.*, 2021).

In addition to these dietary behaviors that directly affect health, the COVID-19 pandemic and its related resulting forced quarantine have had many other negative consequences. The closure of borders and disruption of the export and import processes has disrupted the supply chain of many essential foods. All these change have led to a decrease in economic and purchasing power of essential items, especially foods (Shafiee Seifabadi and Bagheri Dolatabadi, 2020). Losing jobs and thus reducing the purchasing power of quality foods, along with increasing stress, fear, and anxiety from the pandemic and economic conditions, lead to low-cost, high-energy and cheap foods to control these negative emotions (Landaeta-Díaz *et al.*, 2021). The results of a study by Mandel et al. in Bangladesh showed that during the pandemic, the consumption of fish, which is one of the main food items in the Bangladeshi diet, decreased in all households, regardless of economic status. In their study, 75% of people stated that the increase of fish price was the main reason for the decrease in its consumption. According to the results of this study, if the COVID-19 pandemic continues for a long time, urban residents with low income, reduced income or lost jobs will experience food insecurity (Mandal *et al.*, 2021). In the pre-pandemic period, large numbers of Italians ate their breakfast and lunch outside the home (Cavallo *et al.*, 2020). It indicates the difference in the level of well-being and access of people to high quality and appropriate foods, among the studied population groups.

Béné showed in his review study that most of the food and nutrition insecurity at the local level (households, communities, and regions) in low and middle income countries (LMICs) is the result of two structural problems and shocks and stressors. Thus, local shocks, such as drought or floods, as well as stressors, such as corruption, local insecurity, and the seasonal impassability of roads, severely affect the local food supply chain, as well as food producers, retailers, transportation systems, and others. This generally leads to physical and economic disruptions in food supply-food shortages, food loss or price fluctuations in rural and urban areas and ultimately short-term and long-term consequences, the most important of which are acute and chronic hunger and malnutrition (Béné, 2020).

There are limitations in this study, different methods have been used for sampling and data collection and also various groups and foods have been evaluated, which should be addressed in future studies. Moreover, most of the reviewed studies were conducted in the form of online surveys due to the quarantine condition, which due to the self-report nature of these studies, can lead to errors in the results.

In this review survey, the number of studies conducted in the less developed and low- and middle-income countries (LMICs) was very limited. At the same time, LMIC countries experience more and different problems during the COVID-19 pandemic. Another limitation of this study relates to the participants. Since the study was conducted using online questionnaire, most participants had a relatively high literacy and education, as well as Internet access and online survey tools. Therefore, people of lower socio-economic levels from low income countries are less likely to attend this study.

Therefore, due to the long period of the pandemic, it is better to consider the trend of changes in food selection and food behavior in the future studies based on seasonal changes and the occurrence of different waves of COVID-19 in the world and the start of vaccination in the populations, as well as changes in the mood and

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feeling of the participants.

Conclusion

Forced quarantine and social isolation resulting from COVID-19, accompanied by the formation of new interactions and behaviors, have had a profound impact on the lives of populations around the world. During this period, various motivations, such as health maintaining and weight control, suppressing negative emotions, enjoying the taste of food, food quality, food safety, access to food due to transportation constraints, price and purchasing power, play a significant role in peoples' food selection. These motivations have been studied in different populations. These changes are considered as a risk factor for non-communicable diseases, if they lead to a decrease in the quality of nutrition. Therefore, the effect of quarantine and social isolation is very important on the quality of nutrition and prediction of predict health consequences, at the population level.

Conflict of interest

The authors declare that there is no conflict of interest.

Authors' contribution

Dolati S participated to the original idea, designed the project and collected the data. Dolati S and Hariri-Far involved to manuscript draft. Dolati S, Hariri-Far A, Mollarasouli Z and Imani A participated to manuscript final edition. All authors read and approved the final version of manuscript .

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